2 ZERO HUNGER

Preface to Transitioning to Zero Hunger

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1. Introduction

Food insecurity is a worldwide concern. Today, the quest for a world where everyone has access to sufficient, safe, and nutritious food has never been so crucial. In 2021, around 2.3 billion people were food-insecure, seriously affecting around 11.7% of the world's population (FAO et al. 2022). Food insecurity has been exacerbated by the social and health crises the world has been experiencing since 2019. The COVID-19 crisis and the Russia–Ukraine conflict have fundamentally affected food supply both for agricultural products and for the inputs used to produce them. These crises have disrupted supply chains, limited access to markets, and increased the vulnerability of marginalized populations (Ben Hassen and El Bilali 2022).

Experts agree that food security can only be achieved through inclusive, resilient, and sustainable agrifood systems (FAO 2023). Agrifood systems go beyond simple access to food and encompass the entire food chain, including the production, processing, distribution, and consumption of agricultural and food products (Neik et al. 2023). Agrifood systems are weakened by climate change, the loss of biodiversity, and rising poverty. Although advancements in technology offer promising avenues to enhance food production while minimizing environmental impact (Foley et al. 2011), agrifood systems still generate significant hidden costs linked to environmental, social, and health problems, as stated in the 2023 report of the FAO.

Since the adoption of the SDGs in 2015, efforts and initiatives to promote sustainable agriculture, ensure food and nutrition security and eradicate hunger have been deployed around the world. Today, there are many signs that the "zero hunger" objective set out in the Sustainable Development Goals (SDGs) will not be achieved. The FAO estimates that nearly 670 million people will still be suffering from hunger in 2030. This was made clear at the UN Summit on Food Systems in 2021, where several nations made a firm commitment to implement policies aimed at transforming agrifood systems.

This book analyzes the factors behind hunger and the sustainability of food production, and highlights approaches aimed at a transition to zero hunger.

Chapter 2 deals exhaustively with the links between SDG 2 and the other SDGs, in particular the global resolution of problems such as poverty, health,

education, and climate change, while Chapter 3 highlights the essential role of social capital in combating the structural factors of hunger and provides a critical analysis of agroecology. The analyses of agroecology and conventional food production are expanded in Chapter 4. Chapters 5 and 6 deal with the resilience and productivity of production systems and their sustainability, with a particular focus on agroforestry and agrobiodiversity. Chapters 7 and 8 deal with case studies of yam farming in West Africa and coconut-based livestock farming in Sri Lanka, respectively, as contributions to achieving food security and improving people's incomes. Finally, in Chapter 9, approaches aimed at limiting food waste are presented as solutions for achieving the "Zero Hunger" objective while contributing to environmental sustainability.

2. Highlights

2.1. Pathways to Zero Hunger

SDG 2 aims to eradicate hunger and ensure food and nutritional security by 2030. Achieving this goal necessarily involves a phase of promoting sustainable food production. This transition phase towards zero hunger requires tackling various issues relating to the production, distribution, access, and use of foodstuffs. The transition to zero hunger will undoubtedly require coordinated efforts at the national, regional, and international level, with complex and multi-faceted challenges to reconcile increased agricultural productivity with environmental protection and global social and economic objectives (Okello et al. 2021). To this must be added efforts to guarantee physical and economic access to sufficient, healthy, and nutritious food, considering individual food preferences. Today, more than ever, it is necessary to integrate nutrition into food production, as malnutrition is recognized as a global phenomenon affecting both underdeveloped and developed countries (Beyerlee and Fanzo 2019). It is important to consider indigenous food systems, particularly the development of traditional crops that are often best adapted to their biophysical, socio-economic, and cultural contexts, but which have unfortunately been neglected until now (FAO 2022). In addition, the production of healthy, balanced, and sufficient food requires access to innovations and technologies such as precision agriculture, digital technologies, biotechnologies, and innovative solutions for the storage and transport of foodstuffs. Access to innovations does not guarantee their adoption by stakeholders. The adoption of innovations requires a good connection between research and development through a transdisciplinary approach that enables them to be co-created and correspond to the real needs of stakeholders. (Kiba et al. 2020; Jacobi et al. 2022). Participatory and adaptive solutions that consider

local institutional capacities, the diversification of agroecosystems and ecological management, and the quality of local diets should therefore be favored (Blesh et al. 2019). Sustainable land management is essential if the world is to achieve food security. Soil, an essential support for agricultural production, is being degraded at an exponential rate, although the extent and impact of this degradation cannot be accurately assessed. It should be possible to develop a global approach to disentangle the natural and anthropogenic causes of soil degradation, based on ecological approaches to production and remote sensing (Bindraban et al. 2012).

None of the approaches toward zero hunger are possible without eradicating poverty (SDG 1) and inequality (SDG 10) and improving the livelihood of people (SDG 3). Finally, policy and governance around trade, land tenure, soil health, and regulations that affect food production and distribution are necessary, as are good partnerships between governments, non-governmental organizations, businesses, and the research community to share the necessary knowledge and resources.

2.2. Case Studies

In Chapter 2, Lile et al. explore the complex relationship between SDG 2 and the other SDGs to identify direct and indirect links. They show that SDG 2 does not stand alone but is instead closely linked to all the other SDGs. To achieve zero hunger, the authors stress the urgent need to find answers to the issues of poverty, health, education, inequality, and climate change in a comprehensive manner. They point out that given the interconnections between the different SDGs, zero hunger cannot be achieved through isolated efforts, but rather through a synergy of actions between government agencies, international organizations, civil society, private companies, and other stakeholders, each naturally playing its role according to its area of expertise. The authors suggest that policies and programs to tackle the root causes of hunger should be formulated transparently and integrated into national development programs that can be regularly monitored and evaluated.

In Chapter 3, Gian L. Nicolay examines the essential role of social capital in combating the structural factors contributing to hunger. The author analyzes the drivers of hunger, including poverty, wars, pandemics, climate change, gender, age, race, societal divisions, and capitalism. He shows that social capital is a key parameter for predicting and solving the problem of hunger. These include extension systems, agencies that link farmers to markets and external agencies, innovation platforms, farmer field schools, cooperatives, and business groups. According to the author, these social organizations enable sustainable intensification to succeed as an important element of the food system in low-income countries and improve

economic performance. The author also makes a critical analysis of agroecology, comparing it with industrial agriculture, and proposes a morphological analysis and solutions for a sustainable food production.

In Chapter 4, Epule and Chehbouni discuss the implications of agroecology and conventional agriculture for food security in Africa. They highlight the fact that the continent faces the daunting challenges of climate change and variability and examine the contributions, benefits, and challenges associated with agroecology and conventional agriculture. The authors stress the need to promote agroecology so that it achieves the same yields as conventional agriculture. However, they recognize the difficulty of getting out of the agroecology/conventional agriculture dilemma, given the involvement of several factors in the African context. Looking ahead, the authors suggest innovations to make conventional agriculture cleaner and more sustainable, the multiplication of pilot studies on agroecology, and a political approach that is both bottom-up and top-down to guarantee the success of the various initiatives.

The study by Dissanayaka et al. (Chapter 5) presents agroforestry—combining trees, crops, and animals—as an important multi-purpose approach for the productivity and resilience of production systems. They highlight different agroforestry practices and the potential benefits in terms of land use, food production, biodiversity conservation, and adaptation to climate change. Factors such as site selection and planning, component selection, planting, system management and harvesting, and the use of products are presented as key elements in the implementation of agroforestry, although these elements may vary according to the context and objectives. Finally, the authors discuss the limitations of agroforestry systems and suggest ways of improving them.

Achieving food and nutritional security requires crop diversification, as demonstrated by the authors Weerasekara and Plooger from Sri Lanka (Chapter 6). In this chapter, the importance of agrobiodiversity and the need to diversify global food production are discussed, as are the risks of losing this agrobiodiversity. The authors recommend the use of local traditional food plants to achieve food and nutritional security. The study identified 85 species of food plants of great importance. Traditional food preparation and preservation methods are presented and discussed. From the authors' analysis, it emerges that traditional local crops are less costly and more environmentally friendly sources of food, since they are well adapted to unfavorable climatic and edaphic conditions and have good resistance to pests and diseases.

In Chapter 7, Aighewi et al. show the potential of a traditional crop such as yam for achieving food security and improving household incomes in West Africa. They also outline the challenges faced by yam farmers, including poor seed quality. The authors present an initiative to improve yam production by setting up formal quality seed production systems as part of the project 'Yam Improvement for Income and Food Security in West Africa (YIIFSWA)'. This initiative has led to the production of certified yam seed and the development of yam seed markets. Virus detection tools and technologies for eliminating infected sources, as well as high-ratio propagation technologies, are presented as a strategy for improving yam seed quality and productivity, thereby contributing to food security and reducing household poverty.

In Chapter 8, Nuwarapaksha et al. show the importance of integrating coconut cultivation and livestock production in the Sri Lankan context as an innovative and sustainable approach offering mutual benefits, including increased productivity, improved soil health, and reduced dependence on mineral fertilizers. The authors argue that although this system provides livelihoods for farmers while conserving natural resources, further research is needed to identify the most appropriate animal and plant species.

Achieving zero hunger requires good management to minimize food waste. Chapter 9 by Balan et al. looks at limiting food loss and waste, a pervasive problem that persists despite global efforts. The authors map food losses around the world. They highlight the importance of reducing food loss and waste in the context of SDG 2 and propose key measures to mitigate these challenges at all stages of the food chain, including production, storage, processing, distribution, retail and food services, and household losses. Furthermore, the authors believe that it is essential to identify and assess the factors contributing to food waste to effectively tackle the problem. This chapter provides useful guidelines for authorities, businesses, organizations, and consumers to help them adopt sustainable practices and promote effective food management.

3. Conclusions

The transition to zero hunger calls for innovation throughout the chain of the agrifood system. This book has examined the links between SDG 2 and the other SDGs, as well as the role of social capital, agroecology, agroforestry, crop diversification, innovative farming systems, and reducing food losses as essential elements in achieving food and nutrition security. The book provides analyses and solutions from a variety of authors that can be used by policy makers, researchers, and practitioners engaged in the global effort to combat food and nutrition insecurity. The discussions highlight the need for holistic and collaborative approaches to address the complex web of challenges associated with achieving SDG 2 and related goals.

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References

- Ben Hassen, Tarek, and Hamid El Bilali. 2022. Impacts of the Russia-Ukraine War on Global Food Security: Towards More Sustainable and Resilient Food Systems? *Foods* 11: 2301. [CrossRef] [PubMed]
- Beyerlee, Derek, and Jessica Fanzo. 2019. The SDG of zero hunger 75 years on: Turning full circle on agriculture and nutrition. *Global Food Security* 21: 52–59. [CrossRef]
- Bindraban, Prem S., Marijn Van Der Velde, Liming Ye, Maurits van den Berg, Simeon Materechera, Delwendé Innocent Kiba, Lulseged Tamene, Kristín Vala Ragnarsdóttir, Raymond Jongschaap, Marianne Hoogmoed, and et al. 2012. Assessing the impact of soil degradation on food production. *Current Opinion in Environmental Sustainability* 4: 478–88. [CrossRef]
- Blesh, Jennifer, Lesli Hoey, Andrew D. Jones, Harriet Friedmann, and Ivette Perfecto. 2019. Development pathways toward "zero hunger". World Development 118: 1–14. [CrossRef]
- FAO. 2022. The Future of Food and Agriculture: Drivers and Triggers for Transformation. Available online: https://doi.org/10.4060/cc0959en (accessed on 22 October 2023).
- FAO. 2023. In Brief to The State of Food and Agriculture 2023: Revealing the True Cost of Food to Transform Agrifood Systems. Available online: https://doi.org/10.4060/cc7937en (accessed on 24 October 2023).
- FAO, IFAD, UNICEF, WFP, and WHO. 2022. In Brief to The State of Food Security and Nutrition in the World. Repurposing Food and Agricultural Policies to Make Healthy Diets More Affordable. Available online: https://doi.org/10.4060/cc0640en (accessed on 22 October 2023).
- Foley, Jonathan A., Navin Ramankutty, Kate A. Brauman, Emily S. Cassidy, James S. Gerber, Matt Johnston, Nathaniel D. Mueller, Christine O'Connell, Deepak K. Ray, Paul C. West, and et al. 2011. Solutions for a cultivated planet. *Nature* 478: 337–42. [CrossRef]
- Jacobi, J., A. Llanque, S. M. Mukhovi, E. Birachi, P. von Groote, R. Eschen, I. Hilber-Schöb, D. I. Kiba, E. Frossard, and C. Robledo-Abad. 2022. Transdisciplinary co-creation increases the utilization of knowledge from sustainable development research. *Environmental Science & Policy* 129: 107–15. [CrossRef]

- Kiba, Delwendé Innocent, Valérie Kouamé Hgaza, Beatrice Aighewi, Sévérin Aké, Dominique Barjolle, Thomas Bernet, Lucien N. Diby, Léa Jeanne Ilboudo, Gian Nicolay, Esther Oka, and et al. 2020. A Transdisciplinary Approach for the Development of Sustainable Yam (*Dioscorea* sp.) Production in West Africa. *Sustainability* 12: 4016. [CrossRef]
- Neik, Ting Xiang, Kadambot H. M. Siddique, Sean Mayes, David Edwards, Jacqueline Batley, Tafadzwanashe Mabhaudhi, Beng Kah Song, and Festo Massawe. 2023. Diversifying agrifood systems to ensure global food security following the Russia–Ukraine crisis. *Frontiers in Sustainable Food Systems* 7: 1124640. [CrossRef]
- Okello, Moses, Jimmy Lamo, Mildred Ochwo-Ssemakula, and Francis Onyilo. 2021. Challenges and innovations in achieving zero hunger and environmental sustainability through the lens of sub-Saharan Africa. *Outlook on Agriculture* 50: 141–47. [CrossRef]

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