

2025



Towards a state of the food system report for Australia

Editors Rohan Nelson, Lilly Lim-Camacho & Cathy Robinson





ISBN 978-1-4863-2151-3

CSIRO Agriculture and Food

Citation

Nelson R, Lim-Camacho L, Robinson CJ (eds) (2025) Towards a state of the food system report for Australia. CSIRO, Australia.

Copyright

© Commonwealth Scientific and Industrial Research Organisation 2025. To the extent permitted by law, all rights are reserved and no part of this publication covered by copyright may be reproduced or copied in any form or by any means except with the written permission of CSIRO.

Important disclaimer

CSIRO advises that the information contained in this publication comprises general statements based on scientific research. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No reliance or actions must therefore be made on that information without seeking prior expert professional, scientific and technical advice. To the extent permitted by law, CSIRO (including its employees and consultants) excludes all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.

CSIRO is committed to providing web accessible content wherever possible. If you are having difficulties with accessing this document, please contact **csiro.au/contact**.

Cultural sensitivity

Aboriginal and Torres Strait Islander people should be aware that this report contains images, voices and/or names of deceased persons. In some Aboriginal and Torres Strait Islander communities, hearing recordings, seeing images or the names of deceased persons may cause sadness or distress and in some cases, offend against strongly held cultural prohibitions (see Cultural sensitivity | AIATSIS corporate website).

CONTENTS

Acknow	wledgme	ents	V	
List of	authors		VI	
Forewo	ord		VII	
Abbrev	viations		VIII	
Execut	ive sumr	nary	1	
ABOU	T THIS F	REPORT	6	
OVER\	/IEW – 1	TOWARDS A STATE OF THE FOOD SYSTEM	8	
	Introdu	ction	9	
	The sta	te of Australia's food system	9	
	Food sy	Food system thinking		
	From analysis to action			
	Toward	s a food system strategy	23	
<u>Part 1</u> :	: Insight	ts into food system goals	26	
1	NUTRITION		27	
	Key poi	ints	28	
	1.1	Nutrition in Australia	28	
	1.2	Issues and challenges	29	
	1.3	Opportunities to improve nutrition	32	
2	RETAIL	ENVIRONMENT	34	
	Key points			
	2.1	Australian food retail today	35	
	2.2	Overlooked issues and alternatives	37	

	2.2	overlooked issues and alternatives	57
	2.3	Priorities for improving reporting and management	38
3	FOOD	SAFETY	40
	Key poi	nts	41
	3.1	State of food safety	41
	3.2	Challenges with reporting	41
	3.3	Priorities	44

4	INDIGE	NOUS FOOD SYSTEMS	.46
	Key poi	nts	.47
	4.1	Unique aspects of our Indigenous food systems	.47
	4.2	Reporting on Indigenous food systems	.48
	4.3	Future priorities	. 50
5	POLICY	COHERENCE	. 52
	Key points		
	5.1	The state of food policy coherence	.53
	5.2	Issues and challenges	. 55
	5.3	Opportunities to improve policy coherence	.56
<u>Part 2:</u>	Insight	s into food system sustainability	. 59
6	SUSTAI	NABILITY	.60
	Key points		
	6.1 Sustainability of Australia's food system6		
	6.2 Challenges with sustainability measures and reporting6		.64
	6.3 Cha	llenges and next steps in tracking the sustainability of Australia's food system	.66
7	CIRCUL	AR ECONOMY	.68
	Key poi	nts	.69
	7.1	Circularity of Australia's food system	.69
	7.2	Monitoring circularity in Australia's food system	.70
	7.3	Priorities for action	.73
8	LIFE CY	CLE ASSESSMENT	.75
	Key points		
	8.1	Is Australia's food system sustainable?	.76
	8.2	Challenges posed by current approaches to sustainability	.77
	8.3	Driving the sustainability of Australia's food system	.78

<u>Part 3</u>	Insight	s into food production and its impacts	80
9	HIDDEN COSTS		81
	Key points		82
	9.1	The cost of Australia's food system	82
	9.2	What is the true cost of food?	84
	9.3	Reporting for better food futures	86
10	MANUI	FACTURING	87
	Key points		88
	10.1	State of the food manufacturing system	88
	10.2	Reporting to enable manufacturing	89
11	ECONOMICS		93
	Key points		94
	11.1	The value of Australia's food system	94
	11.2	Limitations of economic reporting	98
Referer	ices		101
Glossar	у		114

ACKNOWLEDGMENTS

This report is part of a vision shared by the Food System Horizons initiative that seeks a future where food systems deliver food and nutritional security for all, in a way that is economically viable, socially just and environmentally sustainable in a dynamic and interconnected world. Through Food System Horizons, CSIRO and the University of Queensland are using science to help Australians understand our food system, our roles in it and who we need to work with to make it more sustainable, nutritious and equitable. This vision acknowledges that the food system – by sitting between natural and human systems – is critical for human welfare, social and economic outcomes as well as environmental sustainability. This report also acknowledges that Australia is on a journey towards being able to report on the state of its food system. The report draws on evidence from across the food system to address a range of food system priorities. It has been reviewed by experts from around Australia.

The authors and editors acknowledge the reviewers who have informed this work. These reviewers have provided commentary on specific insights given their area of expertise. In particular, we would like to thank Dio Antille, Robert Barlow, Jessica Bogard, Naomi Boxall, Sinead Boylan, Andrew Cameron, Jo Edwards, Garry Griffith, Gilly Hendrie, Leif Lundin, Ben Macdonald, Jarred Mair, Aaron Simmons, Yuba Subedi, Ben Trevaskis, George Verikios, Torres Webb, Astrid Whitbread, Stuart Whitten, Kristen Williams, Olivia Wright, Katherine Wynn, and Charley Xia.

We would also like to acknowledge the efforts of the following CSIRO colleagues who provided input, guidance and/or support at various stages of the report: Jody Bruce, Michelle Colgrave, Rick Llewelyn, Larelle McMillan, Michael Robertson, Rose Roche, Frank Sperling, and Katherine Wynn. From the Department of Agriculture, Fisheries and Forestry, colleagues who provided insights into food policy included: Larissa Arney, Paul Denny, Adam Fennessey, Matt Lowe, Hannah Osborn, and Caroline Wardrop. Michelle Gortan of the Macdoch Foundation and Jarred Mair of New Zealand's Ministry of Primary Industries provided third-party strategic insights on the approach and potential impact of such a report.

Insights into the evolution of food system reporting were provided by Dale Ashton, Will Chancellor, Emily Dahl, Jo Edwards, and Lindsay Hogan of ABARES; Rene Chaustowski of the Department of Industry, Science and Resources; Sarah Pennell of Foodbank; Klara Kalocsay and Megan Redmond of Food Frontier; Rachel Chambers of the Queensland Fruit and Vegetable Growers Association; Mirjana Prica of Food Innovation Australia Limited; and Amanda Lee of the University of Queensland. Thank you also to Scientell for editorial and design support.

LIST OF AUTHORS

Section	Author and affiliation
Towards a state of the food system	Rohan Nelson, ¹ Andy Hall, ¹ Lilly Lim-Camacho ¹ and Cathy Robinson ¹ ¹ CSIRO
Nutrition	Jessica Bogard ¹ and Sinead Boylan ¹ ¹ CSIRO
Retail environment	David Reynolds, ¹ Jeremy Farr, ¹ Lilly Lim-Camacho ¹ and Charley Xia ² ¹ CSIRO ² Australian National University
Food safety	Narelle Fegan ¹ and Rozita Vaskoska ¹ ¹ CSIRO
Indigenous food systems	Max Fabila ¹ and Sinead Boylan ¹ ¹ CSIRO
Policy coherence	Jeremy Farr, ¹ Jessica Bogard ¹ and Kelly Parsons ² ¹ CSIRO ² University of Cambridge
Sustainability	Peat Leith, ¹ Lynne M Macdonald, ¹ Larelle McMillan, ¹ Michael Battaglia, Cathy Robinson, ¹ Heleen Kruger, ² Anwen Lovett, ³ Rob Kancans, ² Katie McRobert, ⁴ Chiara Pasut ¹ and Senani Karunaratne ¹ ¹ CSIRO ² Australian Bureau of Agricultural and Resource Economics (ABARES) ³ Council of Rural Research and Development Corporations ⁴ Australian Farm Institute (AFI)
Circular economy	Cathryn O'Sullivan, ¹ Maja Arsic, ¹ Anton Wasson, ¹ Sabrina Greenwood, Pablo Juliano, ¹ Colleen MacMillan, ¹ Alessio Miatto ¹ and Heinz Schandl ¹ CSIRO
Life cycle assessment	Maartje Sevenster ¹ ¹ CSIRO
Hidden costs	Cecile Godde, ¹ Fentahun Abebe, ¹ Javier Navarro ¹ and Steven Lord ² ¹ CSIRO ² Environmental Change Institute, University of Oxford
Manufacturing	Pablo Juliano, ¹ Rohan Nelson ¹ and Ingrid Appelqvist ¹
Economics	Rohan Nelson ¹

FOREWORD

Australia's food system is a logistical and economic success. It feeds approximately 100 million people, including 27 million Australians, with food produced by around 100,000 farmers and delivered through more than 2500 supermarkets.

But our food system is much more than what farmers produce through our landscapes, and success means much more than producing and exporting commodities. Australia's food system is also expected to provide equitable access to safe, nutritious and healthy food, produced sustainably for all Australians. As our food system matures, these goals are increasingly within our reach. And we have an intergenerational responsibility to pursue them vigorously.

Australia is currently in a period of transition towards more holistic coordination of our food system to meet a broader set of sustainability, equity and health goals. We routinely oversee systems of equal complexity in other parts of our society and economy, and we have a highly optimised agricultural sector, which is able to support a more integrated food system into the future.

A critical step towards recognising and coordinating the food system is being able to monitor and report on it. This report provides a first step towards reporting on the interactions across Australia's food system that pose the greatest challenges and create the greatest opportunities. Our goal is to equip Australia with a robust evidence base that allows us to set the directions we want our future food system to take and to develop practical strategies for getting there.

Michael Robertson, Larelle McMillan, Sagadevan Mundree and Matthew Morell

ABBREVIATIONS

AASF	Australian Agricultural Sustainability Framework
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
AFGC	Australian Food and Grocery Council
AIHW	Australian Institute of Health and Welfare
BADDR	Blaming, Aggregate, Decontextualised, Deficit and Restricted
CSIRO	Commonwealth Scientific and Industrial Research Organisation
FAO	The Food and Agriculture Organization of the United Nations
FIAL	Food Innovation Australia Limited
FRSC	Food Regulation Standing Committee
FSANZ	Food Standards Australia New Zealand
GDP	Gross Domestic Product
GVP	Gross Value of Agricultural Production
ISFR	Implementation Subcommittee for Food Regulation
LCA	Life Cycle Assessment
OECD	Organisation for Economic Co-operation and Development
SDGs	United Nations Sustainable Development Goals
TCA	True Cost Accounting
UN	United Nations

Executive summary

Australia's food system includes all the processes involved in producing, distributing and consuming food and ingredients. It is worth around \$800 billion, and feeds approximately 100 million people (including 27 million Australians), with food produced by around 100,000 farmers and delivered through more than 2500 supermarkets. However, in addition to production and export, we also want Australia's food system to provide equitable access to safe, nutritious, and healthy food produced sustainably.

Australia is transitioning towards more holistic coordination of our food system to meet a broader set of sustainability, equity and health goals. We routinely manage systems with similar complexity, including economywide systems where significant public leadership balances sectoral interests with broader societal goals. A critical step is being able to monitor and report on the food system.

This report aims to help build a robust evidence base to explore the directions we want our future food system to take, highlighting gaps and biases in reporting, and developing practical strategies. The overview, 'Towards a state of the food system', summarises our current understanding, including recognising the state and features of the food system, allocating responsibility for managing it, and enabling interactions across the food system.

The report presents expert insights from across the food system, in 11 Insights organised into three parts: Insights 1 to 5 present the food system's diverse goals in nutrition and health, food retail, food safety, Indigenous food systems, and food policy; Insights 6 to 8 present food system sustainability, life cycle assessment, and a circular economy; Insights 9 to 11 present food production and its unintended environmental and health impacts.

Managing Australia's food system

This report makes the case that the food system needs to be managed through interventions that improve its performance and future trajectories of development and that better reporting has a key role to play. This type of system management is best implemented in a distributed way through inclusive deliberation and genuine partnership between government, industry and community. Examples include emergency management, air traffic control, maritime safety, the road transport system, the pharmaceutical system, the Australian Defence Force, multiple state and Commonwealth police forces and criminal justice systems, the social welfare system and the health system.

We also know how to balance sectoral interests with wider societal interests when managing systems similar to the food system. Central agencies such as Treasury, Finance, Defence and Departments of Prime Minister/ Premier and Cabinet have evolved as mechanisms for elevating important societal goals above conflicting sectoral interests. Other nations, such as Canada and the United Kingdom, already have food portfolios for managing food system interactions.

The analysis of the state of Australia's food system has been organised around the three linked steps we need to take to move from analysing Australia's food system to managing it better:

1. Recognise the food system

The insights in this report suggest that better recognising the food system would help us to agree on the goals that Australians have for it and help us to understand the interactions across the system that need to be managed to meet these goals. A priority is breaking free from a siloed, sectoral view of the food system. Seeing the food system as more than producing and exporting agricultural commodities is likely to enable a strong complementary regional food manufacturing sector that complements ongoing commodity exports. It will enable Australians to recognise the impact that food environments have on dietary choices and health, and to work with governments and retail businesses to shape preferred food futures. It could enable new food technologies to shift some of the burden of meeting sustainability goals away from farming businesses.

2. Allocate responsibility

Allocating responsibility is essential for moving from abstract conceptualisations of the food system to proactively managing it. Key to this is recognising the degree of public leadership necessary to prioritise a more balanced mix of sustainability, equity, nutrition and health goals, alongside ongoing economic goals. We already have well-developed mechanisms enabling the public sector to initiate action to address the unintended environmental and health impacts that the private sector lacks commercial incentive to address. Public sector leadership can be enabled through efforts to improve the coherence of food policy across local, state and federal governments, and by broadening innovation strategies to make important connections across the food system.

3. Enable interactions

Much of the potential to proactively manage food system challenges and opportunities lies in enabling interactions between previously disconnected or misaligned components of the food system, such as human nutrition and farming. To date, these connections tend only to be made during affordability and climate-related crises – or when there are threats to commodity export markets, such as the reemergence of tariffs. Strategic processes could enable communities, governments and industry to explore the degree of policy coherence and reporting necessary to proactively manage the food system. Priorities include analysing and reporting on the impact of food environments on dietary choices and health to support the proactive design of healthier and more affordable future food environments. Progress on





sustainability and food security requires processes for agreeing on goals, supported by reporting that acknowledges and brings together diverse perspectives.

Insights from across the food system

The collective knowledge used in the report's overview to analyse the state of Australia's food system is organised into three categories.

Goals

Insights into nutrition, retail environments, food safety, Indigenous food systems and policy coherence reveal how competing perspectives of the food system can obscure or de-prioritise important societal goals for Australia's food system. Key points from Insights 1 to 5 are listed below.

- The overarching purpose of Australia's food system is to nourish Australians and contribute to the diets of millions of other people around the world in nations that import food from Australia.
- A reporting focus on agricultural production and exports has distracted from the perception that agricultural commodities are food, obscuring and de-prioritising nutrition and health outcomes.
- Lack of recognition of the impact that food environments have on dietary choices and health outcomes is impeding processes for designing better future food environments.
- Australia's strong reputation for producing

safe food needs constant investment to protect against threats emerging with new food technologies and distribution pathways.

- Recognition of Indigenous food systems goes hand-in-hand with recognition that local Indigenous food practices, products and human–food interactions are difficult but important to incorporate into national food policies and priorities.
- Australia's public sector has mechanisms for coordinating food policy, but the goal of coherent food policy goes beyond coordination to reconciling goals and reinforcing action across the food system.

Sustainability

Insights into the sustainability of Australia's food system are complemented by insights about the circularity of the economy and life cycle assessment. These reveal the multiple perspectives and scales from which food system sustainability can be assessed and managed. This, in turn, reveals how viewing sustainability from any single sectoral or methodological perspective can obscure our understanding of the overall sustainability of Australia's food system. Key points from Insights 6 to 8 are listed below.

• It is not yet possible to make definitive statements about the sustainability of Australia's food system because indicators are patchy and provide insights into the sustainability of only some food system components – some of which are improving, while others are in decline.



- A focus on the sustainability of individual products or iconic indicators like greenhouse gas emissions has also distracted from more holistic views of sustainability.
- Understanding the overall sustainability of Australia's food system requires processes for agreeing on sustainability goals, actions and measures for tracking progress towards those goals.
- Circular economy thinking is emerging as a promising strategy for improving the sustainability of Australia's food system.
 Regulatory reform is needed to recognise that historically hard-won protections on human health can be maintained in a more circular economy.
- The sustainability of individual food products does not guarantee the sustainability of Australia's food system – system-wide assessments of sustainability are needed.

Food production and its impacts

A focus on narrow economic measures has prevented us from recognising the success of Australia's food system and caused us to overlook environmental and health impacts that affect the longer-term economic potential of the food system. Revealing the hidden costs of the food system helps us to identify opportunities for avoiding and managing them. Key points from Insights 9 to 11 are below.

Australia's food system is worth \$800 billion

 almost eight times the size of agriculture –
 but focusing on this economic narrative
 alone limits our view of the food system's
 value and what it does for Australian society.

- Reporting on sectoral economic goals has crowded out reporting necessary to pursue a broader mix of longer-term sustainability, equity, food safety, nutrition and health goals.
- New business models are emerging with potential to enable thriving regional food manufacturing industries to complement bulk commodity exports, and reporting is needed to help shape these.
- Identifying and measuring the hidden costs of our food system, including malnutrition, diet-related diseases, animal welfare and environmental degradation, are important steps towards addressing and even avoiding these costs.

Next steps

This report begins to consolidate an evidence base for negotiating the goals we need to manage across Australia's food system and agreeing on actions for pursuing these goals. Embedding regular food system reporting into institutions that have a mandate to recognise and enable food system interactions is likely to be a necessary first step towards being able to 'see', understand and manage the food system. This will, in turn, support communities, governments and industries in working together to decide what Australia's future food system should look like and what actions are needed to achieve it.



ABOUT THIS REPORT

Purpose

Australia's food system includes all the processes involved in producing, distributing and consuming food and food ingredients, from natural resources like water and soils that support agricultural production, through the manufacturing, processing and distribution of food, to its impacts on nutrition and human health. Our food system has evolved to feed Australians and contribute to the diets of people in Australia's export markets around the world. It is a complex and ever-changing system that presents us with surprising interactions and sometimes unintended consequences. What is reassuring is that we routinely manage systems with similar complexity, including economy-wide systems where significant public leadership balances sectoral interests with broader societal goals.

This report and the roadmap that preceded it have shown that we have a deep understanding of the challenges and opportunities facing Australia's food system, and a growing knowledge of how to manage it. This report is designed to help us move from analysing these challenges and opportunities to building the evidence base necessary to explore what we want our food system to look like in future and how to move it in that direction. In the process, the report highlights opportunities to better recognise and manage Australia's food system by highlighting gaps and biases in reporting that obscure important food system attributes and interactions.

Approach

Our current understanding of the state of Australia's food system is summarised in the overview, 'Towards a state of the food system'. We use 'towards' to acknowledge that this is a first step towards more regular food system reporting and that future iterations of this report are likely to evolve in purpose, authorship and scope. This first attempt to describe the state of Australia's food system is organised around three steps we can take to move from analysing our food system to managing it better:

- 1. recognise the food system
- 2. allocate responsibility
- 3. enable interactions.

Recognising the state and features of Australia's food system is a necessary step towards allocating responsibility for managing it. In turn, allocating responsibility for managing it helps us to more deliberately enable interactions across the food system that can help us manage the challenges and opportunities facing it.

This analysis of the state of the food system draws together expert insights from diverse perspectives across the food system and provides examples of actions these steps are likely to involve in different parts of the food system. These expert insights are then presented in Insights 1 to 11 of the report. They summarise our growing knowledge of Australia's food system and are organised into three parts:





Figure 1: Structure of this report

O Part 1: Insights into food system goals

Insights 1 to 5 present insights into the diverse goals that we have for our food system, based on research in nutrition and health, food retail environments, food safety, Indigenous food systems and the coherence of food policy.

O Part 2: Insights into food system sustainability

Insights 6 to 8 present insights into food system sustainability, including the example of life cycle assessment and efforts to create a more circular economy.

O Part 3: Insights into food production and its impacts

Insights 9 to 11 present insights from the production-oriented components of the

food system, complemented by insights into their unintended environmental and health costs.

The structure of this report is summarised in Figure 1. An organising principle of this report is that better management of the food system is more likely to come from prioritising food system interactions that affect important challenges and opportunities, rather than from proliferating conceptual models of the food system or attempting to produce comprehensive databases for describing it. This means that future reports are likely to have different, but not necessarily more, insights from across the food system. The constant evolution of the food system and our understanding of it necessitates prioritisation of an eclectic mix of the issues most in need of attention.

Overview

Towards a state of the food system

Rohan Nelson, Andy Hall, Lilly Lim-Camacho & Cathy Robinson





INTRODUCTION

This report is a first step towards a regular report on the 'state of the food system' in Australia. We analyse the state of Australia's food system using the available mix of data and methods. The report highlights opportunities to better recognise and manage Australia's food system by highlighting gaps and biases in reporting that obscure important food system interactions. Insights into reporting and management are drawn across the food system, loosely grouped into the goals of the food system, issues affecting its sustainability and issues to do with food production and its impacts (Figure 1). These insights into the state of Australia's food system are used to analyse opportunities for better recognising the food system, allocating responsibility for its management and enabling interactions that help address challenges and opportunities. Future reports will likely contain an even broader and more eclectic mix of insights from across the food system.

THE STATE OF AUSTRALIA'S FOOD SYSTEM

Economic success

Australia's food system generated over \$800 billion in goods and services in the financial year 2022–23 and added over \$200 billion to Australia's economy. It employed more than 3.5 million people across food value chains from agricultural production to food services and supported a workforce around four times larger than its own over the previous decade. Australia's food system is growing rapidly, and production-based estimates suggest that it is capable of feeding approximately 100 million people. The value added to the Australian economy by the food system grew by 1.3% per year between 2006–07 and 2022–23.

Australia has a reputation for clean and safe food that is central to its trading image around the world. The logistical efficiency and safety of Australia's food system are impressive given Australia's vast size and small population. The system has for long periods provided convenient and affordable food to Australia's mostly urban population.

Commodities versus food

However, this economic narrative provides only a partial view of Australia's food system. It focuses attention on the size of the agricultural sector, rather than on agriculture's role within the food system or its contribution to supporting multiple sectors across Australia's economy, including mining, manufacturing and services. Claims that Australia is food secure are based on Australia's aggregate status as a net exporter of bulk agricultural commodities such as wheat and beef. Food security should also take into account food affordability issues driven by high living costs, and the diversity of foods and food groups required to meet nutritional requirements.

Currently, millions of Australians routinely rely on food charity. Australia's food system does not produce enough vegetables to meet recommended daily intakes. Production-based analysis of food security also overlooks the critical role that food environments play in shaping dietary choices and health outcomes.



The promotion of convenient, highly processed foods is costing the Australian economy billions in lost productivity from the impact of preventable, diet-related diseases. These challenges suggest a significant opportunity for communities, governments and businesses to work together to create future food environments that are healthier, more sustainable and more equitable.

Food environments

A food environment describes all the factors affecting decisions to acquire, prepare and consume food, including what foods are made available, how those foods are marketed, how much different foods cost and their affordability, how far consumers need to travel to buy food, and what other goods and services they can access when buying food.



Australia's food system is worth around \$800 billion but focusing on the economics alone limits our view of the food system's real value to Australian society.



Unintended consequences and missed opportunities

Commercial activity across Australia's food system, particularly in the agricultural sector, generates a range of unintended but significant environmental impacts. Together, the net present value of the overall negative health and environmental impacts of Australia's food system is around 13% of Australia's gross domestic product (GDP). These environmental impacts, including climate change and damage to fragile soils, have contributed to a plateauing of agricultural productivity. The food system has tended to focus on commodity exports. By shifting our focus, we have the chance to embrace opportunities to develop and test innovative business models and food processing technologies with the potential to drive productivity growth in food manufacturing. For example, we have the opportunity to create new high-value regional food manufacturing industries for products that complement bulk commodity exports. Such products may help Australia meet noneconomic goals such as healthy diets, waste management and providing culturally diverse food options. New food technologies potentially use more energy but less land than conventional agriculture, creating both new sustainability challenges and opportunities. New foods such as complementary proteins may also help Australians meet nutritional goals as part of a balanced diet, complementing the intake of meat and other existing sources of protein.

New business models are emerging with potential to enable thriving regional food manufacturing industries to complement bulk commodity exports, and reporting is needed to help shape these.

Preferred food futures

Australia's food system is highly efficient from a short-term economic perspective. However, mechanisms for negotiating and working towards the food futures desired by diverse groups across Australian society seem to be underdeveloped. Public sector leadership is likely to be needed to balance ongoing economic goals with sustainability, equity and health goals because of the mixed incentives that profit-motivated businesses have to pursue these goals. Food policy needs to be supported by the consolidated reporting and accountability arrangements provided to other systems, such as the health, social welfare and criminal justice systems. Food policy is fragmented across portfolios as diverse as agriculture, industry, social services, health, transport, environment and urban planning. There are few formal mechanisms to recognise the food system or manage its priority interactions. This inhibits system-wide action to correct problems. The good news is that we know, for example, how to correct the health impacts of highly processed foods and the food environments that promote them. Australia has heavily regulated other potentially addictive and harmful consumer products such as tobacco and alcohol. In a similar way, greater coordination, information sharing and constant vigilance are required to overcome a tendency for food safety to be left to corpora-





Public sector leadership is needed to balance economic goals with sustainability, equity and health goals for Australia's food system

tions with mixed incentives to report on emerging threats.

Rebalancing metrics

There are gaps in the evidence necessary for identifying and negotiating goals for the food system and agreeing on actions for pursuing these goals. This has constrained the development of consolidated food system planning. A past focus on monitoring progress towards short-term economic goals has not been matched by the development of systems for monitoring progress towards sustainability, equity and health goals. It is also challenging to make definitive statements about the sustainability of Australia's food system because people with different interests and perspectives value sustainability in different ways. Progress has been made towards creating metrics that can help prioritise action towards agreed sustainability goals for the food system. However, these metrics have yet to be embedded into accountable institutions with statutory reporting arrangements.

Similarly, defining and meeting Indigenous food system goals remains especially challenging. Current reporting on the national food system lacks the detail necessary to negotiate improved futures for diverse Indigenous food systems. Mechanisms are also needed for incorporating learning and food products from Indigenous food systems into Australia's industrial food system.

Aligning reporting with food system goals

This report begins to consolidate an evidence base to support more holistic, proactive and forward-looking management of Australia's food system. It seeks to close a gap between the challenges and opportunities facing Australia's food system and the kinds of reporting available to understand and manage these challenges and opportunities. It does this by examining the state of Australia's food system from diverse perspectives across the system using the information currently available, and showing how more holistic management of Australia's food system is inextricably linked to more holistic reporting.



Reporting on economic goals has crowded out reporting of longer-term sustainability, equity, nutrition and health goals.



A brief history of food system reporting

One of the key reasons we can't 'see' important interactions across Australia's food system is because reporting has evolved to support a narrow set of mostly economic goals within individual sectors such as agriculture (Lim-Camacho and Nelson, 2024).

A sectoral approach to reporting has become deeply embedded in Australia. Australia's systems of reporting on agriculture and the food system took their current shape following World War II. The Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) and its predecessor organisations have regularly reported on the economic dimensions of individual food industries since 1945 (e.g. see BAE, 1945, 1946, 1947, 1948) and have more recently produced reports on food manufacturing and trade (DoA, 2014).

Since then, Australia has successfully structured its economy and approach to policy to pursue economic efficiency, driven by competition policy reforms (Harper et al., 2015; Hilmer et al., 1993). While this reporting is useful in tracking the economic efficiency of production-oriented sectors such as agriculture and food manufacturing, it is less useful for tracking and managing non-economic goals such as sustainability, equity and health.

A result of this is that economic reporting on the agricultural sector is highly developed and focuses on the productivity and profitability of farm businesses (see ABARES, 2025a) and the value generated by agricultural production via commodity exports (see ABARES, 2025b).

Data on food manufacturing are less developed. Statistics continue to be produced

on the employment and value-adding of manufacturing industries (see ABS, 2024), but there is no ongoing public sector analysis of these data. Reporting on the food retail sector has focused on the competitiveness of fresh produce and food retail markets through irregular public inquiries (see ACCC, 2025).

Reporting on the nutrition and health impacts of the food system is entirely separate from agriculture and food manufacturing and is mostly based on irregular Australian Bureau of Statistics (ABS) surveys. Household expenditure on food is routinely reported, but public sector reporting on equity issues such as the affordability of food or the influence of food environments is mostly absent.

For decades now, there have been signs of society-wide demand for more holistic food system reporting. Since 2000, various organisations have tried to fill gaps created by a public sector withdrawal from food system reporting by creating their own reports. Prominent examples include the publication of food manufacturing statistics by organisations such as Food Innovation Australia Limited (FIAL, 2020) and the Australian Food and Grocery Council (AFGC, 2025), the creation of a Hunger Report by Foodbank (2024), reports by Food Frontier on the state of the alternative protein industry (Food Frontier, 2023), the Hort360 best practice management platform developed by Queensland Fruit and Vegetable Growers (Growcom, 2025) and global benchmarking of the health and nutrition status of Australia's food environments by the INFORMAS network (INFORMAS, 2025).

FOOD SYSTEM THINKING

Australia's food system has evolved to feed Australians and contribute to the food security of millions of other people in Australia's export markets. It includes all the processes of producing, distributing and consuming food and food ingredients, from natural resources like water and soils that support agricultural production, through the manufacturing, processing and distribution of food, to its impacts on nutrition and human health. Interactions between these disparate components of the food system and an array of biophysical and socio-economic drivers of change mean that food systems are dynamic and can be unpredictable. Food system thinking is a way of organising our understanding of all the interconnected activities, people and inputs that are required to feed people (Figure 2). These activities include transforming ingredients into food, marketing it and disposing of by-products and waste. Food systems are part of the environment, culture and economy of every nation, which can give food systems like Australia's some unique characteristics. These characteristics include a strong regional identity with trusted sustainability credentials including adaptation to drought and to Australia's diverse climates and soils.



Figure 2: Australia's food system includes all the activities associated with producing, distributing and consuming food and food ingredients, from natural resources like water and soils that support agricultural production, through manufacturing, processing and distribution of food, to the impacts of food on nutrition and human health. Source: Food System Horizons (Palmer, 2024)





The purpose of Australia's food system is to nourish Australians and contribute to the diets of millions of other people around the world.

The goals we have for our food systems change over time as social and economic priorities change. This means that the capabilities we need to build into food systems often need to change to meet new goals. The defining feature of food systems is multiple and diverse interactions between activities. These interactions can result in surprising and difficultto-manage health, environmental, economic and social outcomes. They can also make the food system difficult to 'see', resulting in food system challenges not being effectively managed and food system opportunities being overlooked (Lim-Camacho and Nelson, 2024).

Awareness of Australia's food system has been growing, and the challenges and opportunities facing it were comprehensively reviewed in a 2023 'roadmap' (CSIRO, 2023). The roadmap found that Australia has an opportunity to take a global leadership role in building sustainable, productive and resilient food systems. Five focal areas were identified as key challenges to Australia's food system:

- enabling equitable access to healthy and sustainable diets
- minimising waste and improving circularity
- facilitating Australia's transition to net zero emissions
- aligning resilience with socio-economic and environmental sustainability
- increasing value and productivity.

Reports such as the 2023 roadmap have given us a profound understanding of the challenges and opportunities facing Australia's food system. This report seeks to move from exploring these challenges and opportunities to building the evidence base necessary to agree on food system goals and for negotiating action to meet these goals.



Australia has an opportunity to take a global leadership role in building sustainable, productive and resilient food systems.



FROM ANALYSIS TO ACTION

We know how to manage food systems

This report makes the case that the food system needs to be managed through interventions that improve its performance and future trajectories of development and that better reporting has a key role to play. However, tackling food related challenges and opportunities requires a type of system management that supports the ongoing evolution of the food system while at the same time providing guiderails on its direction of travel aligned to a diversity of national aspirations. This type of system management is best implemented in a distributed way through inclusive deliberation and genuine partnership between government, industry and community.

Food system thinking is developing around the world, and there is growing consensus on the practical steps necessary to manage food systems (e.g. see Bustamante et al., 2024; Conti et al., 2024; Mausch et al., 2020). These steps are increasingly being recognised in global best practice for applied food system policy (Deconinck et al., 2022). This combined knowledge and practice suggests three types of actions necessary to manage food systems:

1. Recognise the system

An essential first step is to recognise the food system, the broad mix of goals that society has for it and the interactions that need to be managed to meet these goals.

2. Allocate responsibility

A second critical step is allocating responsibility for negotiating and meeting food system goals, and for reporting on progress towards meeting these goals.

3. Enable interactions

A third step is enabling interactions across the food system by creating collaborative processes for negotiating goals and actions for pursuing them, and governance processes for negotiating trade-offs between conflicting goals.

Recognition of the food system, allocation of responsibility for managing it and practical processes for enabling interactions vary widely across Australia's food system. The system and its interactions need to be recognised before responsibility for managing them can be allocated, and responsibility needs to be allocated before coordination and governance can be enabled. Varying degrees of maturity of systems thinking and practice across the food system, especially in government and industry, set the challenge for institutional reform. The institutional reforms that are required involve a rebalancing of institutions and practices across the public sector that are designed almost exclusively to meet sectoral economic goals, with the institutions and practices required to meet a broader set of economic, sustainability, equity and health goals by managing food system interactions. These institutions and practices include processes for negotiating food policy goals, agreeing on actions across government for inducing progress towards them and embedding the monitoring systems that build on this report to routinely evaluate progress.

Recognising the system, allocating responsibility for managing it and enabling system interactions are not abstract or academic





A common challenge with managing food systems

A challenge common to managing systems like Australia's food system is continuously adapting the system to meet changing societal goals. A number of factors work against our collective ability to agree on changing goals and proactively adapt the food system to meet them. Most of these factors are different types of 'path dependency' or 'lock-in', which imply that our willingness and ability to understand and manage the future is overly constrained by past perspectives and practices. This has led to the creation of 'silos' of activity and interest across Australia's food system that pursue sectoral interests independently and that are sometimes in conflict with each other.

Conti et al. (2021) describe multiple types of path dependency affecting food systems, all of which tend to be mutually reinforcing:

- Misaligned policies and incentives and conflicts across scales – can create clusters of policy, regulation and thinking that reinforce sectoral perspectives. These silos can develop inertia against adapting to external pressures for change.
- Technological persistence occurs when skills, knowledge, policy and institutional settings tend to reinforce existing technologies and practices, and disadvantage new ones.
- Infrastructure rigidities form when longlived investments in infrastructure such as energy, transport and regulatory systems tend to favour existing commercial activities.



- Political interests can skew the direction of change, especially when powerful actors have strong incentives to instil perspectives and drive change in directions that protect their interests.
- Attitudes and cultures can cause a general aversion to change that combines with vested interests to lock in current practices and resist change as 'mission creep'.
- The processes used to set research and development priorities and reward scientists can combine with sectoral interests and the risk aversion of funders to favour incremental, sector-specific research and development.



notions for a theoretical food system. Nor can they be ignored as peripheral goals imposed by remote international bureaucracies focused on the environment, developing countries or vulnerable communities. They are practical steps for a real, functioning food system that the Australian Government has already recognised a need for. The 2023 parliamentary inquiry into food security in Australia called for a national food strategy (to recognise the food system), a Commonwealth ministerial portfolio for food (to allocate responsibility) and a national food council (to enable interactions) (Commonwealth of Australia, 2023).

Recognise the food system

Recognition of Australia's food system varies across its component parts and low recognition is often due to 'lock-ins' to sectoral interests (see Box – A common challenge with managing food systems).¹ From an industry policy perspective, the food system has historically been equated with agricultural production and commodity exports and - to a lesser extent with local Australian food manufacturing and employment. This approach to food policy has supported the growth of a highly efficient agricultural sector, facilitated by Australia's comparative advantage in land. The agricultural sector is reinforced by a world-class levy-funded research and development system that has emphasised the size of the sector and the productivity necessary to maintain competitiveness in export markets.

However, this focus on agricultural production seems to have reduced recognition that most agricultural commodities (excluding fibres such as wool and cotton) are food. This lack of recognition of commodities as food has conseguences for nutrition and health. As the insight sections of this report show, Australians have a low awareness of how historical patterns of agricultural production and a focus on commodity exports have shaped food availability. Likewise, there is low awareness of how these patterns have led to food environments associated with poor health outcomes in Australia and its export markets around the world. Emphasising agricultural production to enable bulk commodity exports has also reduced recognition of the potential to create innovative hubs of regional food manufacturing. These have the potential to meet employment and other economic goals while linking consumers to local food producers to pursue broader cultural, nutrition, equity and health goals.

The development of Australia's food manufacturing sector has been conditioned by a perception that Australia's relatively high labour costs mean that food manufacturing cannot be economically viable. Consequently, there is a view that world markets for bulk commodity exports will continue to be the dominant economically viable option (Griffith and Watson, 2016). An immense ongoing industrial and research effort to sustain agricultural productivity seems to have crowded out smaller but complementary pathways for food manufacturing and export growth.

New business models such as regional innovation hubs have the potential to overcome the indivisibility of labour and capital costs that has hampered the scaling-up of small-tomedium food manufacturing enterprises. New food technologies such as precision fermentation may be less land- and labour-intensive than agriculture, but perhaps more capital-, energy- and perhaps water-intensive. This has

¹ Sectors are defined here in the economic sense of aggregations of related industrial interests and activities.

the potential to alter Australia's comparative advantage by shifting production from labour to capital, and to shift some of the burden for meeting sustainability goals away from farming businesses that depend on land. New food technologies that produce food products such as complementary proteins also offer avenues to meet nutrition and health goals.

The sustainability goals that Australians increasingly have for their food system partly originate from the environmental consequences of a quest to remain internationally competitive in global commodity markets. Inexorable pressure to continuously extract more and more productivity from Australia's highly optimised agricultural systems has inevitably put pressure on Australia's fragile and infertile soils and other natural resources such as water and biodiversity. Collective agreement on what this means will allow Australians to be confident that Australia's food system is sustainable.

Allocate responsibility

The allocation of responsibility for managing Australia's food system is currently hampered by two types of policy-related path dependency. The first is a lack of public sector recognition of the food system due to a long history of pursuing sectoral goals via economic and administrative specialisation. Designing public agencies to pursue the interests of individual sectors has proven efficient for meeting some (mostly economic) sectoral goals, but it has also created silos of responsibility for policy, reporting and industry engagement that are deeply entrenched. These silos are mutually reinforcing to the point where people working within them can feel obliged to resist the idea of food systems as an inappropriate and unresourced expansion of their responsibilities.

The second type of policy-related path dependency is a deep conditioning regarding the roles of the public and private sectors in agriculture and food-related policy, derived from past policy experiences that may no longer be relevant to future food policy. Public sector attitudes and approaches to agricultural policy continue to be conditioned by a long and hard-won history of market reform in agriculture (see Productivity Commission, 2016). Government intervention to bolster commodity prices proved highly inefficient. It raised food prices for consumers and distorted incentives that changed what foods were produced so much so that deregulation has led to lower food prices and significant productivity gains (Gray et al., 2014; Productivity Commission, 2016). However, a legacy of this experience seems to have been a general withdrawal of public sector intervention from agriculture and agriculture-related food policy since the 1990s, and a belief that the private sector is more



We have well-developed mechanisms for the public sector to act on important societal goals that businesses lack commercial incentives to address.



efficient at setting directions for the sector. Aspects of agricultural policy where public leadership has been retained tend to facilitate bulk commodity exports, including efforts to maintain biosecurity protocols and maintain market access.

The question is, however, whether the private sector is capable of recognising and pursuing the broader suite of sustainability, equity and nutrition goals that Australians increasingly hold for Australia's food system, alongside ongoing economic goals. The success of withdrawing government intervention from agricultural marketing to meet economic efficiency goals seems to have led to a belief that the private sector can more efficiently meet all other policy goals.

The reality is that an over-reliance on markets in Australia's food system has resulted in a range of challenges that are either unintended by-products of market-related activity or are important societal goals that businesses have little or no commercial incentive to provide. Most sustainability challenges, such as land degradation, greenhouse gas emissions, pests and diseases and biodiversity loss, are unintended by-products of market-based activities in agriculture and food manufacturing. At best, markets can only provide muted incentives for important societal goals such as equity, food safety, cultural diversity, nutrition and health.

Australia's market reforms since the 1990s now also mean that we have 30 years of experiential evidence that free markets are unable to deliver a sustainable, equitable or healthy food system for Australia. We already have well-developed mechanisms enabling the public sector to initiate action to address the unintended environmental and health impacts that businesses lack commercial incentives to address. Similar experience internationally across a range of 'grand societal challenges', including food security, has led to the development of new forms of public leadership to pursue public interest sustainability, equity and health goals for national economies and food systems (e.g. see Mazzucato, 2016).

Growing pressure to meet a suite of sustainability, equity and health policy objectives that go beyond the knowledge and experience of managing industry policy has led to an emerging recognition in public sector agencies of the need to better coordinate disparate elements of food policy. So far, however, no public sector agency has been given a whole-of-government mandate to coordinate existing strands of food policy in Australia or to develop more integrated approaches to future food policy. This means, for example, that researchers producing emerging forms of integrated food system reporting, such as the true cost of food and circularity, have no public agency to report to. Neither is there a public agency to plan action based on these researchers' findings.



Public sector oversight is needed to monitor Australia's food environments and their consequences for nutrition and human health.



Responsibility for defining and pursuing sustainability is locked into sectoral perspectives, and responsibility for gaining consensus on food system sustainability and how to monitor it has not yet been allocated.

Free market thinking has also been locked into the interpretation of public health epidemics in diet-related non-communicable diseases. These are seen as an acceptable consequence of personal choice, foregoing the benefits of collective action to improve public health and alleviate public health costs. No public sector agency has a mandate to monitor the evolution of food environments in Australia or their consequences for nutrition and human health, or to engage communities in proactively shaping food environments into the future. Even the historically strong regulation surrounding food safety is becoming fragmented as a withdrawal of public sector ownership places increasing reliance on food companies with conflicting interests to balance profitability with food safety outcomes.

Reducing the separation between Indigenous food systems and Australia's industrial food system could provide opportunities to understand and address challenges in diverse Indigenous food systems, and to integrate products and learning from Indigenous food systems into the industrial food system. these negotiation processes. Negotiation on food system goals has been patchy and inconsistent since federation, often driven by crises such as drought (ACCC, 2008) or cost-of-living pressures (Commonwealth of Australia, 2023). Organisations such as ABARES and the Australian Institute of Health and Welfare (AIHW) have been created to provide a consistent flow of data and analysis for select parts of the food system, but they often have no interaction. Even in the parts of the food system where reporting does exist, it is not strongly embedded in the processes necessary to bring people from across the food system together to negotiate food system goals and trade-offs between them, or to agree on actions to pursue these goals. This is not just hampering



Reporting on Australia's food system is needed to manage public-good food system challenges and to promote commercial innovation and growth.

Enable interactions

Enabling food system interactions involves bringing organisations and individuals together to negotiate the collaboration and trade-offs needed to agree and pursue food system goals. It also involves creating an evidence base to support deliberation and decision-making in Australia from managing public-good food system challenges such as sustainability, equity and nutrition. It may also be inhibiting commercial innovation and growth. For example, opportunities exist to monitor and report on the evolution of food manufacturing innova-



tion hubs around Australia, as well as on influences on their success and enablers of rich regional food cultures across Australia. This is especially critical for the south-east Queensland region ahead of the 2032 Brisbane Olympics. There are opportunities for governments at all levels to work with communities and food retailers to design regional food environments that better connect consumers to local food producers to meet cultural, sustainability, equity and health goals.

Australia lacks mechanisms for reporting and analysing the evolution of its food environments. It also lacks processes for negotiating preferred futures for these. A tendency to blame commercial retailers for food environments that do not meet equity and public health goals overlooks the public sector's responsibility for negotiating what mix of goods and services should be provided, and how these can be provided when it is not commercially viable to do so. Shareholders have a critical role to play. They expect large supermarket chains to maximise profit subject to whatever limitations are placed on them by Australian society via government policy and regulation. However, they also benefit from improved sustainability, equity and health outcomes. Also missing are the robust mechanisms for gathering civil society preferences for what food environments and regional food cultures should look like into the future and enabling these preferences to be heard by governments, in addition to powerful corporate interests.

Methods to assess sustainability from different perspectives are under continuous development. Agreement on what food system sustainability means and how to assess it will help monitor progress on sustainability. Promising examples include methods of accounting for the true cost and circularity of food systems. These remain experimental, however, and lock-ins to sectoral reporting will need to be addressed before these complementary systems can be built into processes for negotiating food systems with lower environmental, health and social impacts. The future of sustainability reporting lies in the entwined development of science-based reporting on the sustainability of food system components, with processes for negotiating whole-of-food-system sustainability goals and trade-offs. Similarly, greater coordination, information sharing and constant vigilance are required to overcome a tendency for food safety to be left to corporations with mixed incentives to report on emerging threats.

Indigenous food systems have long been recognised for their intrinsic cultural value and their role in remote food security. They are now increasingly being recognised for their potential to enrich Australia's industrial food system. However, this recognition tends to be done through a colonial lens that implies that Indigenous food systems need to adapt to Australia's industrial food system, rather than vice versa.



Indigenous food practices and human– food interactions have potential to inform and enrich Australia's food system.



A deeper 'decolonised' recognition of Indigenous food systems is currently hampered by the top-down aggregation of reporting systems. This degree of aggregation masks the local detail required to understand diverse local Indigenous food systems and makes it difficult to effectively engage Indigenous communities.

TOWARDS A FOOD SYSTEM STRATEGY

Recognising Australia's food system and allocating responsibility for managing crucial interactions is becoming less of an abstract 'nice to have' and becoming more and more essential to advancing Australia's economy and way of life. Australia routinely recognises and actively engineers systems with similar complexity to the food system, including society-wide systems where significant public leadership is needed to address market failures and balance sectoral interests with broader societal goals. Examples include emergency management, air traffic control, maritime safety, the road transport system, the pharmaceutical system, the Australian Defence Force, multiple state and Commonwealth police forces and criminal justice systems, the social welfare system and the health system. The goals of these activities have proven to be beyond the capability of markets to deliver, and a high degree of public leadership and coordination has been put in place across Australia's three tiers of government to guide, regulate or replace absent market incentives to meet societally important goals.

Common to many of these examples is a need to negotiate and balance sectoral interests that are often in conflict with broader societal interests, and to coordinate action across sectors to pursue societal goals. Within governments, central agencies such as Treasury, Finance and especially Departments of Prime Minister/Premier and Cabinet have evolved as mechanisms for elevating systemic public good outcomes above competing sectoral interests. They focus political will and administrative effort to bring together the capabilities needed to pursue public-good goals. Canada – with a food system similar to Australia's – already has a combined agrifood portfolio coordinating food system policy (Government of Canada, 2025). The government of the United Kingdom also has an integrated Department of Environment, Food and Rural Affairs (DEFRA, 2025).

Most of these big public systems have highly developed reporting systems associated with them. An example relevant to the food system is the State of the Environment Report (Commonwealth of Australia, 2021). Regular reporting would enable the food system to be recognised and help allocate responsibility for prioritising and managing food system challenges



Food system reporting supports collaborative dialogue between governments, industry and the wider Australian community about the state and future of Australia's food system.





and opportunities. Food system reporting also supports deliberative dialogues between governments, industry and the wider Australian community as to what Australia's future food system should look like into the future and acceptable steps for getting there.

Participants across Australia's food system have important roles to play in recognising and managing it. The non-market nature of many food system goals requires public sector leadership to evaluate whether current food system institutions and reporting systems remain fit-for-purpose and what functions need to be redirected or added. Civil society food system leaders have a significant role to play in balancing sustainability, equity and health goals for Australia's food system alongside ongoing economic goals. Industry has a role to play in recognising community goals and helping to design efficient delivery of non-market services while meeting profit directives from shareholders. Researchers can support this process by marshalling evidence from novel forms of

analysis that provide new insights into critical interactions and trade-offs across the food system.

This report and the roadmap that preceded it have shown that Australians collectively have a deep knowledge of the challenges and opportunities facing Australia's food system and a growing knowledge of how to manage these. This report has begun to consolidate an evidence base necessary for negotiating priority goals for food system management and agreeing on pathways for pursuing these goals. Embedding regular food system reporting into institutions with a mandate to recognise and enable food system interactions is likely to be a necessary first step towards being able to 'see' the food system. This will, in turn, support strategies that arise from communities, governments and industries working together to decide what Australia's future food system should look like and what actions are needed to achieve this preferred future food system.



Prioritise not generalise

The growing pressures to diversify the goals of Australia's food system have been comprehensively reviewed in a food system 'roadmap' produced by CSIRO (2023), with broad consultation across the food system. New food system goals create pressure to supplement sectoral reporting with reporting on food system interactions that are causing acute challenges or creating prospective opportunities (Lim-Camacho and Nelson, 2024).

Research worldwide reveals that one response to these changing goals has been a proliferation of food systems frameworks. This, in turn, has led to calls for harmonised reporting (e.g. see Fanzo et al., 2021). Harmonised global reporting has a role to play in supporting international benchmarking by enabling national food systems to be compared. However, it has proven much less useful for guiding context-specific policy and management (Conti et al., 2024; Deconinck et al., 2022). Harmonised reporting at a local scale seems impractical

given constraints on reporting budgets and is likely to be defeated by the rapid evolution of food systems and the challenges and opportunities emerging from them (Bustamante et al., 2024; Deconinck et al., 2022).

A pragmatic approach to prioritising scarce research and reporting resources suggests that processes are needed for negotiating priority food system challenges and opportunities to report on. A global review of the evidence available for food system policy found that context-appropriate national reporting is needed to help define the characteristics of policy issues and the effectiveness of potential policy responses and to engage the actors and interests involved (Deconinck et al., 2022). Felt local impacts are likely to motivate specific local policy responses much more than claims of urgency based on generalised global processes such as the United Nations Sustainable Development Goals (UN SDGs).



<u>Part 1</u>

Insights into food system goals



<u>Insight</u>

1 Nutrition

Jessica Bogard and Sinead Boylan


KEY POINTS

- Australia experiences high rates of dietrelated diseases due to poor-quality diets.
- A reporting focus on agricultural production and exports has distracted from the nutritional value of food, and risks accessibility and affordability issues being overlooked.
- Better recognition of the influence of food environments on dietary choices is needed to enable improvements in nutrition and health.



Australia experiences diseases due to poorquality diets despite a relative abundance of safe, high-quality food.

1.1 Nutrition in Australia

Australia has an industrialised food system characterised by a relative abundance of safe, high-quality food, which is provided to over 27 million consumers every day. However, Australia's food system is also associated with obesity and epidemic rates of diet-related non-communicable diseases. Around twothirds of Australian adults and almost one-third of children and adolescents were overweight or suffered from obesity in 2022, up from 56% and 20% in 1995, respectively (AIHW, 2024). Obesity rates in Australia are among the highest rates of Organisation for Economic Co-operation and Development (OECD) countries (OECD, 2023). The Foodbank (2024) Hunger Report suggests that almost one-third of Australian households (an estimated 3.4 million households) experienced moderate or severe food insecurity in the previous 12 months.

Diet quality for the average Australian is poor, characterised by low consumption of fruit

and vegetables and excess consumption of discretionary foods that are energy-dense and nutrient-poor (Figure 3). Less than 5% of Australians consume amounts of fruit and vegetables consistent with dietary guidelines. Discretionary food accounts for around onethird of dietary energy intake among adults and around 58% of household food expenditure (AIHW, 2018; Lee et al., 2020). Displacement of healthy foods with discretionary foods means that many Australians suffer from micronutrient deficiencies despite the relative abundance of food. For example, around 70% of adult women aged 19-30 years consume inadequate calcium and 40% consume inadequate dietary iron to meet physiological needs (AIHW, 2018). Thirty-one per cent of First Nations people in remote communities are estimated to be food insecure (Commonwealth of Australia, 2023).



THE AVERAGE AUSTRALIAN DIET



Figure 3: Comparison of the average Australian diet (adults 19–50 years) with the 2013 Australian Dietary Guidelines. The average Australian diet is expressed as a percentage of the benchmark recommendations. The red dashed line represents 100% of the recommendations in the Australian Dietary Guidelines. Source: Hendrie et al. (2022)

Unhealthy diets are now the third leading cause of disease in Australia, after overweight/ obesity and tobacco use, and cost the economy more than \$16 billion each year when considered with other diet-related health risks (AIHW, 2022). Dietary risks are also contributing to growing health inequities, where the disease burden from poor diet among the most socioeconomically disadvantaged communities is twice as high as the least disadvantaged group (AIHW, 2021).

1.2 Issues and challenges

Unhealthy food environments are a major driver of the poor health and nutritional status of Australians. Food environments include all the factors affecting decisions to acquire, prepare and consume food, including how food is marketed, access to shops and affordability (see Insight 2, Retail environment). Australia is performing well in several areas of food environment policy relative to international best practice. These include some aspects of labelling such as regulation of ingredient lists, nutrition information panels and health claims, and the exclusion of fresh fruits and vegetables from goods and services tax (Sacks and Mann, 2023). National strategies for preventative health and addressing obesity have been developed (Commonwealth of Australia, 2021, 2022), and the Australian Dietary Guidelines and supporting scientific evidence are under review.

However, there are several aspects of food environments where Australia falls short of global benchmarks. These include restrictions on the promotion of unhealthy foods, taxes or levies on unhealthy foods, healthy food provision in public sector workplaces, support for health promotion agencies, and dedicated



efforts for addressing obesity and nutrition. In addition, there is room for improvement in some aspects of labelling. Over 80% of nutrition content claims do not fully comply with regulations and only 36% of packaged food and drinks display the health star rating (Sacks and Mann, 2023).

While the impact of food environments on dietary choices has long been recognised in health policy, it is much less recognised in other areas of food policy such as agriculture and manufacturing. This creates an opportunity for stronger and more coherent policies to pursue health outcomes. An over-reliance on markets to meet nutrition goals means that public health epidemics in diet-related non-communicable diseases are interpreted as an acceptable consequence of personal choice, foregoing the benefits of collective action to improve nutrition and alleviate public health costs. Australia has already regulated tobacco to improve



Diet-related health epidemics are being interpreted as an acceptable consequence of personal choice, foregoing the benefits of collective actions that could improve nutrition and health. public health (Swinburn et al., 2019; Wilkinson et al., 2019). Health and community groups in Australia have called for a tax on sugar-sweetened beverages, but this has been strongly opposed by the Australian beverage industry (Cancer Council, 2024).

The result is a food system where unhealthy foods are readily available, convenient and aggressively marketed to consumers. They are often manufactured explicitly to be highly palatable, encouraging overconsumption using low-cost ingredients including sugar, fat and salt (Monteiro et al., 2019). Such foods now account for more than half of all packaged foods on supermarket shelves (Crino et al., 2018). Fast food outlets are heavily concentrated in areas of socio-economic disadvantage and around schools, driving poor dietary patterns among these groups (Thorton et al., 2016).

Australia is perceived to be food secure due to an exportable surplus of bulk agricultural commodities (ABARES, 2020). More than 70% of Australia's agricultural production is exported. The other 30% feeds a population of 27 million (ABS, 2024), so Australia is estimated to be able to feed another 63 million people, or around 100 million people in total. This metric is misleading as an indicator of food security because it assumes that commodities are food. By assuming a diet based on grains and beef, which dominate exports (Figure 4), dietary requirements for fresh fruit and vegetables, or the potential of alternative sources of proteins such as dairy products, pulses and eggs, are downplayed. The metric also ignores the impact of food environments on dietary choices and issues relating to the accessibility and affordability of food for vulnerable people throughout Australian society (see Insight 2, Retail environment).



SHARE OF AGRICULTURAL PRODUCTION

Figure 4: The share of agricultural commodities in the gross value of agricultural production; average for the 3 years 2019–20 to 2021–22. Source: ABARES (2024)

Better recognition of food environments and their impact on dietary choices is needed to improve nutrition, health and food security

Reporting on nutrition is a necessary step to defining and monitoring progress towards nutrition and health goals. To date, reporting on nutrition has focused on the downstream outcomes of food systems, especially obesity and diet-related disease. Data on food consumption are rarely available on a consistent national scale, making it difficult to understand changes in diets. Food environments have not been consistently reported on in terms of the availability, affordability and marketing of healthy and unhealthy foods, making it difficult to track the outcomes of industry and government policies that influence diets (see Insight 2, Retail environment). This lack of data on the drivers of poor nutrition inhibits the design and implementation of policies to improve nutrition.

In lieu of regular and nationally representative data, Australia's Food Environment Dashboard has been created and supported by public-interest organisations and researchers to monitor and benchmark the upstream drivers of overweight and obesity (Deakin University, 2025). This platform is strengthening accountability of public and private sector actors but lacks sustained long-term resourcing. The voluntary nature of corporate reporting and the political influence of food companies are seen as factors that limit accountability in food systems (Mialon et al., 2016).



Reporting on key factors in food environments that influence diets will help define and monitor progress towards nutrition and health goals.

1.3 Opportunities to improve nutrition

Decades of health research in Australia have shown that educating consumers on healthy diets can be beneficial, but it is not sufficient to reduce rates of obesity and diet-related disease. What is needed is the creation, via public sector leadership, of enabling environments that support and empower people to eat healthy foods by making them more convenient, accessible, desirable and affordable and, in turn, making unhealthy foods less so. The leadership required is similar to the public leadership taken to reduce the consumption of tobacco. Australia's National Obesity Strategy also encourages the creation of supportive environments that empower consumers to make healthier choices (Commonwealth of

Australia, 2022). Taking a whole-of-foodsystem approach, key opportunities lie within food environments, as well as in changes to broader agricultural systems that underpin the supply and affordability of foods. These opportunities are discussed in more detail below.

Reshaping food environments

Key opportunities to reshape food environments to support better health and nutrition include:

- stronger restrictions on marketing of unhealthy food and beverages to children
- mandatory reformulation of certain food products to reduce sodium, saturated fat and sugar
- making the health star rating system mandatory rather than voluntary
- implementing levies on unhealthy foods, including sugar-sweetened beverages (Sacks and Mann, 2023).

Public sector leadership is needed to make healthy foods more convenient, accessible, desirable and affordable.





Aligning agriculture and health

From a nutrition perspective, Australia produces food ingredients such as grains, meat, sugar and oilseeds far in excess of what is needed for the Australian population (Ridoutt et al., 2017). As indicated earlier, much of this is exported and used by other countries to produce highly processed food products, some of which are then re-imported to Australia.

At the same time, agricultural production in Australia is currently insufficient to provide the Australian population with food ingredients in amounts consistent with dietary guidelines. In particular, domestic production of vegetables is insufficient for all Australians to consume recommended quantities, and the gap between production and recommended intakes is not being filled by food imports (Mason-D'Croz et al., 2019; Ridoutt et al., 2017). This is reinforced by a levy system that biases agricultural research and development towards commodities for export, without consideration of the nutritional needs of consumers in those markets.

This is an example of a lack of coherence across sectoral policy objectives (see Insight 5, Policy coherence). An overarching vision that articulates the multiple goals of food systems is essential if structural contradictions such as this are to be identified and managed to optimise synergies and minimise trade-offs in food systems to support health, equity, sustainability and economic priorities.

<u>Insight</u>

2 Retail environment

David Reynolds, Jeremy Farr, Lilly Lim-Camacho and Charley Xia



KEY POINTS

- Convenience strongly shapes how Australians source their food – mostly from supermarkets.
- Economic and geographic disparities in food access mean that not all Australians are served equally well by existing food environments.
- Australians have low awareness of the impact that food environments have on dietary choices and health outcomes, and targeted reporting could help to address this.
- A coherent vision for the future of Australia's food environments will be a key part of achieving food system goals.

2.1 Australian food retail today

Australia's food retail environment involves a large number of businesses, highly concentrated around a small number of brands. In 2024, Australians purchased food and beverages from 22,987 food retail establishments (ABS, 2024a). Only 2556 of these were supermarkets run by ALDI, Coles or Woolworths (Coles, 2024b), yet about 85% of Australia's groceries were purchased from these major supermarket chains (ACCC, 2024).

A food environment describes all the factors affecting decisions to acquire, prepare and consume food, including what foods are made available, how those foods are marketed, how much different foods cost and their affordability, how far consumers need to travel to buy food and what other goods and services they can access when buying food (Figure 5).



Figure 5: Many influential drivers both shape and are shaped by Australia's food retail environment

DRIVERS OF OUR FOOD RETAIL ENVIRONMENT

Australians buy almost all the food they consume – rather than producing it themselves – so food environments are very influential. Consumers help to shape food environments through collective patterns of demand, while voters and community members influence governments and businesses.

Food environments in Australia are optimised for working-age people who live in cities or peri-urban areas, require convenience, receive a median household income, have access to a car and are not constrained by physical or mental health. Even members of this group have found sourcing food challenging through the recent 'cost of living crisis'. While the major drivers of increasing cost of living are beyond the food system, the knock-on effects of reduced disposable income combined with food inflation have led to an increasing incidence of food stress (where more than 25% of disposable income is spent on food) (Landrigan et al. 2017; Pollard et al., 2021).

Convenience

Convenience seems to be the single greatest influence on where Australians source their food. It is at least as influential as low prices. In



Convenience strongly shapes why Australians mostly source their food from supermarkets. 2023, consumers reported that the most common reason for loyalty to one supermarket brand was it being the most convenient (71%), followed by another form of convenience – familiarity with store layout (61%). These reasons for loyalty ranked well above belief that these sources of food were the cheapest (37%) (Canstar Blue, 2023).

Healthy food is not close to home for everyone

The strong influence of convenience, and especially geographic proximity, on where Australians source their food has health implications (see Insight 1, Nutrition). For example, a higher ratio of unhealthy to healthy food outlets near home has been linked to a higher incidence of obesity in adults, while living closer to healthy food retailers has been linked with reducing the risk of children being overweight (Needham et al., 2022).

We trust our food

Australians trust in the safety of the food that Australia's food system produces and distributes (FSANZ, 2023). This trust supports the sale of anonymous food – where the purchaser does not know the origins of the food they buy, such as vegetables on supermarket shelves. This trust and its role in food retail can be taken for granted, but international examples show that populations can lose trust in the quality and safety of their food, with implications for how they source food (Wu et al., 2021).

General trust in the food system is distinct from trust in particular food brands. Consumer trust in the brands of Coles and Woolworths dived from the highest to among the lowest in Australia in 2024 (Roy Morgan, 2024). Social licence difficulties for Coles and Woolworths seem to have been the cause because the two next largest supermarket chains, ALDI and IGA, retained the trust of consumers (Roy Morgan, 2024).

2.2 Overlooked issues and alternatives

Geographic inequality in food access

Australia has geographic inequalities in access to food environments, with remote and urban Australians experiencing very different proximity to retailers and cost of food (ABS 2018; Lee et al., 2021; Pollard et al., 2014). Among respondents to the 2024 Australian Competition and Consumer Commission (ACCC, 2024) survey, 34% of residents in remote areas reported that they had only one retail option, compared to 6% of residents in regional areas. The costs of running food distribution infrastructure, without economies of scale, in low-density populations can increase retail food costs. This can be particularly severe in rural and remote Indigenous communities (Spurway and Soldatic, 2015).

Food retailers are fundamental to Australia's food distribution system, but they are not legally responsible for ensuring food security. Public sector interventions are necessarily case-specific. For example, Health and Wellbeing Queensland (2023) developed the Gather + Grow strategy to enable resilient and affordable food supply chains in remote parts of Queensland.

Inequity in food retail

As well as geographic location, inequitable access to food can be linked to health, disability and poverty (Lee et al., 2021; Seivwright et al.,

2020). Supermarkets already provide important services for people who experience some forms of vulnerability, particularly relating to physical and mental health (Pollard et al., 2014).

Food retail environments reflect Australia's car-oriented retail infrastructure, especially outside major urban centres (Bivoltsis et al., 2023). While convenient for many, car-centric infrastructure underserves non-drivers. In



Economic and geographic disparities in food access mean that not all Australians are served equally well by food retail environments.

Australia's 21 largest cities, disability is more prevalent in less walkable areas with fewer amenities, including public transport and healthy food retail (Fortune et al., 2020). More walkable food retail environments would have co-benefits for both drivers and non-drivers (Summerhayes et al., 2024).

Shopping online

Online retail is growing as a way for Australians to source food. A 2024 survey found that 20% of consumers had recently purchased groceries both online and in-store, with 6% buying online only (ACRS, 2024). In 2022, only 52% of Australians reported buying groceries exclusively in-store, while 35% bought groceries mainly in-store and partly online, and 13% did so mainly or exclusively online (Appinio and Spryker, 2022).

Online shopping fits with a consumer trend to seek ways to minimise time and effort spent shopping. The value of online food purchases surged 157% between 2019 and 2024 (seasonally adjusted; ABS, 2025). The increase was partly due to COVID restrictions, but the upward trend has continued since then with 6.6% of all food sold in Australia purchased online in 2024, from 5.8% in 2022 (ABS, 2025). Coles (51%) and Woolworths (45%) dominated online grocery sales in 2024, followed by Amazon (23%) (Statista, 2025). Online food purchasing has also reshaped food environments by boosting niche ways of sourcing food, as in the case of takeaway food delivery and meal boxes.

Concentration, competition and market power

Large supermarkets in Australia have been the subject of several inquiries in recent decades, exploring whether market concentration is enabling the abuse of market power. Woolworths and Coles are estimated to hold 65% of the grocery market, with a further 10% held by ALDI and 7% by Metcash (IGA) (Treasury, 2023). Within Coles and Woolworths, concentration in the form of home-brand products as a share of sales is also increasing (Coles, 2024a; Woolworths, 2024). Home brands can increase profits by reducing costs and increasing bargaining power with ingredient suppliers and food manufacturers (ACCC, 2024; Pulker et al., 2018b).

The growth of other actors in the market has been pointed to as a sign of healthy competition (e.g. by Coles, 2024b). More recent entrants such as ALDI and Costco have leveraged the large size of their well-established overseas businesses to expand into Australia. Major barriers to entry for smaller players include rent and energy prices and labour (costs and shortages) needed to match the 'everything-all-thetime' convenience offered by large established retailers (ABS, 2024b; Meris, 2024). To manage these barriers, some smaller food retailers are focusing on specialised products and providing online ordering and delivery services (Meris, 2024). Others focus on value, guality or provenance of food and alternative ways of sourcing and distribution, such as through closer relationships between consumers and producers enabled by farmers' markets (ABC, 2024).

Food retail is community space

As well as providing access to food, food retail environments are social spaces in which people in local communities interact, building social cohesion and reducing social isolation (Williams et al., 2024). Smaller greengrocers, butchers and specialty shops can support community interaction for diverse ethnic groups (Voloder, 2015).

2.3 Priorities for improving reporting and management

Monitoring food retail environments

Australians currently have a low awareness of the influence that retail food environments have on dietary choices and health outcomes (see Insight 1, Nutrition). Consistent methodologies and data standards for analysing food environments have yet to be established for Australia, and data on food sales are held closely by food retailers. The AIHW has proposed monitoring food environments in Australia (AIHW, 2012). Australia's Food Environment Dashboard (Deakin University, 2025) offers access to the patchy data available (see Insight 1, Nutrition). Analyses of food environments, such as those conducted in Perth and



Most Australians have low awareness of the impact that food environments have on dietary choices and health outcomes.

Melbourne, could be extended (Bivoltsis et al., 2020; Needham et al., 2022). Supermarkets could work towards understanding the contribution of home brands to nutrition and health (Pulker et al., 2018a), following the example of Tesco in the United Kingdom (Tesco PLC, 2025).

Reporting on competition-distorting trends

There is ongoing debate regarding whether consolidation in Australia's food retail system has created market power for supermarkets that is used to disadvantage consumers or producers of food and its ingredients (Merrett, 2020). Internationally, inquiries by public agencies such as the ACCC tend to infer market power and its abuse from pricing and procurement practices, but these inquiries are not always conclusive (Deconinck, 2021). One avenue for future research is the role of market power in shaping food retail environments through practices such as land banking.

Preferred retail food environments

Monitoring is a first step towards enabling governance processes to negotiate preferred future food environments. Processes are needed that bring communities, governments and industries together to balance ongoing economic goals with sustainability, equity and health goals for Australia's food system. It is likely that large supermarket chains will continue to play a significant role in Australia's food environments. Processes are needed to negotiate the mix of commercial and non-commercial goods and services that supermarkets are expected to provide, and to build public support for non-commercial obligations.



<u>Insight</u>



Narelle Fegan and Rozita Vaskoska





KEY POINTS

- Although Australia has a reputation for producing safe food, it has a high incidence of some foodborne pathogens for a developed country, indicating that improvements are needed.
- Food safety is essential to building trust in our agrifood system both domestically and globally.
- Food safety continually evolves to assess threats arising from new foods, technologies and distribution pathways.

3.1 State of food safety

Australia is known globally for producing food that is clean, green, safe and of high quality (Australian Food and Agriculture Taskforce, 2024). Despite this reputation, rates of foodborne illness for some pathogens are among the highest in the developed world (Figure 6). Public health costs associated with foodborne illness in Australia were estimated to be \$2.81 billion annually in 2023 (Australian National University, 2023).

3.2 Challenges with reporting

In Australia, food safety metrics consider a range of food system aspects. Metrics may reflect on the prevalence and concentration of pathogens in food, the costs of managing food safety or the social and economic impacts of the food system itself. Incidence of foodborne illness is a standard metric for monitoring food safety, but it does not reflect the flow-on reputational consequences, which can be

INCIDENCE OF FOODBORNE ILLNESSES

2010 20

CAMPYLOBACTERIOSIS Incidence per 100,000 pop





Figure 6: Incidence of foodborne illnesses (campylobacteriosis and salmonellosis) between 2018 and 2023 in Australia, New Zealand and the United States. Data compiled from National Notifiable Diseases Surveillance System (Australia), BEAM Dashboard, Centers for Disease Control and Prevention (United States) and Ministry for Primary Industries Foodborne Disease Annual Reports (New Zealand) disproportionately large. Food businesses are as vulnerable as the poorest performer in their value chain or industry. If one business has a food safety incident, this can negatively impact whole industries and brands. Impacts can lead to job losses, product disposal, empty supermarket shelves and legal actions for compensation. Flow-on effects to farmers' and workers' livelihoods, as well as effects on consumer trust, are more difficult to quantify and remain uncaptured in systemically collected metrics.

Some food safety data are collected on a continuous basis, while others are collected occasionally or in a manner that is reactive or dependent on resources. Some of the most used metrics include:

- foodborne illness notifications, through the National Notifiable Diseases Surveillance System hosted by the Department of Health and Aged Care
- cost of foodborne illness, commissioned through Food Standards Australia New Zealand (FSANZ)
- food recalls, collected by FSANZ
- levels of chemical contaminants, investigated by the Australian Total Diet Study done by FSANZ
- residue levels in imported food, collected and reported by DAFF
- prevalence and concentration of foodborne hazards, collected by industry organisations for benchmarking and trade purposes
- food product regulatory and customer

requirement compliance data, collected by food producers, manufacturers and retailers.

These data are rarely connected and information is not always shared due to the stigma associated with foodborne hazards; the fear of regulation; the fear of breaking of trust in value-chain relationships; and the fear of damaging brand reputation. Greater data sharing with built-in mechanisms to retain trust would provide more opportunity to proactively manage food safety issues. It would also enable shared learning across different sectors to improve food safety management.



Food safety is essential to building trust in our agrifood system both domestically and globally.

Overarching policy and regulations

The bi-national joint food regulatory system of Australia and New Zealand is made up of the policies, standards and laws that make Australia's food safe to eat (Australian Government Food Regulation, 2024). The regulatory framework for food safety in Australia is very complicated (Figure 7). Food ministers of Australia and New Zealand hold the responsibility for food safety regulation. They span federal and



right. Adapted from: Commonwealth of Australia, 2025; FSANZ, 2019; FSANZ, 2023 state governments in Australia, and encompass agricultural and health portfolios.

FSANZ is the federal agency responsible for developing the Australia New Zealand Food Standards Code. Australian state and territory agencies are responsible for implementing, monitoring and enforcing food regulation in Australia. Food imports fall under the Department of Agriculture, Fisheries and Forestry. There are also consumer protection and trade practice laws that are enforced by the ACCC related to product safety and fair-trading practices.

While there is information on how these institutions govern food safety regulation, there is often complexity around implementation, partly because regulation lags behind advancements in technology and innovation. An example is cellular agriculture, which does not fit neatly into the definitions of primary production because its production processes span processing to final product. New food technologies mean that there is an increasing need to research hazards emerging from novel foods. Reporting this knowledge will help ensure that regulations adapt to be fit-forpurpose into the future and enable staff in regulatory agencies to be trained to implement regulation of potential new threats.

Private standards

Federal standards and laws provide high-level guidance for food safety practices. The granularity of the implementation of these rules in practice often comes down to adding a layer of 'private standards' adopted by businesses. These provide detailed procedures and plans for businesses within the food industry such as certification schemes and audits (Vaskoska and van der Meulen, 2014). These private standards contribute to the management of food safety at an industry level and provide a foundation for an effective pathway towards compliance.

3.3 Priorities

The constant changes in hazards and practices and the emergence of new food technologies, foods and marketing strategies mean that constant vigilance is needed to maintain food safety. Successful past management can lead to complacency regarding future risks and a fragmentation of food safety efforts. Any modification to the food system can impact food safety in a positive or negative way, and understanding these impacts is vital to maintaining a trusted system.

Most food safety reporting uses reactive metrics that report impacts after an event has already occurred. More proactive approaches would enable the likelihood of an event happening to be considered so that proactive prevention measures can be put in place. Proactive approaches are undertaken by government agencies in Australia and New Zealand via horizon scanning tools (e.g. FSANZ and VIBE – Vigilance and Intelligence Before food issues Emerge; FSANZ, 2024). These help to anticipate threats that could impact food safety. Some food industries subscribe to commercial tools for horizon scanning to inform risk assessment and decision-making.

Reports from stakeholder workshops and industry and government strategies have identified emerging and evolving threats as well as numerous challenges arising from systemic or structural change. These reports and strategies highlight the need to carefully manage interactions between food safety and other initiatives like sustainability and food security. For example, food safety is captured in the Australian Agricultural Sustainability Framework (AASF; see Insight 6, Sustainability) and parallels are often drawn with biosecurity assessment and management.

Food safety challenges are constantly evolving from structural change in the food system, as well as from emerging threats. A lack of coherence in food safety regulation due to the multiple agencies involved can make it difficult for the food safety system to adapt to new threats, and this highlights the need for policy coordination and national oversight (see Insight 5, Policy coherence). Ensuring that food safety regulations are based on robust science is another ongoing structural challenge. Food safety systems need to adapt to constantly changing consumer preferences, as well as an aging population that is more susceptible to foodborne hazards. Other structural challenges include declining research capacity, shortages of skilled professionals, inadequate infrastructure and the need for more education and training to close skills gaps.



Food safety must continually evolve to assess threats arising from new foods, technologies and distribution pathways.



Environmental challenges such as climate change and extreme weather events can lead to new food safety concerns, and new foodborne hazards often arise from catastrophic events such as fires, floods and droughts. Foodborne microorganisms can readily adapt and become more resilient over time and move into new geographical areas. New food safety hazards can develop with new food products and processing technologies. Offsetting this is the potential for innovation in hazard detection, disease source tracking and the use of big data to provide new risk management insights.

The complexity of global and domestic supply chains poses challenges for food safety management, requiring effective through-chain control, continuous assurance systems, enhanced traceability and rapid identification of food fraud. Understanding foodborne hazard origins is essential for effective risk mitigation, as is increased data sharing between government, researchers and industry. Interactions between food safety and other goals of the food system such as sustainability and food security need to be carefully managed to avoid conflicts. For example, efforts to pursue sustainability through waste minimisation and reuse can conflict with the advantages of disposable plastics for preventing the spread of foodborne diseases.

<u>Insight</u>

4 Indigenous food systems

Max Fabila and Sinead Boylan

1 AUSTRALIA'S INDIGENOUS FOOD SYSTEMS



65,000+ years experience managing complex, sustainable, nutritious and equitable food systems





- Access to Indigenous and healthy non-Indigenous food sources consistent with Indigenous food security desires
- Harmful data practices continue to reproduce misleading and decontextualised narratives



Embedded in Country Indigenous food systems are embedded in ancestral land, water and sky ecosystems that provide food and nutrition for all things on Country **Diverse and locally specific** food systems that reflect the unique social, geographic, environmental and cultural contexts of Indigenous Australia

3 OPPORTUNITIES

- Advance culturally relevant and appropriate data
- o Build Indigenous-led research agendas
- Align food-related policy with Indigenous priorities and values

KEY POINTS

- Aboriginal and Torres Strait Islander (Indigenous) Peoples have managed complex, healthy and equitable food systems since time immemorial.
- Indigenous food systems are highly diverse, embedded within more than 250 locally specific language, cultural and family systems.
- Advancing culturally relevant and appropriate data will enhance the ability to report definitively on the state and resilience of Indigenous food systems.
- Prioritising bottom-up reporting that engages and reflects the diverse food system priorities of Indigenous communities will foster more authentic, inclusive and effective outcomes.

The following viewpoints are those of the lead author and were not written as a part of a consultative process. They are based on their current experiences as an Indigenous (Jabirr Jabirr) researcher involved in the Food Systems Horizons initiative. Input from other studies was incorporated into this insight in partnership with the non-Indigenous co-author, and the final version was reviewed by Indigenous and non-Indigenous reviewers.

4.1 Unique aspects of our Indigenous food systems

It is difficult to report definitively on the state of Indigenous food systems. This is due to a lack of culturally relevant and appropriate data and data-gathering methodologies to understand and monitor Indigenous food security. In lieu of an ability to report on Indigenous food systems, this section provides a brief overview of the unique aspects of Indigenous food systems, future research and reporting priorities.

Indigenous Peoples have managed complex, healthy and equitable food systems since time immemorial. Indigenous food systems are embedded within a network of more than 250 locally specific language, cultural and family systems (cultural groups) bound to designated parts of the Australian continent. Indigenous Peoples' food systems are embedded in 'Country' (ancestral land, water and sky ecosystems) and encompass the presence of, and relationships with, all living, non-living, human and more-than-human elements (Poelina, 2024; Sherriff et al., 2022). Healthy Country is intrinsically linked with Indigenous (and non-Indigenous) Peoples' health and wellbeing (Cresswell et al., 2021). Caring for Country - and managing it – fosters ongoing cultural and spiritual connections with Country while providing access to food resources that are essential to Indigenous Peoples' health and wellbeing.



Indigenous Peoples have managed complex, healthy and equitable food systems since time immemorial. The diversity of Indigenous Peoples around the world means there is no blanket definition for Indigenous food systems (FAO, 2021). The Food and Agriculture Organization of the United Nations (FAO) (2021, p.2) suggests that Indigenous food systems generally 'involve the totality of human agencies (knowledge, strategies, techniques, values, sharing) for the production, generation, utilisation, access, availability, stability and management of food that is nutritious, culturally and spiritually fulfilling and sustainable for future generations'.

The ongoing process of colonisation has disrupted and reshaped traditional Indigenous food systems. As a result, Indigenous Peoples rely on both Indigenous and non-Indigenous food (Deen et al. 2025). Indigenous Peoples see an important role for both traditional and non-traditional foods in supporting food security. Members of Aboriginal communities at a Good Food Systems project meeting in 2010 (Menzies School of Health Research, 2016, p. 1) made the statement:

Food security for us is when the food of our ancestors is protected and always there for us and our children. It is when we can easily access and afford the right nontraditional food for a collective health and active life. When we are food secure we can provide, share and fulfil our responsibilities, we can choose good food knowing how to make choices and how to prepare and use it.

Indigenous Peoples demonstrate strength and resilience in maintaining food security despite facing systemic barriers within the Australian food system, which does not yet fully support their needs (Wilson et al., 2020). A key challenge for the Australian food system is enabling access to Indigenous and healthy non-Indigenous food sources consistent with Indigenous food security desires.



Indigenous Peoples demonstrate strength and resilience in maintaining food security despite facing systemic barriers within the Australian food system.

4.2 Reporting on Indigenous food systems

Advancing culturally relevant and appropriate data will enhance the ability to report definitively on the state and resilience of Indigenous food systems. Palawa Professor Maggie Walter (2018) explained the ongoing harmful data practices experienced by Indigenous Peoples. These included BADDR data: Blaming, Aggregate, Decontextualised, Deficit and Restricted (Walter, 2018). The continued engagement and reproduction of BADDR data continues to reproduce misleading and decontextualised narratives related to Indigenous Peoples. Table 1 provides an overview of the characteristics of BADDR data compared to Indigenous data needs.





DOMINANT BADDR DATA **INDIGENOUS DATA NEEDS Blaming data** Lifeworld data Data contrast Indigenous/non-Indigenous We need data to inform a comprehensive, data, rating the problematic Indigene against nuanced narrative of who we are as peoples, of the normed Australian as the ubiguitous our culture, our communities, our resilience, our pejorative standard. goals and our successes. Aggregate data **Disaggregated data** Data are aggregated at the national and/ We need data that recognise our cultural and geographical diversity to provide evidence for or state level, implying Indigenous cultural and geographic homogeneity. community-level planning and service delivery. **Decontextualised data Contextualised data** Data are simplistic and decontextualised We need data inclusive of the wider social structural context/complexities in which Indigefocusing on individuals and families outside of their social/cultural context. nous disadvantage occurs. Deficit, government-priority data **Indigenous-priority data** Data reprises deficit-linked concepts that We need data that measure more than problems service the priorities of government. and address our priorities and agendas. **Restricted access data** Available and amenable data Data are barricaded by official statistical We need data that are both accessible and agencies and institutions. amenable to our requirements.

Table 1: BADDR data outcomes versus Indigenous data needs. Source: Adapted from Walter (2018);Australian Indigenous Governance Institute and Maiam nayri Wingara (2018).

Examples of existing Indigenous food- and nutrition-related reporting¹ can be found below:

- National Aboriginal and Torres Strait Islander Health Survey (ABS, 2022–23)
- Closing the Gap Information Repository (Productivity Commission, n.d.)
- Northern Territory Market Basket Survey 2021 (Department of Health, 2022).

Culturally relevant and appropriate data need to be negotiated with Indigenous peoples to report on the state and resilience of Indigenous food systems.

4.3 Future priorities

Indigenous-led research

Legitimacy remains an overwhelming imperative for reporting on Indigenous food systems. Extensive consultation with diverse Indigenous Peoples is required to identify legitimate research priorities to support reporting on Indigenous food systems. Indigenous-led research agendas are critical to building the baseline knowledge and evidence to support healthy and equitable Indigenous food systems. Examples of research priorities that need validation and refining include:

- the existing and potential future contribution of Indigenous foods to Indigenous Peoples' health and wellbeing
- culturally appropriate and relevant food security monitoring and evaluation tools (e.g. exploring strategies to incorporate food security monitoring and reporting into existing Indigenous organisations or land and sea management programs)
- the relationships between food-related policies and Indigenous food and nutrition security as well as health and wellbeing
- strategies to support Indigenous led and owned bushfood enterprises, along with research into how Indigenous foods could contribute to broader food systems.

These recommendations can be found in reports summarising government engagement with Indigenous communities, including the National Strategy for Food Security in Remote First Nations Communities discussion paper (National Indigenous Australians Agency, 2024), the Gather + Grow Action Plan for 2023–2032 (Health and Wellbeing Queensland, 2023), the Food Summit report (Aboriginal Medical Services Alliance Northern Territory, 2021) and the Report on food pricing and food security in remote Indigenous communities (House of Representatives Standing Committee on Indigenous Affairs, 2020).

¹ Reporting only by government agencies. Does not include research studies that have examined the prevalence of food insecurity.



Targeted investment in Indigenous-led and inclusive approaches to Australia's food system reporting is needed to ensure food system measures and methods align with Indigenous priorities and cultural protocols.



Future research and reporting

Many improvements to Indigenous food systems research and reporting could be made. A first step is greater emphasis on Indigenous co-designed reporting based on methods that can assess if and how the food system meets the requirements of diverse Indigenous Peoples. Commitment to place-based research that strives to deliver positive local outcomes and supports Indigenous self-determination should support this bottom-up, needs-based approach.

Targeted investment in Indigenous-led and inclusive approaches to Australia's food system reporting is needed to ensure food system measures and methods align with Indigenous priorities and cultural protocols. Greater focus is needed on research that addresses the systemic causes of food insecurity affecting Indigenous Peoples and the factors that support and empower their role and agency in the Australian food system.

Lastly, better coordination of Indigenous research projects is needed to reduce duplication and fragmentation of engagement with Indigenous Peoples. Appropriate time and resources need to be allocated to building long-term relationships with Indigenous Peoples that extend beyond individual project timelines. These relationships must account for the burden Indigenous Peoples carry when participating in research projects. This will lay a foundation for greater authenticity, meaning and ownership.

<u>Insight</u>

5 Policy coherence

Jeremy Farr, Jessica Bogard and Kelly Parsons



KEY POINTS

- Food policy in Australia is currently fragmented across portfolios and tiers of government.
- Policy coherence has potential to reconcile goals and reinforce action across the food system.
- Mechanisms for coordinating food policy exist, but sectoral perspectives continue to dominate.
- The value of pursuing policy coherence lies in the benefits it brings to Australia's food system, in concert with international processes and pressures.

5.1 The state of food policy coherence

Food policy in Australia is currently fragmented across portfolios as diverse as agriculture, environment, industry, social services, health, transport and urban planning, and there are no formal mechanisms for recognising the food system or managing its policy interactions. Responsibility for components of food policy is distributed across federal, state and local government. Governments in Australia have not yet adopted the kind of integrated portfolios for food policy that countries such as Canada and the United Kingdom have.

Within the Australian Government, responsibility for food policy has become dispersed among 11 different portfolios (Figure 8). The agriculture portfolio focuses on production, exports and the profitability of farm businesses, and factors that affect these such as biosecurity ļ

Food policy in Australia is fragmented across portfolios and tiers of government.

and food safety. Environment focuses on the natural resources such land, water and biological diversity that affect the productivity of agriculture. This portfolio is also interested in the environmental impacts of the food system, including waste, greenhouse gases and the impacts of land management on biological diversity. Responsibility for food manufacturing sits in an industry department, while the social services and health portfolios focus on the equity and health implications of food availability and access. Transport and urban planning are critical to supply chains and the location of retail outlets (see Insight 2, Retail environment). Other public sector institutions, such as the ACCC and Treasury, play important roles in policy allied to food, such as fair trading and competition policy. Critical components of the

FEDERAL GOVERNMENT DEPARTMENTS RESPONSIBLE FOR FOOD RELATED POLICY



Figure 8: Responsibility for policy across Australian Government departments. Adapted from: Naudiyal et al. (2021, 2022) food system, such as the design and management of food retail environments, are as yet unallocated to any public agency (see Insight 1, Nutrition).

Policy coordination mechanisms already exist but are patchy across the food system. A National Food Plan released in May 2013 was not adopted due to a change of government in September 2013 (Carey et al., 2016). A parliamentary inquiry in November 2023 recommended a national food strategy overseen by a national food council and federal ministerial portfolio. A well-established system of meetings for food ministers from Australia (federal and state) and New Zealand helps to achieve policy coherence for food safety in Australia and New Zealand (see Insight 3, Food safety). Food supply chains are considered part of emergency management responses. Ephemeral and informal coordination mechanisms wax and wane between policy colleagues working on shared issues across diverse portfolios.

5.2 Issues and challenges

Food policy coherence is about the degree to which policies across the food system reinforce or contradict each other in meeting societal goals (Parsons and Hawke, 2019). The degree of coherence required will depend on what these goals are and how they change over time. Improvements will often involve tradeoffs due to limits on the resources available to pursue coherence. It is not uncommon for departments to have conflicting perspectives and goals regarding food system outcomes (Sharpe et al., 2020; Thow et al., 2018). For example, an agriculture portfolio may work towards high food prices to benefit farmers while a social services portfolio may work towards lower food prices to benefit vulnerable people. A focus on production and trade goals means that food safety is valued more than nutrition in trade policy (Baker et al. 2019). The impact of these types of conflicts can range from negligible effects to major barriers for meeting policy objectives (Monticone et al., 2023).

Policy coherence is more than coordination. Coordination is useful for sharing information about the complicated interactions within portfolios. Policy coherence is about anticipating and managing the surprising 'emergent' interactions across the food system. These can have deeply uncertain and often unforeseen consequences that can only be anticipated by viewing the food system more holistically. Examples include the trajectory of farming in Australia, the role of scale economies in supermarkets and food environments, and the impacts food environments have on nutrition and health both in Australia and in overseas export markets (see Insights 1 and 2, Nutrition and Retail environment).



Policy coherence helps to anticipate and manage 'emergent' interactions across the food system.

5.3 Opportunities to improve policy coherence

There is a growing recognition by policy advisers that they can no longer address emerging food system issues such as the affordability dimensions of food security through past sectoral lenses. Future agencies tasked explicitly with coordinating food policy could build on the informal alliances that are forming across policy agencies to provide more holistic food system advice. Regular reporting on food system issues could be a first step towards consolidating informal coordination mechanisms into efficient and fit-for-purpose food policy institutions (Lim-Camacho and Nelson, 2024).

The coherence of food policy in Australia is low because the food system and its interactions are poorly recognised, and responsibility has not yet been clearly allocated for managing them. Policy coherence is not a goal in itself. Sufficient policy coherence is needed to meet food system goals, and the appropriate level is inevitably traded off against the staff and other resources available in policy agencies. An issue is that resources are unlikely to be allocated to food policy coherence as long as government departments are given strong sectoral mandates that diminish recognition of the food system and its interactions. This can mean that policy advisors feel obliged to resist the idea of food systems as an inappropriate and unresourced expansion of their responsibilities.

Australians know how to manage systems as complex as the food system, and policy advisers in government departments have a highly developed hierarchy of mechanisms for achieving appropriate levels of policy coherence (Table 2). As outlined in the overview of this report, these mechanisms are routinely applied to manage similarly complex systems and in situations where sectoral interests need to be subordinated to meet wider societal goals.

Food policy coherence in Australia has not been effectively motivated by pressures to conform to international reporting processes such as the UN SDGs. When seen as legitimate and relevant, international strategies of this kind can help to motivate shared agendas and set clear priorities (Parsons, 2022). A Senate Inquiry in 2019 showed there was cross-party support for the values and aims of the SDGs but disagreement over the extent to which the pursuit of them should be resourced. The SDGs are sometimes interpreted as a developingcountry construct, not relevant to Australia's industrialised farming systems. When combined, these factors mean the SDGs have not served to coordinate policy as intended by the UN (Pawar et al., 2020). This suggests that recognition of the unique benefits to Australia's food system is a necessary first step towards food policy coherence.

Mechanism	Details	Examples
Day-to-day connections	Connections between food policy activities made by individual public servants during day-to-day policymaking.	 Individual connections between government departmental officials. Interdepartmental committees.
Issue-specific projects and supporting groups	Mechanisms for coordinating different departments' input on a specific policy issue. Issue-specific projects are likely to be supported by a dedicated group/taskforce/ committee.	 The Australian Food Pact is an initiative to reduce food waste across the supply chain shared by the Department of Climate Change, Energy, the Environment and Water and the Department of Industry, Science and Resources. National Coordination Group – includes providing food relief.
Cross-government food-themed groups	Committees, taskforces or groups – with public service or ministerial membership across multiple departments – created to coordinate activities on food policy (not just single issues) across government.	 Food Policy Working Group, 2010–11. National Food Security Strategy (proposal) in Inquiry into food security in Australia. The House Standing Committee on Agriculture, 2022–25.
Multi-stakeholder advisory groups	Groups created to coordinate input from private sector and/or civil society stakehol- ders, with officials from one or more departments, focused on food.	 Several groups coordinate with FSANZ on a range of issues linked to different aspects of food safety. Australian Dietary Guidelines – National Health and Medical Research Council, Australian Government Department of Health and Aged Care. Inquiry into food security in Australia uses a multi-stakeholder approach through submissions and consultation, 2022–25.
Overarching food policy projects/ strategies	Mechanisms that bring all (or several) aspects of policy related to food together in overarching cross-government or whole-of-government projects.	 The National Food Plan. 2010–11. National Strategy for Food Security in Remote First Nations Communities (in development), 2023–25.
Food system mapping, monitoring and reporting	Government-led initiatives to map and monitor the food system to provide baseline data to inform policy develop- ment and implementation.	Towards a state of the food system report for Australia (this report).

Table 2: Mechanisms for connecting food policy in Australia (adapted from Parsons, 2022)

Table 2 (continued)

Dedicated units/ agencies within government	Dedicated units of officials within government, focusing on food policy.	 FSANZ focuses narrowly on food safety regulations. The Department of Health and Aged Care oversees initiatives such as the health star rating system. No dedicated units focusing on coordinating different aspects of food policy.
Parliamentary committees	Collaborations between several parliamentary bodies which address aspects of the food system.	Agricultural Standing Committee released the report, Australian Food Story: Feeding the Nation and Beyond (Commonwealth of Australia, 2023). This included proposals for a national food security strategy, food production, consumption and export, climate change and biosecurity, inputs and the supply chain.
Dedicated food policy bodies	Bodies (or a single body) to coordinate work on food, which may be located internally or at arms-length/independent from government. May be used to connect inside and outside government stake- holders working on food system issues.	There is no body currently working with a remit to cover multiple areas of the food system or food issues.
Legislative approaches	Mechanisms to enshrine food policy goals and implementation in law.	There is currently no overarching food system legislation.
Procedural mechanisms	Sets of procedural instruments, such as shared budgets or indicators, which incentivise joint working.	Currently none, as above.
Machinery of government changes	Redesign of ministerial portfolios or reallocation of departmental responsibili- ties to connect issues within a particular role or organisation. May include creation of 'super ministries', which combine multiple policy sectors under one departmental roof.	Proposal for Minister for Food proposed by the Australian Government Depart- ment of Health and Aged Care. National Food Security Strategy (proposal) in Inquiry into food security in Australia. The House Standing Committee on Agriculture, 2022–25.

<u>Part 2</u>

Insights into food system sustainability



<u>Insight</u>

6 Sustainability

Peat Leith, Lynne Macdonald, Larelle McMillan, Michael Battaglia, Cathy Robinson, Heleen Kruger, Katie McRobert, Anwen Lovett, Robert Kancans, Chiara Pasut and Senani Karunaratne



KEY POINTS

- It is not yet possible to make definitive statements about the overall sustainability of Australia's food system.
- Current indicators are patchy and provide limited insights into the sustainability of only some food system components – some of which are improving, while others are in decline.
- Disclosure reporting requirements have driven the development and uptake of environmental indicators for some aspects of sustainability such as greenhouse gas emissions.
- Other indicators are less developed, including social indicators of sustainability for equity and health.
- Future sustainability measures should consider interactions across scales (space and time), sectors and portfolios.

6.1 Sustainability of Australia's food system

The challenge

It is not yet possible to make definitive statements about the overall sustainability of Australia's food system. Sustainability measures for Australia's food system are patchy, both for the current state of sustainability and longer-term trends, and their results can be ambiguous. The sustainability of some components of the food system seems to be improving, while the sustainability of others is in decline. Multiple pressures create cumulative impacts that amplify sustainability threats to Australia's food system.



It is not yet possible to make definitive statements about the sustainability of Australia's food system due to fragmentation of data and methods and lack of agreement on definitions and goals.

A key issue facing food system reporting is that sustainability means different things to people with different goals and underlying values about what needs to be sustained or enhanced and why these things are important. There are general definitions of food system sustainability. The FAO has defined a sustainable food system as one 'that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised' (FAO, 2024). However, definitions of this kind imply that there is agreement about the underlying goals of sustainability. Such agreement does not yet exist across Australian communities, governments and industries. Processes for negotiating agreement on sustainability goals for the food system and coordinating action to pursue these goals remain undeveloped.

State of sustainability

Australia is considered one of the most foodsecure countries in the world when assessed from a production perspective (ABARES, 2020). However, the longer-term productive potential of Australia's food system depends on the state of its soil and water resources, along with other diverse natural capital drivers, and the management of these in the face of increasing climate risk. Pressures on the natural resources that underpin Australia's food system have contributed to plateauing agricultural productivity over recent decades. These pressures increasingly affect the profitability of farms. In some areas, land-use pressure, fragmentation and loss of productive land are undercutting the ability of Australia's soils and landscapes to support the food system (Williams et al., 2021). Soil management issues highlight the nexus between what is changing, what is important to monitor and pathways for driving improved outcomes (see Box - Insights from soil and landscape assessments).

The sustainability of resource management and the environmental impacts of food production can also affect Australia's strong food reputation. Australia's food system significantly contributes to biodiversity loss, largely through land clearing and habitat fragmentation (Trewin et al., 2021). Restoration and other investments in natural capital have grown but remain well below rates that would meet nature positive goals (Reside et al., 2025).



The environmental impacts of food production have the potential to affect Australia's food reputation.



Australia is considered one of the most foodsecure countries in the world, but pressures have contributed to plateauing agricultural productivity. Climate change has significant implications for the sustainability of Australia's food system in terms of both impacts and mitigation. Changing patterns of drought, extreme heat and flooding have implications for agricultural production and food distribution. Climate change has diverse effects on the natural capital assets held by farms through to food safety, adding to risk across the food system (DCCEEW, 2024a). Agriculture, food production and waste contribute over 20% of Australia's greenhouse gas emissions, and are contributing to economy-wide efforts towards net zero emissions.



Insights from soil and landscape assessments

Soil and landscape assessments are well-established tools for guiding sustainable land use. They include key risks such as acidification, soil erosion, carbon decline and nutrient imbalance. They are used to inform national land care priorities (McKenzie et al., 2017) and multiple report cards on land and environment (Williams et al., 2021).

The latest State of the Environment report raises low ground cover and declining soil health as critical concerns and highlights substantial variability across land-use zones (Williams et al., 2021).

Soil monitoring and sustainability reporting

Growing interest in sustainability and natural capital has driven renewed efforts to monitor soil and land systems. The National Soil Action Plan (DAFF, 2022) introduces key initiatives such as:

- the National Soil Monitoring Program (DAFF, 2024), which enhances data availability and benchmarking of soil health across Australian production landscapes
- Australia's National Soil Information System (ANSIS), which supports sustainable land management through improved access to soil data and associated information.

Aligning these efforts with the AASF (National Farmers Federation, 2024) offers an opportunity to integrate soil health insights into Australia's agricultural assessments and suggests pathways for food systems integration.

Towards a multi-scale framework, data integration and standardisation

Soil and landscape research has improved measurement technologies, spatial coverage, data accuracy and availability, and most importantly, analytic capacity. Basic soil measures (e.g. texture, pH, bulk density, soil carbon) can increasingly be translated into functional indicators of soil health or associated risks. These can improve understanding and management of water retention, soil respiration, and carbon and nutrient cycling (Van Looy et al., 2017). They can be used to reduce risks of acidification, erosion, carbon loss or nutrient imbalance and other forms of land degradation (McKenzie et al., 2017).

Despite technical advances, challenges persist in data integration, scaling and appropriate classification, especially when moving beyond plot and farm scales to wider landscape scales. Inconsistent methodologies and varying scales of assessment can create gaps, undermine clarity of analysis and stall identification of actions to address issues across different production systems.

The State of the Environment Report (Williams et al., 2021) emphasises the need for a standardised, risk-based approach to sustainability with nested soil and land indicators. These recommendations align with existing key principles from multi-scale landscape approaches (Bouma, 1997; 2002) and include:

- evaluating indicator scalability and complexity based on purpose
- recognising the value of both data-rich and datalimited scenarios
- standardising analytical workflows to enhance reporting consistency.

Integrating social and ecological insights for better decision-making

Stronger collaboration between soil, social and ecological sciences, and stronger collaboration between farmers and other land managers, is needed to improve how measures are developed and used. Approaches capturing and categorising (typology) experiences, economic drivers, farming cultures and traditions, with management options across diverse farming systems and soils, can add value in complex systems.

In developing management and policy, it has proven useful to understand the heterogeneity of farms and farmers and to develop appropriate typologies that identify patterns and drivers (e.g. Huber et al., 2023; Upadhaya et al., 2023). Forecasting long-term change can have greater decision-making influence than improved data accuracy alone, especially where forecasts help to clarify trade-offs between long-term environmental impacts and short-term economic gains (Alary et al., 2008; Nidumolu et al., 2016).

Conclusion

In summary, soil and landscape frameworks provide valuable lessons for wider sustainability assessment approaches. Effective use of sustainability indicators requires consideration of how data are used to generate appropriately scaled and targeted measures and indicators, how indicators are used in decision-making, and how social, economic and ecological drivers of decisionmaking interact.
Climate change will reduce average farm profits by between 2 and 50%, depending on the rate and degree of climate change (Hughes et al., 2022), and may constrain farmers' land use and management options. Although masked by increasing and targeted use of technology, rainfall decline associated with climate change has already impacted potential grain yields (Hochman and Gobbett, 2017).

The reduction of emissions from the food system needs to be considered alongside the high social value of food. The difficulty of reducing agricultural emissions relative to reducing emissions from other parts of the economy also needs to be considered. While total greenhouse gas emissions and the emissions intensity of Australian food products have fallen, the share of greenhouse gas emissions from food has grown as a proportion of national emissions (DCCEEW, 2024b). Agriculture contributes 17% to overall greenhouse gas emissions, with 79% of these from methane, 18% from nitrous oxide and 4% from carbon monoxide (Commonwealth of Australia, 2023). Slight declines in emissions over recent decades are largely associated with climate and marketrelated changes to stock numbers. Greenhouse gas emissions associated with food production and processing sit within the manufacturing sector and are difficult to estimate. Food waste accounts for about 3% of Australia's annual greenhouse gas emissions (DCCEEW, 2024b).

Insights on nutrition, equity and other hidden costs of food in this report highlight the links between social sustainability and the food system (see Insights 1 and 2, Nutrition and Retail environment). The most prevalent social concerns are around equitable and affordable access to food, driven by food environments and impacts of the cost of living on diets, nutrition and health. Some Australians struggle to access sufficient or adequate food to meet basic nutritional needs – especially in remote areas and among vulnerable groups. Improvements in food system governance are crucial for food system sustainability due to the many intersecting issues and challenges sustainability depends on.

6.2 Challenges with sustainability measures and reporting

Not set within silos

Food systems span many areas traditionally segregated by sectoral and portfolio boundaries, leading to siloing across agriculture, health, environment and manufacturing (see Insight 5, Policy coherence). This forms a substantial barrier to setting directions and goals and developing integrated measures of food system sustainability.



Siloing across agriculture, health, environment and manufacturing is a barrier to developing integrated measures of food system sustainability. The ability to set and pursue meaningful sustainability goals also depends on aligning improvements in data with agreement on what measures matter. The State of the Environment Report (Creswell et al., 2021) called for collaboration to develop consistent multi-scale methodologies and frameworks across land sectors.

Extending the pervasive environmental focus of sustainability to include social goals for Australia's food system is important. Poor nutrition is prevalent in Australia, and reform of food environments is needed to combat it (see Insight 1, Nutrition). Insight 4 (Indigenous food systems) highlights a lack of culturally appropriate goals, measures and methods to assess and learn from Indigenous food knowledge that has evolved over thousands of years. Reporting could also track access to food and its impacts on nutrition, especially in remote areas or within vulnerable income groups (see Insights 1 and 2, Nutrition and Retail environment).

Not just 'hot' issues

Sustainability measures tend to be developed for 'hot issues' like greenhouse gas emissions (see Insight 8, Life cycle assessment). This can result in a narrow framing of sustainability, based on a partial set of indicators, and crowd out broader understandings of the sustainability of the whole food system. A lot of attention is rightly given to greenhouse gas emissions, soil degradation and security, freshwater resources, food loss and waste. There is starting to be more attention given to issues associated with food-related health and chronic non-communicable disease arising from dietary choices and food affordability challenges. There is less (but increasing) attention given to food system impacts on terrestrial and marine biodiversity, natural capital, and social, cultural and economic outcomes for regional and Indigenous communities. In other areas, like food safety, there are good data and reporting around core regulatory issues, and very limited understanding of other areas, such as chemical residues in food.



A focus on individual indicators such as greenhouse gas emissions can result in a narrow framing of sustainability and crowd out understanding of the sustainability of the whole food system.

Not just for some sectors

Sustainability reporting is usually activity-based within sectors or supply chains. This can distract from opportunities to advance sustainability via broader interactions, such as moving towards a more circular economy (see Insight 7, Circular economy). This has led to a proliferation of measures, frameworks and methods, countered by some notable efforts to improve the coherence of sustainability reporting. For example, the nascent AASF (National Farmers Federation, 2024) identifies key sustainability concerns for the farming part of the food system (Figure 9).



Figure 9: The Australian Agricultural Sustainability Framework (AASF). Source: National Farmers Federation (2024)

The AASF and similar sectoral frameworks are less suited to defining pathways to address systemic issues such as reversing increasing obesity or biodiversity decline. This is because outcomes such as nutrition and health are beyond their scope. System-wide sustainability reporting is likely to be required to pursue system-wide sustainability goals.

6.3 Challenges and next steps in tracking the sustainability of Australia's food system

Emerging approaches, such as the AASF, suggest movement towards a more systemic understanding of sustainability, but they retain a mostly sectoral focus. Taking a systems approach to understanding the drivers, barriers, levers and pathways towards agreed food system sustainability goals has potential to draw these sectoral efforts together. The three priorities below would help create more holistic sustainability reporting for Australia's food system.

Focus on system interactions and outcomes

First, sustainability indicators need to move beyond a narrow framing of diverse separate issues to shed light on system-wide interactions and outcomes. Existing indicators tend to neglect interactions that span sectors, regions and supply chains. This can result in the root causes of complex problems like soil degradation and obesity being overlooked – especially where these involve the combined weight of historical, political, economic, biophysical and social drivers. It can also lead to over-reliance on technical interventions, rather than coordinated technological, social, cultural and policy interventions. System-aware approaches to food systems analysis, such as integrated systems modelling and attribution studies, can generate sustainability indicators that support industry and government sustainability strategies. These indicators can help us to understand trade-offs between economic, sustainability, equity and health goals for the food system.

Address the obstacles presented by silo-based approaches

Second, historically siloed approaches to analysing sustainability in agriculture, food manufacturing, health and other parts of the food system remain a major obstacle to progress. These silos highlight the importance of collaborative processes across ministerial portfolios, industry sectors and civil society organisations. These processes can help to define, agree on and target collective food system outcomes and actions to advance them. Currently, even if Australia had good indicators of sustainability, social inclusion and health outcomes, the social, organisational and institutional capacity to utilise them would be lacking (Hall et al., 2024). Appropriate strategies, programs, business models and other interventions to address food system challenges may be quite different to those that address individual farming, food safety, social welfare and population health challenges (Hall et al., 2024).

These priorities highlight the importance of governance and institutional indicators, such as measures of the strength of Australia's innovation system, policy coherence and policy capture, which will all be central to long-term food system sustainability. Flexibility will also be key, as sustainability is not a static construct. Definitions and drivers of sustainability evolve as our understanding of the natural environment, economic systems and social priorities change (McRobert et al., 2022). More work is needed to determine appropriate measures of governance and innovation that can underpin a food system as it moves towards sustainability. However, this report and others on the food system consistently highlight institutional and governance factors as critical drivers of food system outcomes (IPES-Food, 2017).

Get agreement on sustainability directions

Finally, building coherence around food system sustainability requires public leadership and processes for negotiating sustainability goals and agreeing on actions to pursue these long-term directions. System-level change is often met with understandable resistance from stakeholders concerned about its impacts, creating barriers to transition (McRobert et al. 2023). Setting sectoral sustainability goals is a step forward for the sectors involved, but in isolation, sectoral goals can reinforce narrow perspectives on sustainability that forego options for improving whole-of-system sustainability. For example, system-wide approaches to reducing greenhouse gas emissions would not impose the same requirements on agriculture (a hard-to-abate sector with significant social and environmental value) as they would on easier-to-abate sectors. System-wide approaches can also help align national goals for sustainability with international standards and reporting frameworks.

<u>Insight</u>

7 Circular economy

Cathryn O'Sullivan, Maja Arsic, Anton Wasson, Sabrina Greenwood, Pablo Juliano, Colleen MacMillan, Alessio Miatto and Heinz Schandl



KEY POINTS

- Australia's overall material circularity rate is 4.6%, while the circularity rate of biological materials, including those within the food system, is 2.8%.
- Australia generates 33 million tonnes of organic waste each year, much of which ends up in landfill.
- Regulatory reform is needed to recognise that historically hard-won protections on human health can be maintained in a more circular economy.

7.1 Circularity of Australia's food system

Each year, Australia generates around 48 million tonnes of organic waste, of which around 33 million tonnes is generated from agricultural, forestry and aquaculture production. An estimated 9.55 million tonnes of this organic waste is produced pre-farm gate (AgriFutures, 2023). Organic waste includes animal waste, crop residues, product losses and processing waste. Food waste alone accounts for 7.6 million tonnes annually, costing the Australian economy over \$36.6 billion.

Despite a relatively high recycling rate for biological materials (63%), most of these materials are currently converted to energy rather than reintegrated into the food system. Because energy recovery is not considered part of circular material flows, Australia's total biological material circularity is only 2.8%. There is significant potential to increase the safe reintegration of biological materials into the food system.



Improving the circularity of the food system will require better integration of food system waste streams into the agricultural, energy and materials sectors.

Although Australia's circularity of biological material is low, a substantial amount of food waste is repurposed into new products. Figure 10 shows that large volumes of food waste are used in processed food products, animal feed and non-food applications (e.g. energy). Composting transforms organic waste into soil amendments that can be returned to agriculture, while food rescue and upcycling also help to reduce waste.

Looking ahead, improving the circularity of the food system will require better integration of food system waste streams into the agricultural, energy and materials sectors. Australia has the potential to produce 90 million tonnes of biological materials for bioenergy, biochemicals or biomaterials beyond its current food production. This opportunity is largely driven by crop stubble, grasses and forestry by-products, which could provide a sustainable resource base for a more circular bioeconomy.



Figure 10: Sources and end destination of recovered, lost and wasted food in Australia (in thousands of tonnes per year). Source: Hetherington et al. (2022)

7.2 Monitoring circularity in Australia's food system

One of the key challenges in advancing circularity within Australia's food system is a lack of a clear and consistent definition of what circularity means and how it should be measured. The integration of circular economy concepts into the Australian food system is relatively new, with commercial applications emerging gradually and limited integration into economic and policy frameworks.

The term circular economy is often interpreted differently across businesses, industries and policymakers. However, the recent release of Australia's Circular Economy Framework by the Department of Climate Change, Energy, the Environment and Water in 2024 represents a significant step towards aligning these diverse perspectives. The new framework sets a national goal of doubling Australia's circularity rate by 2035 and defines a circular economy as 'an economic model that promotes sustainable and efficient use of resources as a way to support environmental, economic and social outcomes'. The framework outlines three interrelated strategies to improve circularity (DCCEEW, 2024):

- designing out waste and pollution
- circulating products and materials in their highest value
- conserving natural resources while also regenerating nature.



Bega Circular Valley

The Bega Circular Valley is a collaborative effort led by the Regional Circular Co-operative to drive circular economy initiatives in the region. The collaboration includes government (e.g. Bega Shire Council, NSW Department of Primary Industries, NSW Decarbonisation Hub, Fisheries Research and Development Corporation), industry (e.g. Bega Group, AACo, Essential Energy, Rabobank, Deloitte) and community groups.

The initiative aims to establish the Bega Valley as the most circular regional economy in Australia by 2030. It will enable projects to connect businesses, who can work together to create an industrial ecology that allows by-products from one industry to be used as resources for another. The program aims to move beyond zero waste and optimised recycling to establish regenerative economic, environmental and social development for the region.



As practical applications of the circular economy emerge (see example in Box – Bega Circular Valley), the demand for robust circular economy metrics, indicators and standards is expected to grow. While technological barriers are often highlighted as obstacles for circular economy adoption, significant policy, regulatory, economic and social challenges also hinder progress across various sectors, including the food system (Arsic et al., 2022). To help address some of these barriers, a range of circularity index metrics can be applied to the food system (Table 3). Table 3: Examples of Australian circular economy metrics that may be applied to food systems

General circular economy metrics (Miatto et al., 2024)

End-of-life recycling rate (the percentage of a material in waste that is recycled)

Circularity rate (the share of secondary materials against all materials used in the 'domestic material consumption' phase)

Theoretical circularity maximum (the percentage of materials that are used for purposes other than energy generation)

Circularity gap (relative difference between the current circularity rate and the theoretical maximum circularity achievable)

Circular economy metrics relevant for agrifood systems (Circular Australia, 2022)

Food production and waste (waste generated in the production, distribution and consumption of food)

Share of waste recovered for energy (percentage of solid waste diverted from landfill and recovered through thermal processes)

Nutrient capture and reuse (e.g. tonnes of nutrients in organic waste streams that are processed and returned to soils)

Material recycling rate (percentage of solid waste diverted from landfill and recovered through material recycling, e.g. plastic packaging or organics recycling processes)

Significant work remains in defining appropriate metrics for food systems, particularly in managing risks including food safety, pollution avoidance and land-use change. Given the cross-sectoral nature of circular material flows, these risks must be addressed in new and integrated ways. Metrics and measurement frameworks must be carefully designed and selected to accurately represent biological materials, account for variations in scale (from individual businesses to entire regions) and align with available data. The UN Economic Commissions for Europe has begun the global discussion to set the framework for assessing circularity through the Guidelines for Measuring Circular Economy, which provide a set of guiding principles that Australia could adapt to suit our system (UNECE, 2024).



Improving circularity involves connecting surplus or unwanted materials from one part of the economy with areas where they can be repurposed effectively.

7.3 Priorities for action

Several recent roadmaps for the agriculture, food, protein and nutraceutical industries highlight the need to enhance circularity across Australia's food system. Improving circularity involves connecting surplus or unwanted materials from one part of the economy with areas where they can be repurposed effectively. Achieving this will require better alignment of regulation and policy across local, state and federal jurisdictions, ensuring a coordinated approach to circular economy implementation. Priorities for action include mapping current biological material flows to support food loss and waste reduction through strategies such as:

- increasing food recovery by diverting food to food rescue organisations
- developing new food products and manufacturing processes that transform safe, high-quality, food-grade by-products into new food products (see description of NutriV Goodies vegetable snacks in Box Fighting food waste with novel food products)
- commercialising upcycled second-grade food products to maximise resource use and reduce waste (see description of Grainstone spent grain flour in Box – Fighting food waste with novel food products).



Fighting food waste with novel food products

NutriV Goodies process pre-retail vegetable losses into powders that are made into snacks. Each pack of snacks contains two servings of vegetables. This company offers an avenue for farmers to sell produce that does not meet certain retail standards and would otherwise go to waste.

Grainstone spent grain flour is made from brewers' spent grain – the mash that remains after brewing beer or spirits. It has been commercialised into a flour with enriched protein content, reduced carbohydrates and high prebiotic value. This is a higher value product than the animal feed that is usually made from brewers' spent grain, and it benefits human nutrition.





Other strategies include:

- developing sustainable and viable pathways for circular agricultural, industrial and energy products
- supporting alternative uses of food and agricultural waste by developing new products and technologies for bioenergy, biofertilisers and biochemicals that can replace fossil fuel-based fuels and chemicals
- reviewing waste-related regulation to recognise that human health and the environment can be protected in ways that enable a more circular economy
- recognising how circular products reduce waste disposal costs and internalise the societal cost of environmental impacts, helping early-stage circular businesses scale efficiently
- establishing efficient coordination mechanisms that enable regulators to collaborate with waste producers, processors and researchers to uphold food safety and environmental standards through measuring, monitoring and mitigating risks such as pathogens, chemical contaminants, odours and excess environmental nutrients
- developing concrete metrics and analytical tools to measure how circular products in the food system contribute to broader sustainability goals and targets.



Insight

8 Life cycle assessment

Maartje Sevenster



KEY POINTS

- Life cycle assessment (LCA) is a powerful framework for quantifying environmental and other impacts of producing and consuming goods and services.
- The results of product LCA are often overinterpreted to make incorrect inferences about the food system as a whole.
- If a product is currently produced at lower environmental cost than alternatives, there is no guarantee that a future shift in consumption to that product will improve overall food system sustainability.
- To inform decision making for food system sustainability, tailor-made assessments can take into account effects of large-scale shifts

8.1 Is Australia's food system sustainable?

As discussed in the sustainability overview (see Insight 6, Sustainability), it is currently difficult to say whether Australia's food system is sustainable due, in part, to a fragmentation of methods and data. Many assessment methods focus on individual activities, products or components of the food system, and this can obscure our view of how to pursue sustainability for the overall system.

For example, an over-reliance on productlevel assessments led early biofuel and bioenergy policy to assume that biofuels have a lesser environmental impact than fossil fuels. However, when demand for biofuels increased, their production was no longer marginal but required significant additional land and potentially



deforestation. Policy has evolved to acknowledge the value of avoiding direct and indirect deforestation, but this is still mostly assessed at a product level. A similar example is the effect of replacing dairy with soy milk (Simmons et al., 2023). It is tempting to assume that locally produced food is more sustainable than food transported from elsewhere, but this can prove be a mistake if there are large offsetting differences in in the sustainability of underlying production systems.

One often utilised method for assessing sustainability is LCA. It is often used to identify more 'eco-efficient' products relative to competing alternatives and to make claims that certain products perform environmentally better than others. However, there is no guarantee that independent and incremental improvements in the sustainability of individual food products will result in a sustainable Australian food system.

8.2 Challenges posed by current approaches to sustainability

The sustainability of the food system is not an abstract issue but an absolute necessity if Australia is going to continue to feed its own population and contribute to feeding 10 billion people globally over the next several centuries. When it comes to environmental sustainability, the food system is intimately connected with nature, but current metrics and strategies do not yet adequately reflect this.

LCA is often used to take a snapshot of the current environmental impact of food system components such as the production of agricultural crops, food manufacturing processes or consumer food products. This can lead to a focus on incrementally improving the 'ecoefficiency' of 'hotspots', such as production processes that are intensive in greenhouse gas emissions. However, there is no guarantee that independent and incremental improvements in the eco-efficiency of these hotspots will result in a more sustainable Australian food system. This is because LCA is most often used in its micro-focused 'attributional' form (see Box – Attributional versus consequential LCA), which provides insights into the sustainability of individual products but not into the sustainability of the overall food system. This narrow focus is natural for profit-driven businesses, but relying on it effectively delegates responsibility for pursuing sustainability to the private sector, and this risks not asking bigger questions about the sustainability of the food system as a whole.

There are three main reasons why it can be misleading to treat product-level LCA as an indicator of food system sustainability. First, a focus on individual product supply chains ignores the potential for combined system optimisation. An example is using LCA to assess whether legumes are more sustainable than beef. If changes to diet are to play a role in food system sustainability, dietary choices need to be informed by sustainability information. For the example of legumes versus beef, both come from a huge variety of production systems with an equally huge range of associated environmental impacts. There are also multiple links between these production systems. Legumes can be used as animal feed, while manure can be used as fertiliser on legumes. In some regions in Australia, the production of legumes and red meat are integrated in mixed-farming systems.



If a product is somewhat 'better' in terms of sustainability relative to another product, this doesn't mean that consuming more of it will improve food system sustainability into the future.

Second, an overemphasis on greenhouse gas emissions relative to other forms of environmental impact can lead to blind spots when comparing traditional agriculture with emerging alternatives such as cultured meat. Recent studies suggest that while cultured meat has a lower carbon footprint than beef, full replacement of beef consumption in countries like the United States or Israel would increase overall energy demand by up to 10% (Meshulam and Makov, 2023). Relying on renewable energy can still pose a sustainability problem because renewables typically reduce greenhouse gas emissions but not other types of pollution.

Third, some LCA metrics implicitly set an unachievable standard by 'benchmarking' agricultural systems against nature. This is the right choice to address certain questions, but the significant gap between agricultural systems and nature has the effect of reducing apparent differences between farming systems. This makes it difficult to inform trade-offs between alternative uses of our natural capital, such as soils and biodiversity, both now and with future potential uses.

In essence, if a good or service is marginally 'better' than a competing alternative at one point in time, it doesn't mean that consuming and producing ever more of it will decrease environmental pressure into the long-term future. This has recently been branded as the 'myth of inevitable sustainability' (Dickson and Clay, 2024). In other words, no product in and of itself can ever be inherently sustainable regardless of quantity. It can only be so as part of a sustainable food system.

8.3 Driving the sustainability of Australia's food system

A practical step towards assessing the sustainability of Australia's food system is to use so-called 'consequential' LCA (see Box – Attributional versus consequential LCA) and interpret these analyses as part of system-wide sustainability frameworks (see Insight 6, Sustainability). This will require some fundamental changes in perspective, including balancing production perspectives of sustainability with consumption perspectives.

The power of LCA is that it naturally connects consumption with production and has the flexibility to inform larger questions of sustainability by adopting a demand-driven perspective. It can address questions such as what the environmental consequences would be of a considerable increase in the consumption of legumes in the Australian diet. These questions require a different approach than the question of whether the current production of a unit of legumes has a lower footprint than the current production of a unit of beef. As another example, the current Australian diet is quite removed from the 'planetary health diet' (Hendrie et al., 2022) – what does this mean for the Australian environment?

No product can ever be inherently sustainable regardless of quantity; it can only be so as part of a sustainable food system.



Attributional versus consequential LCA

Important work is already being done in applying system-wide lenses to sustainability and addressing many of the issues raised above (e.g. Dougherty et al., 2023; Ridoutt et al., 2022 and references therein; Simmons et al., 2023; Soimakallio et al., 2025; Willett et al., 2019; Wu et al., 2025). However, more of this research and its application are urgently needed.

For the past decade, the LCA community has focused on standardising methods and metrics, which has significantly contributed to the practicality and adoption of voluntary and mandatory sustainability reporting. This has been important. However, the risk is that now the proverbial baby is being thrown out with the bathwater. As a framework, LCA was designed to address a broad range of questions by allowing applications to be tailored to context. Standards developed for reporting are typically based on attributional approaches and are therefore not appropriate to apply to questions about future system transitions or more holistic sustainability goals. No company would use last year's tax return to inform long-term strategic planning decisions.

With entity-level ('micro') reporting increasingly being legislated, it is urgent to also get a better understanding of whether this type of reporting will result in the desired ('macro') sustainability outcomes, or what additional approaches may need to be put in place to ensure this (see Insight 6, Sustainability). The food system, with its direct links to nature, land use and biological cycles, is particularly sensitive to methodological nuances, and the Australian food system is possibly even more so than some others (e.g. Sevenster and Cowie, 2024).

ATTRIBUTIONAL VS CONSEQUENTIAL LCA

ATTRIBUTIONAL LCA

Describes what's happening now: what is attributable to product A, what to product B? This is often called a footprint.



What is the average footprint of a pint of beer? -> Attributional LCA, with micro focus, using current average effects

What is the ecological footprint of Australian food consumption? -> Attributional LCA, with macro focus, using current average effects

CONSEQUENTIAL LCA

Evaluates the consequences of a change: what is the net effect (C) of a big shift from A to B?



What is the environmental effect of eating one extra steak? -> Consequential LCA, with micro focus, using current marginal effects

What is the environmental effect of 10% of the population replacing dairy milk (A) with soy milk (B)? -> Consequential LCA, with macro focus, modelling future effects <u>Part 3</u>

Insights into food production and its impacts



<u>Insight</u>



Cecile Godde, Fentahun Abebe, Javier Navarro and Steven Lord



KEY POINTS

- The hidden costs of Australia's food system range from \$98 billion to \$274 billion in net present value terms.
- Australia's food system has the highest per capita hidden costs in the world.
- Hidden costs include animal welfare and human health, loss of biodiversity and ecosystem services, greenhouse gas emissions, pollution and degradation of water, air and soil resources, as well as food waste, insecurity and malnutrition.
- Estimating the hidden costs of Australia's food system provides an opportunity to manage and avoid them.
- Taking ambitious steps to address the hidden costs of Australia's food system could reduce these costs significantly and help retain access to future true-cost sensitive global markets.

Hidden costs of Australia's food system include animal welfare and human health, loss of biodiversity and ecosystem services, greenhouse gas emissions, pollution and degradation of water, air and soil resources, as well as food waste, insecurity and malnutrition.

9.1 The cost of Australia's food system

Recent assessments estimate that the hidden costs of Australia's food system ranged from \$98 billion to \$274 billion in 2020.² These estimates were provided by the Food, Agriculture, Biodiversity, Land-Use and Energy Consortium (Navarro Garcia et al., 2024; lowest value), the FAO (FAO, 2024; highest value) and the Food System Economics Commission (Lord, 2024). These costs are an estimate of the net present value of GDP lost from the unintended effects of the food system, including greenhouse gas emissions, nitrogen pollution, land-use change and non-communicable diseases resulting from the consumption of unhealthy foods.

Environmental costs, while not exhaustive, accounted for between 35 and 82% of these hidden costs across the different estimates (Figure 11; Navarro Garcia et al., 2024; FAO 2024, respectively). Their impact on GDP was estimated through losses in agricultural production, labour productivity and ecosystem services. Estimates of the health costs arose from the effects of unhealthy diets on the proliferation of non-communicable diseases such as cancer, type II diabetes and cardiovascular disease and contributed 18 to 65% of the total cost. The impact of disease on GDP was asses-

² To facilitate comparability across different studies, estimates provided in purchasing power parity were converted into Australian dollars (AUD) using the 2020 Purchasing Power Parity World Bank conversion factors (World Bank, 2025b).



Figure 11: Environmental and health hidden costs of Australia's food system in 2020, by cost category and subcategory (billion dollars). Data from FAO (2024)

sed through labour productivity losses. As yet, available estimates do not adequately account for the social costs associated with Australia's food system and research to improve these estimates is ongoing.

Australia's food system generates the highest per capita hidden costs in the world, due in part to a large agricultural sector and small population. Australia had the 9th highest hidden food system costs globally – with the third highest costs among OECD countries (following the United States and Germany) – and contributed 1.6% to global food system costs (Figure 12). The hidden costs of the Australian food system were nearly ten, eight and seven times lower than that of more populous countries such as China (ranks 1st), the United States (ranks 2nd) and India (ranks 3rd). Australia contributed higher hidden costs compared to other industrialised countries, including France (ranked 14th), Italy (ranked 13th), the United Kingdom (ranked 16th) and Canada (ranked 27th). Australia ranks 8th when costs are normalised for the importance of food in the economy (World Bank, 2025a). Environmental costs are the largest cost in Australia, whereas health costs dominate in other industrial countries such as the United States, the United Kingdom, France, Germany, Italy, Japan and Canada.



© Australian Bureau of Statistics, GeoNames, Microsoft, Navinfo, Open Places, OpenStreetMap, Overture Maps Fundation, TomTom, Zenrin

Figure 12: Total hidden costs in global food systems (in billion 2020-purchasing-power-parity dollars). Data from FAO (2024)

9.2 What is the true cost of food?

Estimates of the hidden costs of food attempt to quantify the non-market impacts of the food system, to complement economic performance measures. When we can't account for environmental and social challenges, it reduces market incentives to manage them. As a result, these impacts have tended to grow as economic goals for Australia's food system have been pursued. The non-market impacts of Australia's food system include animal welfare and human health, loss of biodiversity and ecosystem services, greenhouse gas emissions, pollution and degradation of water, air and soil resources, as well as food waste, insecurity and malnutrition, among others (Figure 13).

These costs are borne by people, communities and industries who may or may not be directly involved in the food system. For example, the public healthcare system bears the medical expenses arising from unhealthy diets, while farmers face climate change impacts and the loss of vital species such as pollinators and soil microbes. While individual choice influences socio-economic and health outcomes, costs also arise from broader system failures such as investment in advertising for unhealthy food and limited access to information for food system actors.

As an export-oriented country, Australia absorbs many of these costs domestically while providing agricultural outputs to other nations. In effect, other countries export costs associated with their food systems to be borne by Australians.



Estimating the hidden costs of Australia's food system provides an opportunity to manage and avoid them.

TRUE COST OF FOOD



Figure 13: The true cost of food goes beyond market value to capturing other costs and benefits to individuals or society

True cost accounting

Estimates of the true cost of Australia's food system are derived from true cost accounting (TCA), a set of evolving methods used to value the environmental, social and health costs and benefits of the food system.

Some TCA methods, like the FAO's, express these impacts in monetary terms, enabling the aggregation of outcomes with physical units such as CO_2 -equivalent metric tonnes of emissions, burden of disease in disabilityadjusted life years and land-use change in hectares. While monetisation can be a limited proxy for the deeper values involved, it does enable comparison with the economic metrics in common use, such as market prices or the costs of addressing specific impacts of the food system.

FAO estimates of hidden costs are not intended for inclusion in producer input or consumer product prices. They provide an estimate of the cost of the food system to the economy, highlighting the priority costs and benefits so that these can be managed and avoided.

There can be an equity dimension to TCA if these costs are disproportionately borne by the rest of society rather than by individuals and organisations generating them.

TCA has evolved due to growing international recognition of the need to reveal and address the non-market impacts of the food system.

The FAO featured TCA in two consecutive editions of its flagship State of Food and Agriculture report (FAO, 2023, 2024). The FAO's methodologies are shared with the Food System Economics Commission (Ruggeri Laderchi et al., 2024). Other global efforts to quantify food system costs, though not specific to Australia, include the UN Food Systems Summit 2021 (Hendriks et al., 2023) and the Food and Land Use Coalition (2019).

Country-specific assessments have also been released for the United States (Rockefeller Foundation, 2021) and the United Kingdom (Sustainable Food Trust, 2019), while countries like Switzerland (via the TRUE-COST-CH project funded by the Swiss Government) and Australia (Godde et al., 2024) are in the process of doing so.

9.3 Reporting for better food futures

To date, many of the costs and benefits associated with Australia's food system have been overlooked in decision-making. Understanding these impacts is a crucial first step in driving action.

A key challenge is that not all food system costs and benefits have been identified, and for many, we still lack the data and methods necessary to understand and monitor them effectively. This is partly due to a past focus on economic measures and the greater ease of observing capital transacted through market mechanisms (e.g. produced capital, labour and wages). In contrast, impacts on natural, social and human capital—such as cultural knowledge, social networks, natural resources and working conditions—have received far less attention and are often difficult to measure objectively (FAO, 2023).

Another challenge lies in developing cost estimates that account for Australia's unique context. The FAO and the Food System Economics Commission have generated internationally consistent cost estimates, facilitating recognition of burden-sharing in international trade between exporting and importing countries. We are leading efforts to tailor FAO estimates to Australia's operating conditions while ensuring alignment with global initiatives. In particular, estimating hidden costs and benefits across Australia's geographically and climatically diverse food system presents theoretical and data challenges. Large discrepancies also remain in Australia's land-use-change data a key driver of environmental hidden costs. Challenges also remain in identifying and communicating effective approaches to contextualising these hidden costs through comparisons with other economic measures. See FAO (2023, 2024) and Navarro Garcia (2024) for

further discussion on methodological priorities.

Reorienting food systems to manage the hidden costs of food and avoid negative impacts is likely to be a slow process, requiring concerted government leadership to address deficiencies in the food system that markets can create. However, the benefits are deep and broad for the whole of Australian society because every Australian is dependent on our food system. Equity in food systems fosters social welfare; nutrition promotes health; sustainability benefits the environment; and diversification supports economic growth. While the financial benefits of addressing hidden costs are not in hand now, they represent an avoided future liability, boosting the potential of the future economy. The insurance sector already factors climate change into sovereign risk assessments, highlighting its growing economic relevance. Labour conditions including health and air quality, as well as the ability of natural capital to sustain environmental and economic systems, are critical to future prosperity. Recognising Australia's strengths, such as low water use and efficient production, in terms of greenhouse gas and nitrogen emissions can also further support trade.

Taking proactive steps to address the hidden costs of Australia's food system through ambitious sustainability policies has the potential to significantly reduce these costs. TCA provides an opportunity to understand and manage the costs and benefits of Australia's food system, enabling a stronger, more sustainable and more equitable economy for current and future Australians.

<u>Insight</u>



 Food System Horizons
 87

 Towards a state of the food system report
 87

KEY POINTS

- The gross value of production from Australia's food manufacturing sector was \$125 billion in 2023, and the sector employed over 200,000 people.
- Australia's food manufacturing industries face challenges from high input costs and shortages of skilled labour.
- New business models and food processing technologies have potential to make regional food processing economically viable by upskilling labour and reducing start-up costs.
- Improved reporting on the development of innovation hubs would help businesses to scale up and extend into new regions.

10.1 State of the food manufacturing system

In 2023, the gross value of Australia's food manufacturing sector was \$125 billion, which is about the same as the gross value of the agricultural sector (ABS, 2024a). Food manufacturing is the largest employer within the manufacturing sector, accounting for 24% of jobs in 2023 (ABS, 2024a). Over 40% of these jobs are in regional areas. In June 2024, there were just over 2000 food manufacturing businesses in Australia (including seafood processing), just under 90% of which were small-to-medium enterprises with less than 20 employees (ABS, 2024b). Although a high proportion of domestic food and beverages are manufactured locally, many rely on imported ingredients. This makes Australian food manufacturing heavily dependent on China, the

Australia's food manufacturing sector faces high input cost and shortages of skilled labour.

United States and Europe for essential inputs (ABARES, 2020; CSIRO, 2021).

Australia's food manufacturing sector faces several challenges, including high input costs, which have impeded the growth of domestic food manufacturing and maintained a focus on exporting agricultural commodities (DISR, 2024). Other challenges include a small domestic market, skilled labour shortages, infrastructure constraints, energy use, compliance with environmental sustainability rules, and the logistical challenges of large distances (Commonwealth of Australia, 2023a). Policies to support value-adding of agricultural commodities have been fragmented (Greenville et al., 2020), and agricultural policy continues to favour commodity exports. The scaling-up of production for new food products has been hampered by limited access to innovation expertise and access to spare processing capacity for piloting new food technologies and market testing (FIPWA, 2025).

10.2 Reporting to enable manufacturing

New business models

Australia's small markets and high labour costs have contributed to a deeply embedded view in agricultural and food manufacturing policy that Australia's food system is unlikely to ever have a comparative advantage in food manufacturing (Griffith and Watson, 2016). This view is supported by sound economic reasoning that favours offshore manufacturing. Processing food closer to large markets such as Asian megacities provides manufacturers with economies of scale and the flexibility to source and blend ingredients from diverse sources to meet changing consumer preferences.

Proposed food manufacturing business models need to have clear strategies for overcoming the economics supporting offshore manufacturing. Alternative business models such as innovation clusters have potential to lower start-up costs by overcoming the indivisibility of labour and capital costs to make it more cost-effective for small-to-medium enterprises to scale up.

Innovation clusters are regional concentrations of interconnected businesses, research institutions and government organisations that work together to establish local ecosystems of resources, knowledge and relationships to support the growth of businesses in a particular field (Porter, 1990). They enable small emerging businesses to commercially acquire the services they need, without having to purchase the assets concerned or to employ the providers of essential services. They also provide an effective means for governments and research organisations to support food industry development. They can help to meet sustainability goals by locating niche, highvalue food manufacturing closer to agricultural producers to increase circularity (see Insight 7, Circular economy). Better connections between food producers and consumers in regional food ecosystems can also help meet important cultural and nutritional goals.

However, there is currently only sporadic reporting on the development of innovation hubs and analysis of factors influencing their success. FIAL (2023) evaluated four regional food manufacturing clusters across Australia. They found that clusters were effective for supporting energy sustainability, food security, circular economy and the exploration of new products and processes. Ongoing reporting would help to gather and communicate learning about the potential of clusters to enable economically viable local food manufacturing and to extend these business models to new regions.

Industry strategy also has a role to play in expanding the role of manufacturing in Australia's food system. FoodManufacturing2050 is a foresighting initiative that will convene communities, governments and industries across the food system to explore opportunities for improving the economic viability of food manufacturing using strategies that go beyond regional innovation clusters. By acknowledging current manufacturing capacity and unlocking new value-adding opportunities, this initiative seeks to deliver a set of transformative programs that will further support a national research and development strategy for food manufacturing.

New food technologies

New food manufacturing technologies such as precision fermentation have potential to ease land use and related sustainability pressures. They also have potential to create new types of food, such as complementary proteins, that can help people to meet their nutritional goals. A problem faced by all emerging industries is that they struggle to register in aggregated industry metrics such as gross value of production (see Insight 11, Economics) amid larger incumbent industries. As discussed in Insight 11 (Economics), a reliance on aggregate metrics of economic size can favour incumbent industries over new entrants in policies such as those that govern research and development funding. Overcoming these biases requires a redirection of innovation metrics from past



New food manufacturing technologies have potential to ease sustainability pressures and create new types of food that can help people meet their nutritional goals. production and productivity to likely success in meeting a future with a more balanced mix of efficient production, value-adding, sustainability, nutrition and health goals.

Seeing agricultural produce as food ingredients

Australia's food system is currently fragmented and siloed across value chains, which exacerbates an industry reliance on imported ingredients and reduces opportunities for local manufacturing (Commonwealth of Australia, 2023a; Commonwealth of Australia, 2025). There is very little information flow between the farmers who produce food ingredients and the manufacturers who take these materials and make food products. This reduces opportunities to tailor agricultural produce for food manufacturing versus exporting it as a bulk commodity. An example is that oilseeds grown for oil content may lack characteristics that make them easier to crush during manufacturing.

Scaling-up new foods

Greater coordination of Australia's food system might also help to facilitate the scaling-up of food manufacturing industries. For example, a regularly updated map of underutilised food processing capacity could help the proponents of emerging food products find spare manufacturing capacity and reduce initial investments in capital infrastructure (Figure 14). New business models that tap into underutilised manufactur-ing capacities have potential to overcome some of the impediments to economically viable food manufacturing in Australia (Commonwealth of Australia, 2023b).





Figure 14: TraNSIT map of processing facilities across Australia and the knowledge gap of processing capability and capacity. Source: CSIRO (2025)

Greater coordination of Australia's food system would increase opportunities to tailor agricultural produce for food manufacturing and scale-up food manufacturing industries.

Overcoming transport challenges

Transport connectivity between food manufacturers and markets is poor, particularly in remote Australia. The state of the roads and rail infrastructure and the reliability of the transport system make food supply chains vulnerable to a range of threats, especially weather events. Transport resilience planning is a vital part of food system reporting. It helps to create options for moving food and other supplies, especially to remote areas, when climate or other events disrupt supply chains. Mapping the interactions between food processing facilities and road networks can help decide factors such as where food distribution centres should be located to best cope with potential supply chain disruptions (CSIRO, 2025).

Environmental sustainability

Food manufacturers are increasingly required to meet sustainability regulations that are necessary for maintaining social licence in Australian and foreign markets. Sustainability reporting and climate disclosure requirements commenced for large Australian entities on

1 January 2025, with smaller entities to start reporting in coming years (ASIC, 2025). As discussed in Insight 6 (Sustainability), Australia does not yet have an overarching framework for reporting on the overall sustainability of the food system, including food manufacturing. An overarching framework of this kind would help us to monitor the sustainability of existing food manufacturing and to assess the sustainability claims made for new food technologies. New food technologies such as complementary proteins are likely to use more energy and water but less land than conventional agriculture, creating both new sustainability challenges and opportunities. Sustainability reporting would also help redesign regulations to minimise waste and improve the circularity of the food system.

Industry strategy

The food manufacturing sector is less well organised than other the other main production-oriented sector of Australia's food system - agriculture. Agricultural industries are represented by peak bodies with industry strategies working towards a shared \$100 billion production target for 2030. Similar strategies have been suggested for Australia's food manufacturing sector, such as the 'Capturing the prize' strategy developed by Food Innovation Australia Limited in 2020 (FIAL 2020), but have gained much less traction across industry and government. This is likely because the manufacturing sector is less organised and therefore less able to negotiate a shared vision for the future. There is a risk that the apparent fragmentation of industry is impeding its development towards a more profitable and internationally competitive future. A new initiative, FoodManufacturing2050 (FM2050),

will bring together industry leaders, policy advisers and researchers to identify shared challenges and develop a long-term vision for the sector. This initiative will build an evidence base around manufacturing capacity that supports the co-development of a strategic, evidence-based vision that helps negotiate the direction for food manufacturing in Australia to 2050. This vision will help to identify industry and government actions to drive towards innovation, policy and industry competitiveness goals.

<u>Insight</u>



Rohan Nelson





- O Production versus Economic development production focus prevents celebrating agriculture's support of Australia's economic development
- **O** Sustainability, health and equity progress obscured by the gross value of agricultural production
- War and famine partly responsible for increases in the gross value of agricultural production
- **R&D funding** Favours production over sustainability, health and equity goals

3 OPPORTUNITIES

- Economic development the food system is more than agricultural production and exports
- \$800 billion we can value the whole food system
- Net values provide greater insights into sustainability than gross measures
- Balance R&D funding for production vs sustainability, health and equity goals

KEY POINTS

- Australia's commercial food system generated over \$800 billion of income in 2022–23 and is growing rapidly.
- Australia's food system employs 3.5 million people and supports an economy with a workforce four times larger than its own.
- Within the food system, Australian agriculture employs a workforce 50 times larger than its own.
- A focus on the gross value of agricultural production is limiting our ability to celebrate the economic success of Australia's food system and our ability to meet a broader set of food system goals.

11.1 The value of Australia's food system

The gross value of Australia's food system was more than \$800 billion in 2022–23, which was an increase of 10.8% from the previous year (Figure 15). This is more than eight times larger than the goal of \$100 billion set for the gross value of agricultural production (GVP) for 2030. It may understate the gross value of the food system because data for industries such as transport, postal and warehousing are not yet published in sufficient detail to identify their food-related components. Across the food industries that are reported, the fastest rates of growth reflected post-COVID-19 recovery in food and beverages services, offset by lower



GROSS VALUE OF FOOD SYSTEM

Figure 15: The gross value of Australia's food system from 2010–11 to 2022–23. Source: ABS (2024)



Figure 16: Value added by industries across Australia's food system from 2010–11 to 2022–23. Source: ABS (2024)

annual rates of growth in wholesaling (5%) and retailing (6%). The total income generated by the agricultural sector (including aquaculture) increased by 8.5% to just under \$122 billion, having already exceeded the \$100 billion target in 2021–22, using ABS data. The gross value of Australia's food system increased by 4.8% per year between 2010–11 and 2022–23, while the agricultural sector (including aquaculture) grew by 6.6% per year over the same period.

The value added by Australia's food system to the Australian economy was over \$200 billion in 2022–23. This reflects the income generated by the food system less purchased inputs. The \$200 billion of value added is more than twice the target set for agricultural GVP by 2030 and \$180 billion more than the value added by agriculture and aquaculture together (Figure 16). Again, this is an underestimate because it does not include the contributions to the food system of the transport, postal and warehousing industries. The value added to the Australian economy by the food system grew by 1.3% per year between 2006–07 and 2022–23. This growth rate was 1.5 times greater than the growth of value added by the combined agriculture and aquaculture industries, which grew at an annual rate of 0.9% over the same period.

Australia's food system supports the ongoing growth of the Australian economy. In particular, it has supported a massive expansion of the Australian economy over the last 100 years (Figure 17). The food system is a major source of employment, and over the decade from 2012–13 to 2022–23, it supported a

FARM VS NON-FARM WORK FORCE



Figure 17: Employment in agriculture and the food system versus the economy-wide Australian workforce

workforce four times larger than its own. Longer-term data show a phenomenal increase in the size of the economy-wide workforce supported by the agricultural workforce. In the 1920s, agriculture supported a workforce that was six times larger than its own, and in the 2020s, it is supporting an economy-wide workforce 52 times larger than its own.

The role of agriculture in economic development

Ultimately, the food system does not exist for its own sake but to support human life on earth. This means that the ultimate measure of the economic success of Australia's food system is not its size but the support it provides for Australia's overall social and economic development. A simple way to measure this is by comparing the number of jobs in the food system with the total Australian workforce that the food system supports.

The ratio of agricultural employment to the total workforce is a summary statistic that reveals a wellestablished, long-term pathway of industrialisation and globalisation (Roe and Gopinath, 2018; Soubbotina and Sheram, 2000). In countries that have abundant land resources, the productivity of labour can initially grow faster than the productivity of other sectors, such as mining, industry and services. This is due to factors such as the initial abundance of land, water and other natural resources, as well as growing education levels, technological development, mechanisation and governance.

High initial rates of agricultural productivity growth mean that the demand for agricultural labour falls over decades because less labour is needed to produce food – especially for populations growing from a small base. This labour is progressively released to other sectors, such as industry and mining, and later to the services sector for jobs that are less amenable to mechanisation or automation (see figure).



AGRICULTURE AND ECONOMIC DEVELOPMENT

Figure – The role of agriculture in economic development. Adapted from: Soubbotina and Sheram (2000)

Rising demand for goods and services also plays a role in the shift of jobs from agriculture to other sectors. As incomes rise, there are natural limits to how much additional food people need to eat, freeing up household incomes to stimulate demand for non-agricultural goods and services. Australia is now firmly a post-industrial nation in which agricultural productivity is highly optimised and absorbs a small share of the overall workforce (2.5%; ABS, 2024). The figure below shows that the agricultural sectors of developing countries support workforces less than 10 times greater than their own, while those in developed countries can support workforces between 20 and 100 times greater than their own.

RATIO OF THE TOTAL WORKFORCE TO THE AGRICULTURAL WORKFORCE



Figure – Ratio of the total workforce to the agricultural workforce in (A) developing countries and in (B) Australia and other developed countries. Source: World Bank (2025)

11.2 Overcoming the limitations of economic reporting

System versus industry

The way we have measured the economic success of Australia's food system has been preventing us from celebrating its full contribution to Australia's economic success. This is because we use partial measures of economic success for individual industries that overlook the combined value of industries across the food system. Gross measures of economic output do not consider the resource or opportunity costs of economic activity.

The single most prominent statistic in Australia's food system is GVP. GVP has been reported regularly since 1949 (Lewis, 1949) and continues to be the headline of agricultural forecasts produced by ABARES (e.g. see Litchfield and Read, 2024). In 2018, the National Farmers Federation revitalised the iconic status of agricultural GVP in modern food system policy by setting a \$100 billion target for industry growth by 2030 at a time when GVP was around \$60 billion (NFF, 2019) (Figure 18). The \$100 billion target was then accepted as policy for the agricultural sector by the Australian Government of the time (DAWE, 2020). GVP has increased steadily over time, which suggests that Australia's agricultural sector is booming and that it will meet the \$100 billion target well before 2030 (Figure 18).

Similar statistics for food processing are published by ABARES (table 9 of ABARES, 2023), the AFGC (2022–23) and FIAL (2023), all based on industry statistics published by the ABS (ABS, 2024). These broader food system statistics are not routinely analysed or reported on, or compared to agricultural GVP, nor are they used to set government targets for indus-

GROSS VALUE OF AGRICULTURAL PRODUCTION



Figure 18: Gross value of agricultural production in Australia from 2007–08 to 2029–30. Source: ABARES (2023)

try growth. FIAL advocated a \$200 billion growth target for the Australian food and agribusiness sector in 2020 (FIAL, 2020), but government support was withdrawn in 2023.

Managing challenges across the food system

More holistic approaches would enable us to understand the overall value of Australia's food system and how managing interactions between food system activities could improve its overall value. This switch is urgently required because single-sector approaches to productivity growth that have served Australia well in the past are proving less and less effective over time (Figure 19). Taking a multi-sector approach to productivity opens opportunities to pursue global competitiveness by improving interactions



TOTAL FACTOR PRODUCTIVITY



between industries across the food system. It also provides an opportunity to monitor and address challenges in the food system, such as interactions between production, retailing, nutrition and waste.

The current use of GVP as a measure of economic success is potentially misleading or inappropriate in a number of ways. First, it uses a statistic that has not been adjusted for general inflation of prices, and therefore, it does not reflect the underlying economic performance of Australia's farming businesses. When adjusted for inflation, GVP has not yet exceeded \$80 billion and is growing at a rate much slower than that widely celebrated in public announcements (ABARES, 2024a) (Figure 20).

Second, Australia exports around 70% of GVP into world markets and has limited influence over factors that determine world prices. Increases in world prices are not always the result of intentional industry or government activity towards meeting industry growth targets. There may be reputational and ethical reasons for not claiming the price benefits induced by events such as wars or famines around the world. For example, in September 2024, ABARES reported that canola 'prices rose through 2021–22 and 2022–23 on the back of droughts in the northern hemisphere, increasing demand for Australian canola and market volatility due to the Russian Federation invasion of Ukraine' (Morton, 2024, p. 41).

Accounting for sustainability, equity and health

Another misleading characteristic of gross measures of value is that they do not consider the resources used in production or the unpriced costs and benefits associated with production. Agriculture's economic contribution to the Australian economy is reflected in the value it adds less any costs it incurs. Net value can be estimated by subtracting the costs of produc-
ADJUSTMENTS TO GVP



Figure 20: Adjustments to Australian GVP to correct for inflation and input costs from 2007–08 to 2023–24

tion (inputs purchased) from the GVP. The cost of inputs to agricultural production are significant, so the net value of production is much lower than the GVP (Figure 20). A similar measure published for agriculture by the ABS is larger than the estimate produced by ABARES for farms because it includes a more diverse spread of business types (see Zammit and Howden, 2020 for a detailed explanation).

But even the net value of production is a poor measure of sustainability because it does not include unpriced costs and benefits. The environmental and health impacts of the food system are significant and are being estimated via TCA methodologies (see Insight 9, Hidden costs). Value added statistics reflect the prices paid for services to treat illnesses or dispose of waste, rather than the costs imposed by illness or the environmental damage caused by waste. This means that value added can perversely increase when the food system has negative impacts on the environment or health.

The use of GVP as an industry target and to cap government contributions to research and development funding may also be working against productivity, sustainability, equity and health outcomes from Australia's food system (see Insight 1, Nutrition). GVP is used in the Primary Industries Levies and Charges Disbursement Act 2024 (Cwlth) to limit the Australian Government's matching of research and development levies to 0.5% of the average industry GVP for the most recent three financial years. This is likely to encourage industries to do research and development that maximises GVP, potentially to the detriment of other important food system goals. It is also likely to favour large commodityexporting industries over the smaller and more diverse fresh produce industries that more directly contribute to healthy diets and affordable food for Australians. A bias towards large commodityexporting industries also makes it difficult to recognise and foster emerging future industries, such as the commercialisation of Indigenous foods and new protein sources. Future mechanisms for specifying the Australian Government's contribution to research and development could include the adoption of metrics that balance production with broader productivity, sustainability, equity and health goals.

REFERENCES

Towards a state of the food system

- ABARES (2025a) Farm performance. https://www.agriculture.gov.au/abares/research-topics/surveys
- ABARES (2025b) Quarterly agricultural commodities report. https://www.agriculture.gov.au/abares/research-topics/agricultural-outlook.
- ABS (2024) Australian Industry. Cat. No. 8155.0. Canberra, Australian Bureau of Statistics.
- ACCC (2008) Report of the ACCC inquiry into the competitiveness of retail prices for standard groceries. Canberra, Australian Competition and Consumer Commission.
- ACCC (2025) Supermarkets inquiry 2024–25. https://www.accc.gov.au/inquiries-and-consultations/supermarkets-inquiry-2024-25.
- AFGC (2025) State of the industry. Australian Food & Grocery Council. https://afgc.org.au/resources/state-of-theindustry
- BAE (1945) Report on the citrus industry survey. Bulletin No. 1. Canberra, Bureau of Agricultural Economics.
- BAE (1946) Economic outlook for the horticultural and viticultural industries. Bulletin No. 2. Canberra, Bureau of Agricultural Economics.
- BAE (1947) Economic outlook for the fat lamb industry. Bulletin No. 3. Canberra, Bureau of Agricultural Economics.
- BAE (1948) Economic outlook for the pig industry. Bulletin No. 4. Canberra, Bureau of Agricultural Economics.
- Bustamante M, Vidueira P and Baker L (2024) Insights from systems thinking and complexity science to strengthen food systems frameworks. Global Food Security 42: 100777.
- Commonwealth of Australia (2021) Australia State of the Environment 2021. https://soe.dcceew.gov.au/.
- Commonwealth of Australia (2023) Australian Food Story: Feeding the Nation and Beyond. Inquiry into food security in Australia. Canberra, Parliament of Australia. House of Representatives Standing Committee on Agriculture.
- Conti C, Hall A, Orr A, Hambloch C and Mausch K (2024) Complexity-aware principles for agri-food system interventions: Lessons from project encounters with complexity. Agricultural Systems 220: 104080.
- Conti C, Zanello G and Hall A (2021) Why are agri-food systems resistant to new directions of change? A systematic review. Global Food Security 31, 100576.
- CSIRO (2023) Reshaping Australian Food Systems a roadmap towards a more sustainable, productive and resilient future for Australia's food, its environment and people. Melbourne, Commonwealth Scientific and Industrial Research Organisation.
- Deconinck K, Giner C, Jackson LA and Toyama L (2022) Making better policies for food systems will require reducing evidence gaps. Global Food Security 33, 100621.
- DEFRA (2025) Department for Environment, Food and Rural Affairs home page. https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs.
- DoA (2014) Australian Food Statistics 2012–13. Department of Agriculture, Canberra.
- Fanzo J, Haddad L, Schneider KR, Béné, C, Covic NM, Guarin A,... and Moncayo JR (2021) Rigorous monitoring is necessary to guide food system transformation in the countdown to the 2030 global goals. Food Policy 104, 102163.
- FIAL (2020) Capturing the prize: the A\$200 billion opportunity for the Australian food and agribusiness sector. Sydney: Food & Agribusiness Growth Centre, Food Innovation Australia Limited. https://www.fial.com.au/sharing-knowledge/capturing-the-prize

- Foodbank (2024) Foodbank Hunger Report 2024. Foodbank Australia. https://reports.foodbank.org.au/foodbank-hunger-report-2024/
- Food Frontier (2023) State of the industry: Australia's plant-based meat industry. Food Frontier. https://www.foodfrontier.org/resource/2023-state-of-the-industry/
- Government of Canada (2025) Agriculture and agrifood Canada home page. https://agriculture.canada.ca/en
- Gray E, Oss-Emer M and Sheng Y (2014) Australian agricultural productivity growth: past reforms and future opportunities. Research Report 14.2. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.
- Griffith G and Watson A (2016) Agricultural markets and marketing policies. Australian Journal of Agricultural and Resource Economics 60(4), 594–609.
- Growcom (2025) Hort360 platform. Growcom. https://www.growcom.com.au/hort360
- Harper I, Anderson P, McCluskey S and O'Bryan M (2015) Competition policy review: Final report. Canberra.
- Hilmer F, Rayner M and Taperell G (1993) National Competition Policy. Commonwealth Government Printer, Canberra.
- INFORMAS (2025) INFORMAS: Benchmarking food environments. INFORMAS. https://www.informas.org/
- Lim-Camacho L and Nelson R (2024) National food system reporting: 'Seeing' Australia's future food system. CSIRO, Brisbane.
- Mausch K, Hall A and Hambloch C (2020) Colliding paradigms and trade-offs: Agri-food systems and value chain interventions. Global Food Security 26, 100439.
- Mazzucato M (2016) From market fixing to market-creating: a new framework for innovation policy. Industry and Innovation 23(2), 140–156.
- Palmer J (2024) What is the food system? Food System Horizons Fact Sheet. Brisbane: The University of Queensland and CSIRO. https://foodsystemhorizons.org/approach/what-is-a-food-system/
- Productivity Commission (2016) Regulation of Australian Agriculture. Report no. 79. Productivity Commission, Canberra.

1 Nutrition

- ABARES (2024) Statistical Tables Table 13 Gross Value of Farm, Fisheries and Forestry Production, Australia. Agricultural Commodities 14, no. 4. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.
- ABARES (2020) Analysis of Australian food security and the COVID-19 pandemic, in ABARES Insights issue 3. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.
- ABS (2024) National, state and territory population June 2024. Australian Bureau of Statistics, Canberra. https:// www.abs.gov.au/statistics/people/population/national-state-and-territory-population/latest-release
- AIHW (2018) Nutrition across the life stages, in Cat. no. PHE 227. Australian Institute of Health and Welfare, Canberra.
- AIHW (2021) Australian Burden of Disease Study 2018: Interactive data on risk factor burden, in Cat. no. BOD 35. Australian Institute of Health and Welfare, Canberra. https://www.aihw.gov.au/reports/burden-of-disease/abds-2018-interactive-data-risk-factors
- AIHW (2022) Health system spending per case of disease and for certain risk factors, in Cat. no. HWE 88. Australian Institute of Health and Welfare, Canberra. https://www.aihw.gov.au/reports/health-welfare-expenditure/health-system-spending-per-case-of-disease

- AIHW (2024) Overweight and obesity, in Cat. no. PHE 251. Australian Institute of Health and Welfare, Canberra. https://www.aihw.gov.au/reports/overweight-obesity/overweight-and-obesity/contents/summary#change_ over_time
- Cancer Council (2024) Public health leaders welcome Diabetes Inquiry push for Australia to tax sugary drinks, Media Release 4 July 2024. Cancer Council. https://www.cancer.org.au/media-releases/2024/publichealth-leaders-welcome-diabetes-inquiry-push-for-australia-to-tax-sugary-drinks
- Commonwealth of Australia (2021) National Preventive Health Strategy 2021–2030. Australian Government, Department of Health, Canberra.
- Commonwealth of Australia (2022) The National Obesity Strategy 2022–2032. Health Ministers Meeting. https:// www.health.gov.au/sites/default/files/documents/2022/03/national-obesity-strategy-2022-2032 0.pdf
- Commonwealth of Australia (2023) Australian Food Story: Feeding the Nation and Beyond. Inquiry into food security in Australia. House of Representatives Standing Committee on Agriculture. Viewed February 2025. https://www.aph.gov.au/Parliamentary_Business/Committees/House/Agriculture/FoodsecurityinAustrali/Report
- Crino M, Sacks G, Dunford E, Trieu K, Webster J, Vandevijvere S, ... and Neal B (2018) Measuring the healthiness of the packaged food supply in Australia. Nutrients, 10(6), 702.
- Deakin University. Australia's Food Environment Dashboard [Internet]. Melbourne (AU): Deakin University; 2025. Available from: https://foodenvironmentdashboard.com.au/
- Foodbank (2024) Foodbank Hunger Report 2024. Foodbank Australia. https://reports.foodbank.org.au/foodbank-hunger-report-2024/
- Hendrie GA, Rebuli MA, James-Martin G, Baird DL, Bogard JR, Lawrence AS and Ridoutt B (2022) Towards healthier and more sustainable diets in the Australian context: Comparison of current diets with the Australian Dietary Guidelines and the EAT-Lancet Planetary Health Diet. BMC Public Health 22(1), 1939.
- Lee AJ, Kane S, Herron LM, Matsuyama M & Lewis M (2020) A tale of two cities: the cost, price-differential and affordability of current and healthy diets in Sydney and Canberra, Australia. International Journal of Behavioral Nutrition and Physical Activity, 17, 1-13.
- Mason-D'Croz D, Bogard JR, Sulser TB, Cenacchi N, Dunston S, Herrero M and Wiebe K (2019) Gaps between fruit and vegetable production, demand, and recommended consumption at global and national levels: an integrated modelling study. The Lancet Planetary Health 3(7), e318–e329.
- Mialon M, Swinburn B, Allender S & Sacks G (2016) Systematic examination of publicly-available information reveals the diverse and extensive corporate political activity of the food industry in Australia. BMC public health, 16, 1-13.
- Monteiro CA, Cannon G, Levy RB, Moubarac, JC, Louzada ML, Rauber F,... and Jaime PC (2019) Ultra-processed foods: what they are and how to identify them. Public Health Nutrition 22(5), 936–941.
- OECD (2023) Health at a Glance 2023: OECD Indicators. OECD Publishing, Paris. DOI: 10.1787/7a7afb35-en.
- Ridoutt B, Baird D, Bastiaans K, Darnell R, Hendrie G, Riley M,... and Keating B (2017) Australia's nutritional food balance: Situation, outlook and policy implications. Food Security 9(2), 211–226.
- Sacks G and Mann D (2023) Policies for tackling obesity and creating healthier food environments: scorecard and priority recommendations for the Australian governments. Deakin University, Melbourne.
- Swinburn BA, Kraak VI, Allender S, Atkins VJ, Baker PI, Bogard JR,... and Dietz WH (2019) The global syndemic of obesity, undernutrition, and climate change: the Lancet Commission report. The Lancet 393(10173), 791–846.
- Thornton LE, Lamb KE and Ball K (2016) Fast food restaurant locations according to socioeconomic disadvantage, urban–regional locality and schools within Victoria, Australia. SSM – Population Health, 2, 1–9.
- Wilkinson AL, Scollo MM, Wakefield MA, Spittal MJ, Chaloupka FJ and Durkin SJ (2019) Smoking prevalence following tobacco tax increases in Australia between 2001 and 2017: an interrupted time-series analysis. The Lancet Public Health 4(12), e618–e627.

2 Retail environment

- ABC (2024) Supermarket anger sees more shoppers finding alternative ways to buy food. Viewed 29 January 2025, https://www.abc.net.au/news/2024-01-15/alternative-shopping-methods-rise-amid-supermar-ket-anger/103316612
- ABS (2018) Neighbourhood impacts on health. Viewed 15 January 2025, <https://www.abs.gov.au/articles/ neighbourhood-impacts-health>.
- ABS (2024a) Counts of Australian Businesses, including Entries and Exits. Viewed 23 January 2025, https://www.abs.gov.au/statistics/economy/business-indicators/counts-australian-businesses-including-entries-and-exits/latest-release#institutional-sector
- ABS (2024b) Grocery retailing and convenience stores. Viewed 15 January 2025, https://www.ato.gov.au/businesses-and-organisations/income-deductions-and-concessions/small-business-benchmarks/in-detail/grocery-retailing-and-convenience-stores
- ABS (2025) Retail Trade, Australia. Viewed on 7 February 2025, https://www.abs.gov.au/statistics/industry/retailand-wholesale-trade/retail-trade-australia/latest-release
- ACCC (2024) Supermarkets inquiry August 2024 interim report. Australian Competition and Consumer Commission, Australia. Viewed 18 December 2024, https://www.accc.gov.au/about-us/publications/serial-publications/supermarkets-inquiry-2024-25-reports/supermarkets-inquiry-august-2024-interim-report
- ACRS (2024) ACRS Retail Monitor 2024 Report. Australian Consumer and Retail Studies, Monash University, Australia. Viewed 30 January 2025, https://issuu.com/monashbusinessschool/docs/2024_acrs_retail_monitor?fr=sMjk3NDgwMDgzODU
- AIHW (2012) Australia's food and nutrition 2012. Cat. no. PHE 163. Australian Institute of Health and Welfare, Canberra.
- Appinio and Spryker (2022) Distribution of grocery shopping channels used in Australia in 2022. Viewed 23 January 2025 via Statista, https://statista.com/statistics/1379602/australia-grocery-shopping-channels-used/
- Bivoltsis A, Christian H, Ambrosini GL, Hooper P, Pulker CE, Thornton L and Trapp GSA (2023) The community food environment and its association with diet, health or weight status in Australia: A systematic review with recommendations for future research. Health Promotion Journal of Australia 34(2), 328–365. DOI: 10.1002/hpja.679
- Bivoltsis A, Trapp G, Knuiman M, Hooper P and Ambrosini GL (2020) Do Changes in the Local Food Environment Within New Residential Developments Influence the Diets of Residents? Longitudinal Results from RESIDE. International Journal of Environmental Research and Public Health 17(18), 6778. DOI: 10.3390/ ijerph17186778
- Canstar Blue (2023) Leading reasons to shop exclusively at a supermarket chain in Australia as of July 2023. Viewed 13 Jan 2025 via Statista, https://www.statista.com/statistics/1258272/australia-reasons-to-shop-exclusively-at-supermarket-chain/
- Coles (2024a) 2024 Full Year Results Release. Coles Group Limited, Australia. Viewed on 24 January 2025, https://www.colesgroup.com.au/DownloadFile.axd?file=/Report/ComNews/20240827/02843633.pdf
- Coles (2024b) Coles Supermarkets' Response to Issues Paper. Viewed 10 January 2025, https://www.accc.gov.au/system/files/Coles-Group-Public.pdf
- Deakin University. Australia's Food Environment Dashboard [Internet]. Melbourne (AU): Deakin University; 2025. Available from: https://foodenvironmentdashboard.com.au/
- Deconinck K (2021) Concentration and market power in the food chain. OECD Food, Agriculture and Fisheries Papers No. 151. Paris, Organisation for Economic Development and Cooperation.
- Fortune N, Singh A, Badland H, Stancliffe RJ and Llewellyn G (2020) Area-Level Associations between Built Environment Characteristics and Disability Prevalence in Australia: An Ecological Analysis. International Journal

of Environmental Research and Public Health 17(21), 7844. DOI: 10.3390/ijerph17217844

- FSANZ (2023) 2023 Consumer Insights. Food Standards Australian New Zealand, Australia. Viewed 11 January 2025, https://www.foodstandards.gov.au/sites/default/files/2024-05/Consumer%20Insights%20Track-er%202023%20Simple%20Report.pdf
- Health and Wellbeing Queensland (2023) Gather + Grow 2023–2032: Queensland Remote Food Security Strategy. Queensland Government, Australia.
- Landrigan TJ, Kerr DA, Dhaliwal SS, Savage V and Pollard CM (2017) Removing the Australian tax exemption on healthy food adds food stress to families vulnerable to poor nutrition. Australian and New Zealand Journal of Public Health 41(6), 591–597.
- Lee A, Patay D, Herron LM, Harrison EP and Lewis M (2021) Affordability of current and healthy, more equitable, sustainable diets by area of socioeconomic disadvantage and remoteness in Queensland: insights into food choice. International Journal for Equity in Health 20, 153. DOI: 10.1186/s12939-021-01481-8
- Meris (2024) Top challenges faced by grocery and convenience retailers in 2025. Viewed 15 January 2025, https://meris.com.au/top-challenges-faced-by-grocery-and-convenience-retailers/
- Merrett DT (2020) The making of Australia's supermarket duopoly, 1958–2000. Australian Economic History Review 60(3), 301–321.
- Needham C, Strugnell C, Allender S and Orellana L (2022) Beyond food swamps and food deserts: exploring urban Australian food retail environment typologies. Public Health Nutrition 25(5), 1140–1152. DOI: 10.1017/S136898002200009X
- Pollard CM, Landrigan TJ, Ellies PL, Kerr DA, Underwood Lester ML and Goodchild SE (2014) Geographic factors as determinants of food security: A Western Australian food pricing and quality study. Asia Pacific Journal of Clinical Nutrition 23(4), 703–713. DOI: 10.3316/informit.874809183741436
- Pollard CM, Landrigan TJ, Gray JM, McDonald L, Creed H and Booth S (2021) Using the Food Stress Index for Emergency Food Assistance: An Australian Case Series Analysis during the COVID-19 Pandemic and Natural Disasters. International Journal of Environmental Research and Public Health 18(13), 6960.
- Pulker CE, Trapp GSA, Foulkes-Taylor F, Scott JA and Pollard CM (2018a) The extent and nature of supermarket own brand foods in Australia: study protocol for describing the contribution of selected products to the healthfulness of food environments. Nutrition Journal 17, 95. DOI: 10.1186/s12937-018-0404-4
- Pulker CE, Trapp GSA, Scott JA and Pollard CM (2018b) What are the position and power of supermarkets in the Australian food system and the implications for public health? A systematic scoping review. Obesity Reviews 19, 198–218. DOI: 10.1111/obr.12635
- Roy Morgan (2024) Bunnings, Aldi and Kmart are Australia's three most trusted brands, while Toyota, Bendigo Bank and Nike are on the up. Viewed 3 February 2025, https://www.roymorgan.com/findings/9666-risk-monitor-guartely-update-june-2024
- Seivwright AN, Callis Z Seivwright AN, Callis Z and Flatau P (2020) Food insecurity and socioeconomic disadvantage in Australia. International Journal of Environmental Research and Public Health 17(2), 559.
- Spurway K and Soldatic K (2015) 'Life just keeps throwing lemons': the lived experience of food insecurity among Aboriginal people with disabilities in the West Kimberley. Local Environment 21(9), 1118–1131. DOI: 10.1080/13549839.2015.1073235
- Statista (2025) Statista Consumer Insights Global survey, January 2025. Viewed 6 February 2025, https://www.statista.com/forecasts/1187999/online-grocery-and-beverage-shopping-by-store-brand-inaustralia
- Summerhayes L, Baker D and Vella K (2024) Food diversity and accessibility enabled urban environments for sustainable food consumption: a case study of Brisbane, Australia. Humanities and Social Sciences Communications 11(1), 1227. DOI: 10.1057/s41599-024-03724-9.
- Tesco PLC (2025) Making healthy diets affordable for all. Viewed on 17 February 2025, https://www.tescoplc. com/sustainability/health/healthy-sustainable-diets.

- Treasury (2023) Food and Grocery Code Independent Reviewer Annual Report 2022–23. The Australian Government the Treasury, Australia. Viewed 20 January 2025, https://grocerycodereviewer.gov.au/sites/grocerycodereviewer.gov.au/files/2023-11/fg-ind-reviewer-ar-2022-23.pdf.
- Voloder L (2015) The 'Mainstreaming' of Halal: Muslim Consumer-Citizenship in Australia. Journal of Muslim Minority Affairs 35(2), 230–244. DOI: 10.1080/13602004.2015.1051753
- Williams MJ, Pilkington A and Parker C (2024) Food relief providers as care infrastructures: Sydney during the pandemic. Geographical Research 62(2), 263–278. DOI: 10.1111/1745-5871.12633
- Woolworths (2024) Full Year Results Announcement. Woolworths Group Limited, Australia. Viewed 24 January 2025, https://www.woolworthsgroup.com.au/content/dam/wwg/investors/asx-announcements/2024/ Woolworths%20Group%20F24%20Profit%20Announcement.pdf.
- Wu W, Zhang A, van Klinken RD, Schrobback P and Muller JM (2021) Consumer trust in food and the food system: a critical review. Foods 10(10), 2490.

3 Food safety

- Australian Food and Agriculture Taskforce (2024) Land of Plenty: Transforming Australia into a Food Superpower, Land of Plenty: Transforming Australia into a Food Superpower, Deloitte Australia.
- Australian Government Food Regulation (2024) About the food regulation system. Viewed 10 February, 2025. https://www.foodregulation.gov.au/about-the-system
- Australian National University (2023) The annual cost of foodborne illness in Australia by food commodities and pathogens. Final Report for Food Standards Australia New Zealand. Australia National University, Canberra
- Centers for Disease Control and Prevention (2025) BEAM dashboard, National Center for Emerging and Zoonotic Infectious Diseases (NCEZID). CDC: United States. https://www.cdc.gov/ncezid/dfwed/BEAM-dashboard.html
- Commonwealth of Australia (2025) About the food regulation system. Food regulation. https://www.foodregulation.gov.au/about-the-system
- Department of Health and Aged Care (2025) National notifiable diseases surveillance system (NNDSS). DHAC: Canberra. https://www.health.gov.au/our-work/nndss
- FSANZ (2019) Food law, treaties and agreements. Food Standards Australia New Zealand. https://www.foodstandards.gov.au/about-us/corporate-information/food-law-and-treaties
- FSANZ (2021) Australian total diet survey. https://www.foodstandards.gov.au/science-data/monitor/australian-total-diet-study
- FSANZ (2023) Food regulatory agencies. Food Standards Australia New Zealand. https://www.foodstandards.gov.au/contact/food-regulatory-agencies
- FSANZ (2024) FSANZ Board communique: 11 December 2024 meeting. https://www.foodstandards.gov.au/news/board-communique-11-December-2024
- Ministry for Primary Industries (2025) Foodborne disease annual reports. MPI: New Zealand. https://www.mpi.govt.nz/science/food-safety-and-suitability-research/human-health-surveillance-and-attribution-programme/foodborne-disease-annual-reports/
- Vaskoska RS and van der Meulen BMJ (2014) Private food law. In: van der Meulen BMJ (Ed.) EU Food Law Handbook (pp. 563–597). Wageningen Academic Publishers.

4 Indigenous food systems

- Aboriginal Medical Services Alliance Northern Territory (2021) Food Summit Report: Food Security in the Northern Territory, AMSANT.
- ABS (2022–23) National Aboriginal and Torres Strait Islander Health Survey, Australian Bureau of Statistics website. Viewed 4 February 2025, https://www.abs.gov.au/statistics/people/aboriginal-and-torres-strait-islander-peoples/national-aboriginal-and-torres-strait-islander-health-survey/ latest-release.
- Australian Indigenous Governance Institute and Maiam nayri Wingara (2018) Indigenous data sovereignty data for governance: Governance of data, briefing paper: 2018. Australian Indigenous Governance Institute and Maiam nayri Wingara.
- Cresswell ID, Janke T and Johnston EL (2021) Overview: Outlook and impacts. In: Australia State of the Environment 2021. Australian Government, Department of Agriculture, Water and the Environment, Canberra. DOI: 10.26194/f1rh-7r05
- Deen C, Sherriff S, Shelling M, Gall A, Cubillo B, Te Morenga L and Matthews V (2025) Measuring Indigenous food security—A case for Indigenous designed tools. Health Promotion Journal of Australia 36(1), e945. DOI: 10.1002/hpja.945
- Department of Health (2022) Northern Territory Market Basket Survey 2021, Northern Territory Government. Viewed 4 February 2025, https://digitallibrary.health.nt.gov.au/entities/publication/67b2066b-7218-487b-a7fc-c16bd8c80362/details.
- Food and Agriculture Organization of the United Nations (2021) The White/Wiphala Paper on Indigenous Peoples' food systems. FAO, Rome. DOI: 10.4060/cb4932en
- Health and Wellbeing Queensland (2023) Gather + Grow 2023–2032: Queensland Remote Food Security Strategy. Queensland Government, Australia.
- House of Representatives Standing Committee on Indigenous Affairs (2020) Report on food pricing and food security in remote Indigenous communities. Australian Government, Canberra.
- Menzies School of Health Research (2016) Developing a good food system in your community. Information Sheet 1, Good Food Systems overview, Australia.
- National Indigenous Australians Agency (2024) National Strategy for Food Security in Remote First Nations Communities – Discussion Paper. National Indigenous Australians Agency, Canberra.
- Poelina A (2024) First Law a gift to healing and transforming climate and just us! Journal of Cultural Heritage Management and Sustainable Development 14(5), 767–772. DOI: 10.1108/ JCHMSD-05-2024-0105
- Productivity Commission (n.d.) Closing the Gap Information Repository. Productivity Commission, Canberra. Viewed 4 February 2025, https://www.pc.gov.au/closing-the-gap-data.
- Sherriff S, Kalucy D, Tong A, Naqvi N, Nixon J, Eades S and Muthayya S (2022) Murradambirra Dhangaang (make food secure): Aboriginal community and stakeholder perspectives on food insecurity in urban and regional Australia. BMC Public Health 22(1), 1066. DOI: 10.1186/s12889-022-13202-z
- Walter M (2018) The voice of Indigenous data: Beyond the markers of disadvantage. Griffith Review, 60. Viewed 4 February 2025, https://www.griffithreview.com/articles/voice-indigenous-data-be-yond-disadvantage/.
- Wilson A, Wilson R, Delbridge R, Tonkin E, Palermo C, Coveney J, Hayes C and Mackean T (2020) Resetting the Narrative in Australian Aboriginal and Torres Strait Islander Nutrition Research. Current Developments in Nutrition 4(5), 1–5. DOI: 10.1093/cdn/nzaa080

5 Policy coherence

- Baker P, Friel S, Gleeson D, Thow A-M and Labonte R (2019) Trade and nutrition policy coherence: A framing analysis and Australian case study. Public Health Nutrition 22(12), 2329–2337. DOI: 10.1017/S1368980019000752
- Carey R, Caraher M, Lawrence M and Friel S (2016) Opportunities and challenges in developing a whole-of-government national food and nutrition policy: lessons from Australia's National Food Plan. Public Health Nutrition 19(1), 3–14. DOI: 10.1017/S1368980015001834
- Commonwealth of Australia (2023) Australian Food Story: Feeding the Nation and Beyond. Inquiry into food security in Australia. Parliament of Australia, House of Representatives Standing Committee on Agriculture, Canberra.
- Lim-Camacho L and Nelson R (2024) National food system reporting: 'Seeing' Australia's future food system. CSIRO, Brisbane.
- Monticone F, Barling D, Parsons K and Samoggia A (2023) Identifying food policy coherence in Italian regional policies: The case of Emilia-Romagna. Food Policy 119, 102519.
- Naudiyal P, Reeve B, Jones A and McDonald S (2021) Food policy in Australia: The role of different Federal Government organisations. The University of Sydney, Sydney.
- Naudiyal P, Reeve B and McDonald S (2022) Who is making food policy in Australia? Centre for Food Policy Research, University of London.
- Parsons K and Hawkes C (2019) Brief 5: Policy Coherence in Food Systems. Rethinking Food Policy: A Fresh Approach to Policy and Practice. Centre for Food Policy, University of London.
- Parsons K (2022) 12 tools for connecting food policy: A typology of mechanisms. Rethinking Food Governance Report 3. The Food Research Collaboration, University of London.
- Pawar M, O'Sullivan D, Cash B, Culas R, Langat K, Manning A...and Ward WS (2020) The Sustainable Development Goals: An Australian Response. The International Journal of Community and Social Development 2(4), 374–393. DOI: 10.1177/2516602620983716
- Sharpe R, Parsons K and Hawkes C (2020) Who makes food policy in England? A map of government actors and activities. The Food Research Collaboration, University of London.
- Thow AM, Greenberg S, Hara M, Friel S, duToit A and Sanders D (2018) Improving policy coherence for food security and nutrition in South Africa: a qualitative policy analysis. Food Security 10(4), 1105–1130. DOI: 10.1007/s12571-018-0813-4

6 Sustainability

- ABARES (2020) Agricultural Outlook. Australian Bureau of Agriculture and Resource Economics, Department of Agriculture Fisheries and Forestry. Australian Government, Canberra.
- Alary V, Gousseff M and Nidumolu UB (2008) Management of the trade-off between environmental sustainability and economic viability Case of nitrogen mitigation balance for dairy farming systems in Reunion Island. The Journal of Agricultural Science 146(4), 389–402.
- Bouma J (2002) Land quality indicators of sustainable land management across scales. Agriculture, Ecosystems & Environment 88, 129–136.
- Bouma J (1997) The land use system approach to planning sustainable land management at several scales. ITC Journal 3/4, 237–242.
- Commonwealth of Australia (2023) National Statement on Climate Change and Agriculture. Commonwealth of Australia, Canberra.

- Cresswell I, Janke T, Johnston EL, Clark G, Cooper S, Costello O... and Woodward E (2021) Australia State of the Environment 2021 – Overview. Independent report to the Australian Government Minister for the Environment, Commonwealth of Australia, Canberra. Australian Government Department of Climate Change, Energy, the Environment and Water, Canberra, Australia. DOI: 10.26194/f1rh-7r05
- DAFF (2022) National Soil Action Plan 2023–2028. Australian Government, Department of Agriculture, Fisheries and Forestry, Canberra.
- DAFF (2024) National soil monitoring program. Department of Agriculture, Fisheries and Forestry: Canberra. https://research.csiro.au/nsmp/
- DCCEEW (2024a) National Climate Risk Assessment first pass assessment report. Department of Climate Change, Energy, the Environment and Water, Canberra.
- DCCEEW (2024b) National Inventory Report 2022, Volume 1. Department of Climate Change, Energy, the Environment and Water, Canberra.
- FAO (2024) Fast Facts What are sustainable food systems? United Nations Sustainable Development Food and Agriculture Organization. Viewed 9 February 2025, https://www.un.org/sustainabledevelopment/fast-facts-what-are-sustainable-food-systems/.
- Hall A, Gopalakrishnan Nair R, Raman S, O'Dwyer J, Brown S, Hart T... and Leith P (2024) Reframing the conversation on agricultural innovation in Australia. CSIRO, Canberra, Australia.
- Hochman Z and Gobbett DL (2017) Climate trends account for stalled wheat yields in Australia since 1990. Global Change Biology 23(5), 2071–2081. DOI:10.1111/gcb.13604
- Huber R, Bartkowski B, Brown C, Benni NE, Feil J-H, Grohmann P... and Muller B (2023) Farm typologies for understanding farm systems and improving agricultural policy. Agricultural Systems 213, 103800. DOI:10.1016/j.agsy.2023.103800
- Hughes N, Lu M, Soh WY and Lawson K (2022) Modelling the effects of climate change on the profitability of Australian farms. Climatic Change 172, 12. DOI:10.1007/s10584-022-03356-5
- IPES-Food (2017) Too big to feed: Exploring the impacts of mega-mergers, concentration, concentration of power in the agri-food sector. Viewed February 2025, www.ipes-food.org.
- McKenzie NJ, Hairsine PB, Gregory LJ, Austin JM, Baldock JA, Webb MJ...and Thomas M (2017) Priorities for improving soil condition across Australia's agricultural landscapes, report prepared for the Australian Government. Department of Agriculture and Water Resources, CSIRO, Canberra.
- McRobert K, Fox T and Heath R (2023) Bringing the AASF to life: Groundwork for implementing the Australian Agricultural Sustainability Framework. Australian Farm Institute.
- McRobert K, Gregg D, Fox T and Heath R (2022) Development of the Australian Agricultural Sustainability Framework 2021–22. Australian Farm Institute.
- National Farmers Federation (2024) Australian Agricultural Sustainability Framework. Viewed 9 February 2025, https://aasf.org.au/.
- Nidumolu UB, Lubbers M, Kanellopoulos A, van Ittersum MK, Kadiyala DM and Sreenivas G (2016) Engaging farmers on climate risk through targeted integration of bioeconomic modelling and seasonal climate forecasts. Agricultural Systems 149, 175–184.
- Reside AE, Carwardine J, Ward M, Yong C, Venegas Li R, Rogers A... and Watson JEM (2025) The cost of recovering Australia's threatened species. Nature Ecology & Evolution 9, 425–435. DOI:10.1038/s41559-024-02617-z
- Trewin B, Morgan-Bulled D and Cooper S (2021) Australia State of the Environment 2021. Australian Government, Department of Agriculture, Water and the Environment, Canberra.
- Upadhaya S, Arbuckle JG and Schulte LA (2023) Farmer typologies integrating latent and observed characteristics: insights for soil and water conservation outreach. Land Use Policy 134, 106889.

- Van Looy K, Bouma J, Herbst M, Koestel J, Minasny B, Mishra U...and Vereecken H (2017) Pedotransfer functions in Earth system science: Challenges and perspectives. Reviews of Geophysics 55, 1199–1256. DOI:10.1002/2017RG000581
- Williams K, Hunter B, Schmidt B, Woodward E and Cresswell T (2021) Australia State of the Environment 2021: Land. Independent report to the Australian Government Minister for the Environment. Commonwealth of Australia, Canberra. DOI: 10.26194/6EAM-

7 Circular economy

- AgriFutures (2023) Pre-farm gate waste management: Baseline waste data for the agriculture, fisheries and forestry sector. Australia. Viewed 7 February 2025, https://agrifutures.com.au/product/pre-farm-gate-waste-management-baseline-waste-data-for-the-agriculture-fisheries-and-forestry-sector/.
- Arsic M, O'Sullivan CA, Wasson AP, Juliano P, MacMillan C, Antille DL... and Clarke W (2022) Australia needs a national policy approach to successfully implement circular bioeconomy in agriculture and food systems. Farm Policy Journal 19(3), 46–60.
- Circular Australia (2022) Circular economy metrics: A review. Circular Australia. https://circularaustralia. com.au/wp-content/uploads/2022/11/Circular-Economy-Metrics-A-Review-Nov-22.pdf
- DCCEEW (2024) Australia's Circular Economy Framework, Department of Climate Change, Energy, the Environment and Water, Canberra Australia. Viewed 7 February 2025, https://www.dcceew.gov. au/environment/protection/circular-economy/framework.
- Hetherington JB, Juliano P, MacMillan C, & Loch AJ (2022) Circular economy opportunities and implementation barriers for Australia's food, feed and fibre production. Farm Policy Journal 19(3), 46-60.
- Miatto A, Emami N, Goodwin K, West J, Taskhiri S, Wiedmann T and Schandl H (2024) A comprehensive material flow account for the Australian economy to support the assessment of Australia's progress towards a circular economy. CSIRO Australia. Viewed 15 January 2025, https://research. csiro.au/circulareconomy/wp-content/uploads/sites/303/2024/03/24-00034_ENV_REPORT_MaterialFlowAnalysisToCircularEconomy_WEB_240305-2.pdf.
- UNECE (2024) Guidelines for Measuring Circular Economy Part A: Conceptual Framework, Indicators and Measurement Framework. United Nations Economic Commissions for Europe, Geneva, Switzerland. Viewed 15 January 2025, https://unece.org/statistics/publications/guidelines-measuring-circular-economy-part-conceptual-framework-indicators.

8 Life cycle assessment

- Dickson E and Clay N (2024) 'Eat up. Save Earth.' Alternative proteins and the myth of inevitable sustainability. Journal of Rural Studies 112, 103447.
- Dougherty JCH, Ridoutt B, Jackson MK, Arsic M, Juliano P and Oddy VH (2023) A conceptual framework for modelling the role of livestock systems in sustainable diets and a sustainable planet. Animal Production Science 63, 1866–1886. DOI: 10.1071/AN23300
- Hendrie GA, Rebuli MA, James-Martin G, Baird DL, Bogard JR, Lawrence A S and Ridoutt B (2022) Towards healthier and more sustainable diets in the Australian context: Comparison of current diets with the Australian Dietary Guidelines and the EAT-Lancet Planetary Health Diet. BMC Public Health 22(1), 1939. DOI: 10.1186/s12889-022-14252-z
- Meshulam T and Makov T (2023) Environmental impacts of large-scale industrial production of cultured meat. In: Proceedings of the 11th International Conference on Industrial Ecology

(ISIE2023).

- Ridoutt BG, Baird D and Hendrie GA (2022) The importance of protein variety in a higher quality and lower environmental impact dietary pattern. Public Health Nutrition 25(12), 3583–3588. DOI:10.1017/S1368980022002221
- Simmons AT, Brandão M, Ritchie Z and Roth G (2023) Environmental consequences of a consumer shift from dairy-to soy-based products. Crop and Pasture Science 75(1), CP23034.
- Sevenster M and Cowie A (2024) Agriculture and the reach of mandatory GHG reporting. Occasional paper 24.01, Australian Farm Institute.
- Soimakallio S, Norros V, Aroviita J, Heikkinen RK, Lehtoranta S, Myllyviita T,... and Toivonen M (2025) Choosing reference land use for carbon and biodiversity footprints. The International Journal of Life Cycle Assessment 30(1), 54–65.
- Willett W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S,... and Murray CJ (2019) Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. The Lancet 393(10170), 447–492.
- Wu L, Huang K, Yu Y, Ridoutt BG, Qu S, and Xu M (2025) Addressing Regional Agro-ecological Boundaries: An Integrated Environmental Footprint Framework for Revealing Sustainability Gaps in Agroecosystems. Environmental Science & Technology 59(9), 4418–4431.

9 Hidden costs

- FAO (2023) The State of Food and Agriculture 2023 Revealing the true cost of food to transform agrifood systems. FAO, Rome. DOI: 10.4060/cc7724en
- FAO (2024) The State of Food and Agriculture 2024 Value-driven transformation of agrifood systems. FAO, Rome. DOI: 10.4060/cd2616en
- Food and Land Use Coalition (2019) Growing better: Ten critical transitions to transform food and land use. The global consultation report of Food and Land Use Coalition. https://www.foodandlandusecoalition.org/wp-content/uploads/2019/09/FOLU-GrowingBetter-GlobalReport.pdf.
- Godde C, Nelson R and Abebe F (2024) The true cost of Australia's food system. Food System Horizons Fact Sheet. The University of Queensland and CSIRO, Brisbane.
- Hendriks S, de Groot Ruiz A, Acosta MH, Baumers H, Galgani P, Mason-D'Croz D,... and Watkins M (2023) The true cost of food: A preliminary assessment. In: von Braun J, Afsana K, Fresco LO and Hassan MHA (Eds) Science and innovations for food systems transformation (pp. 581–601). Springer International Publishing.
- Lord S (2024) Avoided hidden costs in FABLE food system pathways to 2050: Australia key figures. Background brief for the Food and Agriculture Organization of the United Nations (FAO) State of Food and Agriculture (SOFA) 2024. Environmental Change Institute, University of Oxford.
- Navarro Garcia J, Sperling F, Islam N, Marcos Martinez R, Charette-Castonguay A, Mayberry D... and Roche R (2024) Chapter 2: Australia. In: FABLE, 2024 How to reduce agrifood systems' future hidden costs? A multi-country case study – State of Food and Agriculture (SOFA) 2024 background report (pp. 56–84). SDSN, Paris.
- Rockefeller Foundation (2021) True cost of food: measuring what matters to transform the U.S. food system. https://www.rockefellerfoundation.org/reports/true-cost-of-food-measuring-what-mat-ters-to-transform-the-u-s-food-system/.
- Ruggeri Laderchi C, Lotze-Campen H, DeCkerck F, Bodirsky BL, Collignon Q, Crawford M,... and Songwe V (2024) The Economics of the Food System Transformation: Global Policy Report.
- Sustainable Food Trust (2019) The hidden cost of the UK food. Revised edition. Sustainable Food Trust.

- World Bank (2025a) Agriculture, forestry and fishing, value added (% of GDP). Viewed 18 February 2025, https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS.
- World Bank (2025b) Purchasing Power Parity conversion factor, GDP (LCU per international \$). Viewed 16 January 2025, https://databank.worldbank.org/source/world-development-indicators/Series/ PA.NUS.PPP#.

10 Manufacturing

- ABARES (2020) Australian food security and the Covid-19 pandemic, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra. DOI:10.25814/5e953830cb003
- ABS (2024a) Australian Industry. Cat. No. 8155.0. Australian Bureau of Statistics, Canberra.
- ABS (2024b) Australian Industry. Cat. No. 8165.0. Australian Bureau of Statistics, Canberra.
- ASIC (2025) Who must prepare a sustainability report? Australian Securities and Investment Commission. Viewed February 2025, https://asic.gov.au/regulatory-resources/sustainability-reporting/ for-preparers-of-sustainability-reports/who-must-prepare-a-sustainability-report/.
- Commonwealth of Australia (2023a) Australian Food Story: Feeding the Nation and Beyond. Inquiry into food security in Australia. House of Representatives Standing Committee on Agriculture. Viewed February 2025, https://www.aph.gov.au/Parliamentary_Business/Committees/House/Agriculture/FoodsecurityinAustrali/Report.
- Commonwealth of Australia (2023b) Sovereign, smart, sustainable. Driving advanced manufacturing in Australia. House of Representatives, House Standing Committee on Industry, Science and Resources. Viewed February 2025, https://www.aph.gov.au/Parliamentary_Business/Committees/ House/Industry_Science_and_Resources/AdvancedManufacturing/Report.
- Commonwealth of Australia (2025) Food for Thought. The opportunities and challenges for Australia's food and beverage for Australia's food and beverage manufacturing industry. House of representatives. House Standing Committee on Industry, Science and Resources. Viewed February 2025, https://www.aph.gov.au/Parliamentary_Business/Committees/House/Industry_Science_and_Resources/FoodandBeverage/Report.
- CSIRO (2021) Regional plant protein processing hub in north Queensland Scoping the long-term business opportunities for up-cycling applications and smart manufacturing and a case study for Townsville. Commonwealth Scientific and Industrial Research Organisation, Melbourne. DOI: 10.25919/2xbz-7f69
- CSIRO (2025) Supply Chain Transport and Logistics Dashboard. Viewed February 2025, https://bench-mark.transit.csiro.au.
- DISR (2024) Food and Beverage Manufacturing in Australia. Submission to the House of representatives Standing Committee on Industry, Science and Resources. Submission 104. Department of Industry, Science and Resources.
- FIAL (2023) Evaluation of Australian food and agribusiness clusters. Food Innovation Australia Limited. Viewed February 2025, https://www.fial.com.au/sharing-knowledge/cluster-evaluation-report.
- FIPWA (2025) New WA food innovation precinct to drive growth of high-quality, value-added food products in Australia's west. Future Food Systems. Food Innovation Precinct Western Australia. Viewed February 2025, https://www.futurefoodsystems.com.au/resource/new-wa-food-innovation-precinct-to-drive-growth-of-high-quality-value-added-food-products-in-australias-west.
- Greenville J, Duver A and Bruce M (2020) Value creation in Australia through agriculture exports: playing to advantages. Viewed February 2025, https://www.agriculture.gov.au/abares/products/insights/value-creation-in-australia-through-agricultural-exports#australia-has-long-focused-on-raw-and-minimally-transformed-agricultural-exports.

- Griffith G and Watson A (2016) Agricultural markets and marketing policies. Australian Journal of Agricultural and Resource Economics 60(4), 594–609.
- Porter M (1990) The Competitive Advantage of Nations. The Free Press, New York.

11 Economics

- ABARES (2023) Australian Commodity Statistics. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.
- ABARES (2024a) ABARES report highlights Australia's growing production value. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.
- ABARES (2024b) Australian Farm Productivity Broadacre and Dairy Estimates [Online]. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.
- ABS (2024) Australian Industry. Cat. No. 8155.0. Australian Bureau of Statistics, Canberra.
- AFGC (2022–23) State of the industry. Australian Food and Grocery Council. https://afgc.org.au/resources/state-of-the-industry/.
- DAWE (2020) Delivering Ag2030. Department of Agriculture, Water and the Environment, Canberra.
- FIAL (2020) Capturing the prize: the A\$200 billion opportunity for the Australian food and agribusiness sector. Food and Agribusiness Growth Centre, Sydney.
- FIAL (2023) Key facts of Australia's food and agribusiness, and food and beverage sector. https://www.fial.com.au/blogs/post/updated-sector-data.
- Lewis J (1949) Value of rural production Forecast of levels and trends in 1948–49. Quarterly Review of Agricultural Economics 2, 13–15.
- Litchfield F and Read A (2024) Agricultural Overview September 2024. Agricultural Commodities Report 14, 5–10.
- Morton H (2024) Oilseeds. Agricultural Commodities Report 14, 38-46.
- NFF (2019) 2030 roadmap Australian agriculture's plan for a \$100 billion industry. National Farmer's Federation, Canberra.
- Roe TL and Gopinath M (2018) Models of economic growth: Application to agriculture and structural transformation. The Routledge Handbook of Agricultural Economics. Routledge.
- Soubbotina TP and Sheram K (2000) Beyond economic growth: Meeting the challenges of global development. World Bank Publications.
- World Bank (2025) World Development Indicators. World Bank Group. Viewed on March 2025, https://databank.worldbank.org/source/world-development-indicators.
- Zammit K and Howden M (2020) Farmers' terms of trade: Update to farm costs and prices paid. Research Report 20.3. ABARES, Canberra.

GLOSSARY

Harmonising language and terminologies has previously been identified by food system leaders as a goal that a national food system report could help to achieve (Lim-Camacho and Nelson, 2024). To progress this goal, we list key terms and concepts used throughout this report. Our intent is not to impose our definition – but rather to be explicit about which definition we have used, so that readers know the perspectives we are coming from.

Circular economy	'An economic model that promotes sustainable and efficient use of resources as a way to support environmental, economic and social outcomes' (DCCEEW, 2024).
Food environments	The factors affecting decisions to acquire, prepare and consume food, including what foods are made available, how those foods are marketed, how much different foods cost and their affordability, how far consumers need to travel to buy food, and what other goods and services they can access when buying food.
Food system	The processes of producing, distributing and consuming food and food ingredients, from natural resources like water and soils that support agricultural production, through the manufacturing, processing and distribution of food, to its impacts on nutrition and human health.
Food system thinking	A way of organising our understanding and analysis of all the interconnected activities, people and inputs that are required to feed people.
Gross value of production	The value placed on agricultural production at the point (consumption, market or export) where ownership is relinquished by the agricultural sector.
Innovation clusters	Regional concentrations of interconnected businesses, research institutions and government organisations that work together to establish local ecosystems of resources, knowledge and relationships to support the growth of businesses in a particular field (Porter, 1990).
Policy coherence	The degree to which policies across the food system reinforce or contradict each other in meeting societal goals (Parsons and Hawke, 2019). The degree of coherence required will depend on what these goals are and how they change over time.
Sector	Aggregations of related industrial interests and activities.
Sustainability	See 'Sustainable food system'.
Sustainable food system	There are many definitions of sustainability, but the FAO (2024) has made an attempt to define a sustainable food system as one 'that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised'. However, general definitions of this kind imply a level of agreement about sustainability goals that does not yet exist across Australia's community, government or industry. At present, Austra- lian food system stakeholders do not have agreement about sustainability goals, and it may be unrealistic to achieve. We can, however, agree on the general direction we are heading and aim to have complementary goals.
Total factor productivity	A measure of efficiency calculated as the ratio of outputs produced to inputs used.
True cost accounting	A set of evolving methods used to value the environmental, social and health costs and benefits of the food system.

Glossary references

- DCCEEW (2024) Australia's Circular Economy Framework, Department of Climate Change, Energy, the Environment and Water, Canberra Australia. Viewed 7 February 2025, https://www.dcceew.gov.au/environment/protection/circular-economy/framework.
- FAO (2024) Fast Facts What are sustainable food systems? United Nations Sustainable Development Food and Agriculture Organization. Viewed 9 February 2025, https://www.un.org/sustainabledevelopment/fast-facts-what-are-sustainablefood-systems/.

Lim-Camacho L and Nelson R (2024) National food system reporting: 'Seeing' Australia's future food system. Brisbane, CSIRO.

Parsons K and Hawkes C (2019) Brief 5: Policy Coherence in Food Systems. Rethinking Food Policy: A Fresh Approach to Policy and Practice. London: Centre for Food Policy, University of London.

Porter M (1990) The Competitive Advantage of Nations, The Free Press.



FOOD SYSTEM HORIZONS

Catalysing a sustainable, nutritious and equitable food system futures

Contact us foodsystemhorizons.org

For further information

CSIRO Agriculture and Food

Food System Horizons

Dr Rohan Nelson rohan.nelson@csiro.au

Dr Lilly Lim-Camacho lilly.lim-camacho@csiro.au

