

Foreword

Food systems, understood as all activities and actors connecting food production, transportation and storage, processing and catering, distribution, preparation, consumption, and waste and resource management, as well as agricultural input suppliers and the associated regulatory institutions, represent a huge share of human activities and livelihoods. They are also at the centre of humanity's main challenges: climate change, human and environmental health, biodiversity erosion, equitable human development and, naturally, food and nutrition security.

Food and nutrition security is therefore a major area of research in food, agriculture and the environment. Achieving global food security involves identifying ways to transform our food systems to provide sustainable, healthy and accessible food to all human beings, who will number nearly 10 billion by around 2050. New paths forward should encompass all dimensions of food security: availability of agricultural and food products, access to and utilization of food, and stability in the food supply. Designing and accompanying agricultural and food system transitions and achieving global food security covers an incredibly large set of issues, scientific disciplines and scales of analysis. It is therefore not surprising that CIRAD and INRAE, France's two main agricultural research institutions, have taken up a joint research programme on food security. GloFoodS (Transitions for Global Food Security) was launched in 2014 as a 'metaprogramme', an INRAE initiative to address a specific challenge with an interdisciplinary perspective, a dedicated budget and a roadmap shared by stakeholders. But what truly made GloFoodS original was the idea of developing a metaprogramme as a joint CIRAD-INRAE initiative for the first time and bringing together the multidisciplinary scientific skills of INRAE (then INRA) and CIRAD to explore the four dimensions of food security, while also incorporating the public policy dimension.

The GloFoodS flagship programme (2014 to 2020) was a unique experience in joint research management for CIRAD and INRAE. It was motivated by the strategic importance of food security as a research subject in our strategic plans, as well as by the need to gain visibility in international forums on global issues involving food security governance. Beyond the rather conventional analysis of the balance between agricultural supply and food demand, along with the role of food security governance models, GloFoodS added five more areas of research: trends and variability in crop and animal yields; production potential of additional land; innovations in products, processes and organizational approaches to limit food waste; determinants of nutritional transitions and their health and environmental impacts; and links between household access to food and poverty.

When the metaprogramme came to a close at the end of 2020, the scientific leaders behind GloFoodS proposed a series of outreach events, including a final programme workshop. They also formed a scientific committee to edit a volume of contributed chapters from research findings obtained with the support of the GloFoodS programme. As readers can see from the list of chapters, the wide range of topics and scientific fields and disciplines is consistent with the scope of our initial objective when GloFoodS was launched by our two institutions. The metaprogramme covered

a variety of areas and challenges, ranging from food security governance to the impact of food and nutrition transitions on agricultural systems and practices, the global balance between food production and availability, the challenge of reducing food waste by optimizing food processes, the drivers of the agroecological transition in developing and industrial countries, and the relationships between food security, access to land and natural resources at the local level.

By enhancing the joint provision of scientific knowledge on issues related to food security by CIRAD and INRAE, GloFoodS has also contributed to strengthening the position of our research institutions in public debates and international initiatives on food security. It is clear that global food security will remain on the CIRAD and INRAE research agenda for some time, as demonstrated by our priorities and objectives (INRAE 2030 Roadmap, CIRAD Scientific and partnership strategy 2019–2023).

For INRAE, this is particularly true for one of its five scientific priorities detailed in the INRAE 2030 strategic document (‘INRAE2030 – Building a sustainable future through shared science and innovation’): ‘Accelerating agroecological and food transitions while answering socioeconomic challenges’. Within this general priority, a first proposal is to strengthen our understanding of transition processes and food security challenges, such as by modelling and evaluating foresight scenarios of changes in food supply and demand at the global scale; analysing the variety of food systems with regard to their autonomy and resilience at various scales; and analysing trends in agricultural structures and factors of production, including land and labour, their autonomy with respect to public support policies and their vulnerability to global risks (climate, markets, etc.). A second proposal concerns the design of healthy and sustainable food systems available to all. Examples of specific objectives include a more comprehensive understanding of the factors of changes in food systems at the global and local scales, and the evaluation of the health, economic, social and environmental impacts of such changes.

For CIRAD, which works specifically on food systems in developing countries, four out of six of the key thematic fields in its ‘Scientific partnership and strategy objectives’ (OSSP2 covering the period 2019–2024) are directly linked to food systems and GloFoodS research questions: engineering the agro-ecological transition, using territories as levers for sustainable and inclusive development, supporting the transition to more sustainable and inclusive food systems; and helping farming systems in the Global South adapt to climate change. CIRAD is convinced that food systems must change to be able to produce more and better, address all agroecological principles, and ultimately improve food security, the core component of the development-health-climate-environment nexus.

The upcoming United Nations Food Systems Summit (UNFSS) is a strong call to action where leaders expects bold moves and disruptive decisions. The world’s scientific communities must mobilize. Our research institutions have a duty to produce scientific knowledge for which international partnerships are essential, issue guidance for decision-makers, and ultimately bring about real change. We hope readers of the English version of this book (the French version is forthcoming) will be interested in learning more about the scientific communities at CIRAD and INRAE that work on the numerous dimensions of food security and will gain new insights on the topic of food security.

Michel Eddi, former CEO of CIRAD and Philippe Mauguin, CEO of INRAE

Preface

Food and nutritional security refers to the challenge of providing sustainable, healthy and accessible food to all human beings. It comprises four dimensions covering overlapping issues: availability, utilization, accessibility and stability. This tremendous challenge requires a transformation of the world's food systems and the mobilization of all stakeholders and policymakers based on knowledge and scientific evidence. There is a clear need for intersectoral and more integrated knowledge, which is why two major French agricultural research organizations, CIRAD and INRA (which became INRAE in 2020), led an ambitious interdisciplinary flagship programme between 2014 and 2020 on the transitions for global food security: the GloFoodS metaprogramme. This metaprogramme called upon the multidisciplinary scientific skills and the international experience of both institutions to explore the balance and discrepancies between agricultural supply and food needs and the role of governance modes of food security, while accounting for the potential impact of global change. It operated on a variety of scales, from the global level all the way down to the household level. It funded 45 research projects (involving 35 PhD doctoral students) over the 2014–2020 period, mostly with international academic partners and often with stakeholder participation in more than 25 countries, covering a wide range of topics informing food and nutrition security in response to four overarching questions: 1) How does the evolution of agricultural production affect households' dietary transitions and access to food? 2) How does the evolution of agricultural production interact with the efficiency and sustainability of food systems, especially losses and waste? 3) How does governance affect agricultural production systems and land use? 4) How do dietary transitions affect the balance of food availability, agricultural production systems and land use?

The GloFoodS metaprogramme contributed to international research on food security with regard to several dimensions. First, it combined original approaches in agronomy, environmental sciences, nutrition, economics and sociology, among other disciplines, while also adopting a global viewpoint. Second, it connected global change components (climate change and global change, management of natural resources) with nutritional transitions of populations and the impact of those transitions on agrifood chains. Such a global positioning was naturally combined with local approaches so as to compare regional outcomes of global scenarios with observations at a smaller geographical scale. The GloFoodS metaprogramme therefore addressed questions related to agricultural sciences, livestock systems, global modelling, land-use changes, economic and sociological patterns in rural areas, agrifood technologies, nutrition and food security governance. Finally, GloFoodS aimed to provide original research at the interface of food security challenges that are often highly specialized in terms of fields and disciplines.

This book proposes a selection of results that draw upon research projects funded by GloFoodS. The findings address the issue of governance of food systems, the links between agricultural supply and food and nutritional needs, agroecological innovations and dietary diversity, the challenges of innovative processing of

high-quality foods, agroecology and resilient food value chains, and local resource management as a driver of food security.

Conducting the GloFoodS metaprogramme over this period was a formidable scientific and human challenge for us and for the scientific community involved at CIRAD and INRAE. We hope that this book will be useful to readers interested in transitions towards global food security, and that the enthusiasm with which we accompanied the participating researchers will be reflected throughout its pages.

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co-directors of GloFoodS*