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What do we know about THE FUTURE OF FOOD SYSTEMS?

CHAPTER 1

Introduction: WHAT ARE FOOD SYSTEMS AND WHAT CAN WE KNOW ABOUT THEIR FUTURE?

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Key messages

- Food systems are made up of the people, resources, and activities involved in the production, processing, distribution, and consumption of food.
- We cannot know the future of food systems with certainty, but we can make informed projections about alternative possible futures and ways to achieve (or avoid) them.
- This book provides a mosaic of perspectives from a diverse group of experts on the state of knowledge about different aspects of the future of food systems and how they are interlinked.
- Pressure on land and water resources is projected to increase, extreme events will become more frequent, and healthy diets will remain out of reach for many, but innovation and improved policies and investments can help address these challenges.
- Synergies and trade-offs between these different challenges and goals mean that they need to be understood and addressed as integrated parts of dynamic food systems.

WHAT ARE FOOD SYSTEMS (AND WHY DO WE CARE ABOUT THEM)?

After air and water, food is our most basic need. Yet unlike air and water, food also forms an essential part of our identities as families and communities. Food production is the world's largest use of water and land (FAO 2024, 2025; Ritchie and Roser 2019). Until recently, agriculture was also the world's largest source of employment. Today, a quarter of the world's labor force still works in agriculture, with an even greater proportion in low- and middle-income countries (Roser 2023).

But food involves much more than production and consumption. The tremendous growth in variety, abundance, and year-round availability of food that we have experienced in recent decades has been enabled by related growth in the supply chains that link producers to consumers, including processing, storage, transportation, and marketing. This wider set of essential and closely connected activities makes up our food system (Erickson et al. 2010; Ingram 2011; HLPE 2014, 2017; Food Systems Dashboard 2025).

These activities are in turn related to energy, innovation, technology, roads, and many other domains, so in a sense, food systems are all-encompassing. Instead of considering a single food system, it can be useful to think of multiple interconnected food (or agrifood) systems operating at different scales, just as local markets are connected to a larger global market, and local internet service providers are part of a larger worldwide web. While the boundaries of these various food systems may be difficult to delineate, it is not necessary to define food systems precisely to appreciate their importance. Indeed, it is estimated that nearly half the world's people live in households that depend at least partly on agrifood systems for their livelihoods (Davis et al. 2023), and all 8 billion of us are part of food systems as consumers.

Food systems have achieved remarkable progress in recent decades, but they will also face significant challenges in delivering the many outputs and services we expect and need from them in the future (ISDC 2023). For example, progress in reducing hunger has slowed and even reversed in recent years, while the incidence of micronutrient deficiencies and obesity is rising (FAO, IFAD, UNICEF, WFP, and WHO 2024). Pressure on land, water, biological, and atmospheric resources is increasing (FAO 2017; IPCC 2023). Meanwhile, despite the fundamental importance of food systems, those who earn their living from food production often earn much less than those in other economic sectors (World Bank 2025). Looking ahead, the Independent Science for Development Council identifies nine major trends that will continue to affect agrifood systems: demographic trends, changing consumption patterns, market concentration, climate change, environmental degradation, shifting global health challenges, geopolitical instability, growing inequalities, and new technologies and innovations (ISDC 2023).

These interrelated challenges mean that to consider the future of food, we need to look beyond food production to the wider set of activities that bring food to our tables and beyond food consumption to the wider set of impacts and outcomes for people and planet that characterize the performance of those activities. We need to look at food systems.

WHAT CAN WE KNOW ABOUT THE FUTURE OF FOOD SYSTEMS?

Strictly speaking, nothing. Without a crystal ball, we cannot know the future with certainty. But decisions that will affect the future of food systems still need to be made today, and there are insights we can offer with confidence to help guide those decisions.

First, we can draw on experience and understanding of the past and present to make reasoned inferences about the future. This may involve a variety of foresight approaches. Since the dawn of agriculture, farmers (such as the family of 3-year-old Rosita on the cover of this book) have had to make decisions about when and where to plant their crops without knowing what weather and market conditions would be like during the weeks and months before harvest time. Instead, they have drawn on their experience and expectations as a guide. When we consider the future of larger and more complex food systems in a world that is becoming more uncertain, more complex foresight methods are needed, including quantitative tools such as statistical analysis and simulation modeling (see Chapter 37 on foresight modeling).

Second, the future depends partly on choices we — as individuals and society — have not yet made. This presents an opportunity but also a challenge. The opportunity is that we have the chance to inform those choices through analysis and engagement with public and private decision-makers and other stakeholders. The challenge is that the interacting processes that make up food systems are extremely complex, and the goals of decision-makers and other stakeholders are extremely diverse (and sometimes conflicting).

By combining sophisticated quantitative analysis of food systems and qualitative engagement processes with stakeholders, we can identify and explore the likely impacts of alternative future scenarios based on alternative development pathways and external factors, and use the resulting insights to inform the decisions we make about food systems today. So, although we cannot know the future of food systems with certainty, we do know something about *possible* futures of food systems, and what we can do to help achieve (or avoid) them. That is the subject of this book.

THIS BOOK

This book presents a collection of short chapters on the current state of knowledge about different aspects of the future of food systems, written by a diverse group of scientists with experience and expertise in a wide range of related topics, disciplines, and regions. The 109 contributors come from across CGIAR and many other partner research institutions around the world. This collection was begun as part of the CGIAR Research Initiative on Foresight during the 2022–2024 period and completed as part of the ongoing area of work on foresight and prioritization under the CGIAR Science Program on Policy Innovations.

Each chapter examines a particular aspect of food systems, using a standard format to concisely describe recent trends and challenges that highlight the importance of the topic, summarize the latest available foresight research on that topic, and identify key gaps in existing foresight research that merit further attention in the future. These chapters are intended as brief and accessible overviews of the latest foresight research on each topic, guides to help readers find more detailed information if desired, and indications of where our current knowledge of future trends needs to be improved.

The collection includes 15 chapters focused on major drivers and impacts of change in food systems, 11 chapters that provide regional and national perspectives on the future of food systems, 7 chapters on the future of major food commodities, and 3 chapters on food systems measurement and modeling tools.

Even with this diverse set of contributions, the picture remains incomplete. Given the complexity of food systems, it is impossible to characterize them fully. Some topics are missing, and others could easily be developed in much greater detail. We look forward to adding topics that are missing from this collection (such as demographics and genetic resources) and to developing aspects of included chapters that merit expansion.

In a world of complexity and uncertainty, the goal of this book — and the purpose of foresight analysis, more generally — is not to predict the future with precision, but rather to carefully consider and present what can be known about possible future pathways in order to inform choices today.

KEY INSIGHTS

The picture that emerges from this collection highlights the continuing **challenges** that food systems will confront in the coming decades. Poverty will become more geographically concentrated (Chapter 2), healthy diets will remain out of reach for many (Chapter 3), inequalties will persist (Chapters 4 and 14), pressure on land, water, and other resources will increase (Chapters 5 and 7–10), and extreme events will become more frequent (Chapters 6 and 15). Regional and commodity perspectives (Chapters 17–22 and 28–34) illustrate the diversity of challenges, including continued population growth in Africa (versus slowing growth or population declines elsewhere), projected increases in dependence on food imports in low-income countries, and rapid growth in demand for animal-source foods from middle-income populations. They also illustrate commonalities, including rising health concerns associated with overweight and obesity in most regions.

The collection also highlights the importance of **interactions** — including both synergies and trade-offs — across the many dimensions of food systems, including between drivers of change, regions, commodities, and time

periods, as well as among the many outcomes that food systems deliver. For example, improving access to markets may reduce costs for both producers and consumers, but it may also increase pressure on land and water resources. This does not mean that one goal is necessarily more important than another, just that care is needed to understand the multiple consequences (including the unintended ones) of different food systems pathways in order to make better-informed decisions and minimize their costs.

The collection also highlights **opportunities** to address these challenges, including rapid growth in renewable energy (Chapter 11); the critical importance of innovation more generally (Chapter 12), along with its potential to improve efficiency, reduce costs, and lessen trade-offs across multiple goals and interests; and the importance of trade (Chapter 13) and food assistance (Chapter 16) in helping to offset local and regional impacts of conflict and weather shocks. Insights from various countries (Chapters 23–27) show how foresight analysis is already informing food systems policies and investment strategies around the world. Finally, continuous improvements are being made in the data and analytical tools needed (Chapters 35–37) to explore alternative food systems futures, identify challenges and solutions, weigh trade-offs, and inform the choices we face today.

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Related chapters on the future of food system drivers and impacts, regional and national perspectives, food commodities, and foresight tools are available in our Table of Contents.

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