National food security preparedness Green Paper

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APRIL 2025

Special Report

ASPI
AUSTRALIAN STRATEGIC POLICY INSTITUTE

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Contents

Executive summary 4

Recommended policy options 4

Background 7
- The objectives of this Green Paper 7
- Green Paper governance 8

Selected strategic assessments 8
- Domestic food insecurity 8
- Regional stability 9
- Domestic supply chains 9
- Climate and water 10
- Summary 10

Part 1: National food security preparedness 11
- Food security analysis in Australia since 2008 11
- The national food security ecosystem 13
- The food security ecosystem explained 15
- National governance and legislation 15
- Global approaches to food security 18

Part 2: National food security foundations 19
- Food security drivers, threats and risks 19
- Collective assessment 21
- Emerging drivers, threats and risks 21

Part 3: National food security preparedness in practice 22
- Applying effective preparedness in Australia 22
- Threat and risk assessment methodology 23
- Rethinking the economic policy framework 24

Part 4: Collaborating for national food security preparedness 26
- A domestic collaboration framework for food security preparedness 26
- International collaboration for food security and regional self-reliance 29

Conclusion 31

Appendix 32
- Case study 1: Phosphate as fertiliser 32
- Case study 2: Glyphosate 35
- Case study 3: Digital connectivity 39

Notes 43

Acronyms and abbreviations 45

Executive summary

Australia's agriculture sector and food system produce enough food to feed more than 70 million people worldwide. The system is one of the world's least subsidised food systems. It has prospered under a global rules-based system influenced by Western liberal values, but it now faces chronic challenges due to rising geopolitical tensions, geo-economic transitions, climate change, deteriorating water security and rapid technological advances. The world is changing so rapidly that the assumptions, policy approaches and economic frameworks that have traditionally supported Australia's food security are no longer fit for purpose. Potential conflict in the Indo-Pacific is driving enhanced preparedness activity in Australia's defence force, but that isn't being replicated across the agriculture sector and food system in a coordinated manner. Food hasn't featured as a priority in the public versions of the Defence Strategic Review or the National Defence Strategy. This has created a gap in Australia's preparedness activities: if Australia's national security and defence organisations are preparing for potential conflict, then Australia's agriculture sector and food system stakeholders should also be preparing for this period of strategic uncertainty.

Food security is a pillar of whole-of-nation preparedness for an uncertain future. While current targeted preparedness efforts and resilience mechanisms are valuable, they aren't sufficient. Stakeholders are calling for stronger, proactive national coordination from the government to empower and support private-sector action. Meeting that demand is essential to strengthening overall resilience. So, too, is understanding that Australia's food security relies on a holistic and interconnected ecosystem rather than a fragmented supply chain. Australia is a heavily trade-exposed nation that exports 70% of production,[1] so any disruption to maritime and other transport corridors or to the infrastructure needed to move food risks undermining both national food security and Australia's standing as a reliable global supplier.

This work has been written and constructed as a Green Paper, not an academic publication. Informed by six months of consultations with government, the private sector and civil society, the paper combines applied policy analysis and real-world insights to promote deliberate conversation about protecting Australia's food security with the same priority as protecting Australia's national security. The Green Paper is divided into four parts. It also includes three case studies in the Appendix, which use a threat and risk assessment to analyse three critical inputs to the food security ecosystem—phosphate, glyphosate and digital connectivity—to help stakeholders evaluate the vulnerabilities in Australia's food security ecosystem.

The intention of this Green Paper is to deepen understanding of food security as a key public policy issue, stimulate public discussion, inform policymaking and provide both government and key stakeholders with policy options for consideration. This Green Paper's 14 recommended policy options have been designed to equip governments and the private sector with structured national-security-inspired assessment tools and a framework to continuously identify, prioritise and mitigate vulnerabilities. That includes options to centralise the coordination and decentralise delivery of preparedness activities, establish accountability and embed food security as a national security priority and a key element of Australia's engagement across the Indo-Pacific.

Recommended policy options

In keeping with the intent of a Green Paper, the policy options offered here serve as a foundation for informed discussion and policy development between government and industry. They represent a critical starting point for the urgent development and implementation of a National Food Security Strategy.

Australia's rapidly changing strategic circumstances necessitate a coordinated uplift in the approach of the agriculture sector and food system to synchronising preparedness activities that underpin production, transport, logistics, distribution, processing, manufacturing, retailing and consumer understanding. Some industry stakeholders

consulted for this Green Paper have formed the view that market forces alone won't address the challenges of today and the future and that an uplift must be centrally coordinated by the Australian Government in partnership with industry and aligned with broader national preparedness activities.[2] Engagement and accountability at the highest levels of government are seen to be critical.

The Australian Government has the convening power to provide enhanced mechanisms of accountability within existing frameworks[3] that can ensure that preparedness activities are identified, prioritised and delivered primarily by industry. Governments at all levels—local, state/ territory and federal—must enable and support continuous industry-led preparedness initiatives, ensuring that businesses have the tools and resources necessary to build resilience.

Strategic government interventions should be targeted, limited to where they're most needed and guided by a more pragmatic economic policy framework, ensuring that finite public resources are deployed effectively to strengthen national food security without distorting market dynamics.

The uplift must also consider the intersection of food security, sustainability and Australia's emissions-reduction imperative. That will involve embracing technology, biotechnology and food innovation to strike the necessary balance that makes certain that food production is protected and enhanced. It must also underpin Australia's approach to maintaining security, stability and prosperity in our region—strategically deepening regional partnerships and adapting to the evolving strategic landscape.

The following policy options, which are argued for and explained in more detail across the body of this report and summarised in Figure 1, have been designed to accelerate the development of a National Food Security Strategy.

1. All levels of government and industry should conceptualise Australia's agriculture sector and food system as a food security ecosystem,[4] identifying each layer[5] of the ecosystem and the associated domains[6] of food security within them (see page 19).
2. The Department of Agriculture, Fisheries and Forestry (DAFF) should be formally designated as the lead agency responsible for the food system and food security preparedness, and that role should be enshrined in the administrative arrangements orders of government. Elevating food security to a whole-of-government priority would enhance coordination, accountability and crisis-response capacity (see page 28).
3. The Minister for Agriculture, Fisheries and Forestry should be a full member of the National Security Committee of the federal cabinet. That would ensure that food security risks and strategic vulnerabilities are recognised at the highest level of government decision-making, alongside other key national-security issues (see page 28).
4. The minister should be supported by an assistant minister with dedicated responsibility for overseeing food security preparedness activities. That role would ensure focused leadership, cross-government coordination and operational implementation of strategic food security initiatives (see page 28).
5. The Secretary of DAFF should be included in the Secretaries Committee on National Security, reinforcing food security as a national-security priority. That would strengthen interdepartmental coordination, ensuring that food security risks are factored into broader national security planning and decision-making at the highest levels of the Australian Public Service (see page 28).
6. Stakeholder representatives across all domains of the food security ecosystem should be coordinated by an enhanced and expanded Food and Grocery Sector Group (FGSG) within the Trusted Information Sharing Network (TISN).[7] That would align with the objectives of the 2023 Critical Infrastructure Resilience Plan[8] and strengthen the governance framework established under the *Security of Critical Infrastructure Act 2018* (the SOCI Act), ensuring a structured, whole-of-system approach to food security risk management (see page 28).

7. The Office of National Intelligence (ONI) should conduct a dedicated biennial intelligence assessment of the threats to Australia's food security ecosystem to inform public- and private-sector preparedness activities and priorities through the FGSG and foster deeper engagement with DAFF (see page 22).[9]

8. Each domain within the food security ecosystem should initiate a coordinated and systematic process to identify and understand its drivers, risks, threats and vulnerabilities in the context of Australia's current strategic circumstances. That requires the implementation of a structured threat and risk assessment methodology to guide a comprehensive vulnerability analysis. By doing so, stakeholders can prioritise preparedness activities, strengthen resilience and ensure that proactive measures are in place to mitigate emerging threats across all domains of the food security ecosystem (see page 26).

9. The FGSG should be expanded to include research and development (R&D) corporations (RDCs) and other key resourcing entities, ensuring that food security preparedness activities are supported by robust research, innovation and strategic investment. That integration would enhance data-driven decision-making and provide a critical bridge between industry, government and scientific expertise (see page 29).

10. The FGSG should remain under the Minister for Agriculture, Fisheries and Forestry, be staffed by DAFF officials and resourced appropriately. Funding should be realigned from existing siloed policy initiatives to ensure that food security preparedness is adequately funded without unnecessary budgetary expansion (see page 29).

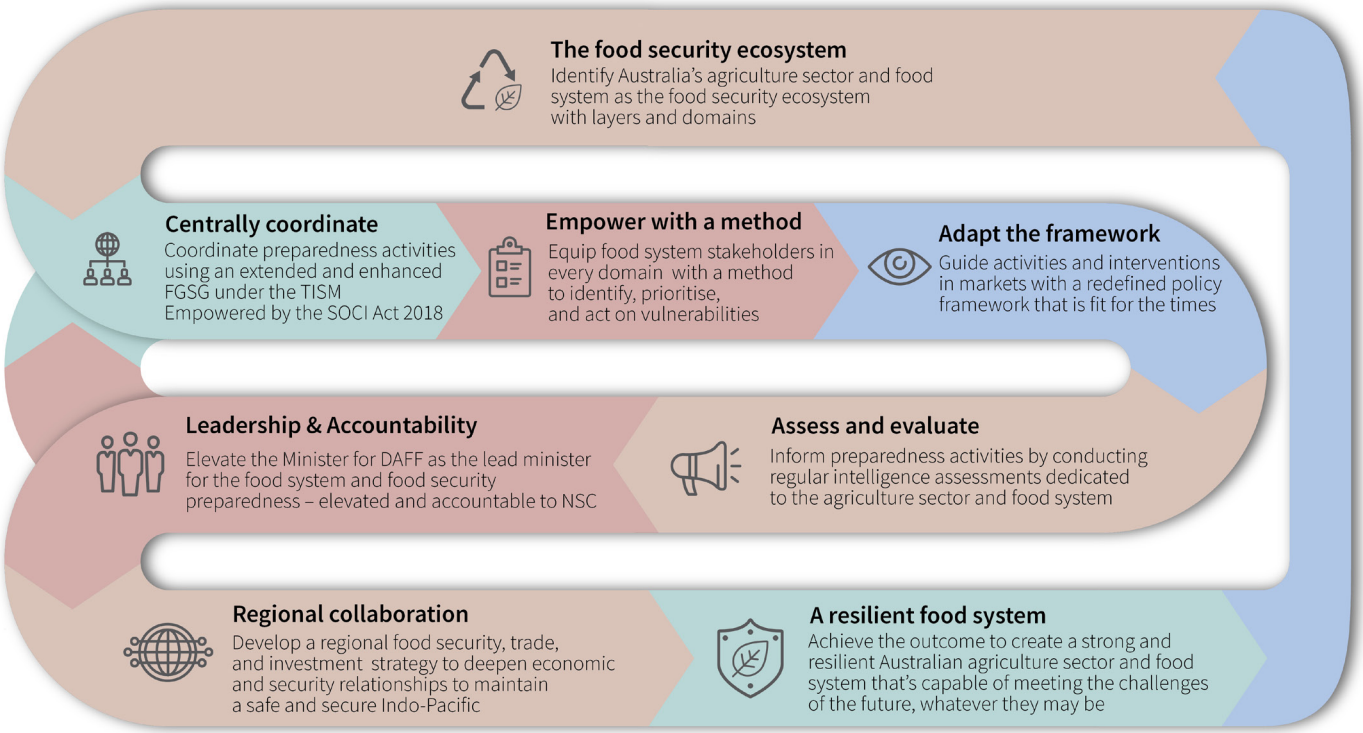
11. The Australian Government, led by Treasury and supported by DAFF, should redefine the economic policy framework that guides policy approaches and market interventions to support preparedness activities that reflect Australia's current strategic circumstances, guiding government intervention in the agriculture sector and food system in line with a higher order strategy that's in Australia's national interest (see page 26).

12. Assign DAFF, as the lead domestic agency responsible for food systems and food security preparedness, the responsibility for developing a dedicated regional food security, trade and investment strategy. The strategy should be comprehensive, including mapping and analysis of natural advantages, be supported by the Department of Foreign Affairs and Trade (DFAT), Austrade, Export Finance Australia, the Australian Centre for International Agricultural Research (ACIAR) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO), and be adequately resourced to ensure its effectiveness. It should also align with the recommendations outlined in Australia's Southeast Asia Economic Strategy to 2040 to enhance regional cooperation and resilience (see page 30).

13. Establish dedicated food security funding and performance targets within Australia's international development program to support the regional food security, trade and investment strategy. That will ensure a sustained and measurable commitment to addressing regional food insecurity while strengthening Australia's strategic position in the Indo-Pacific (see page 30).

14. Expand access to concessional and blended financing mechanisms, such as the Australian Infrastructure Financing Facility for the Pacific, Export Finance Australia and Australian Development Investments, to support regional food and agricultural initiatives. Those investments should focus on enhancing supply-chain resilience, boosting agricultural productivity and addressing food insecurity across the region, reinforcing Australia's role as a trusted economic and security partner (see page 30).

Figure 1: Green Paper policy options high-level summary



Background

Historically, green papers were used to stimulate public discussion and gather feedback on policy proposals before moving to more formal stages, such as white papers or legislation. They were gradually phased out in the 1990s as part of a broader trend towards more streamlined policy development, including the increasing use of discussion papers and strategic reports. While green papers are no longer a standard part of the policy-development process, they remain a valuable tool for stimulating discussion and gathering input on critical issues, serving as a basis for shaping informed, effective, evidence-based policy development.

The objectives of this Green Paper

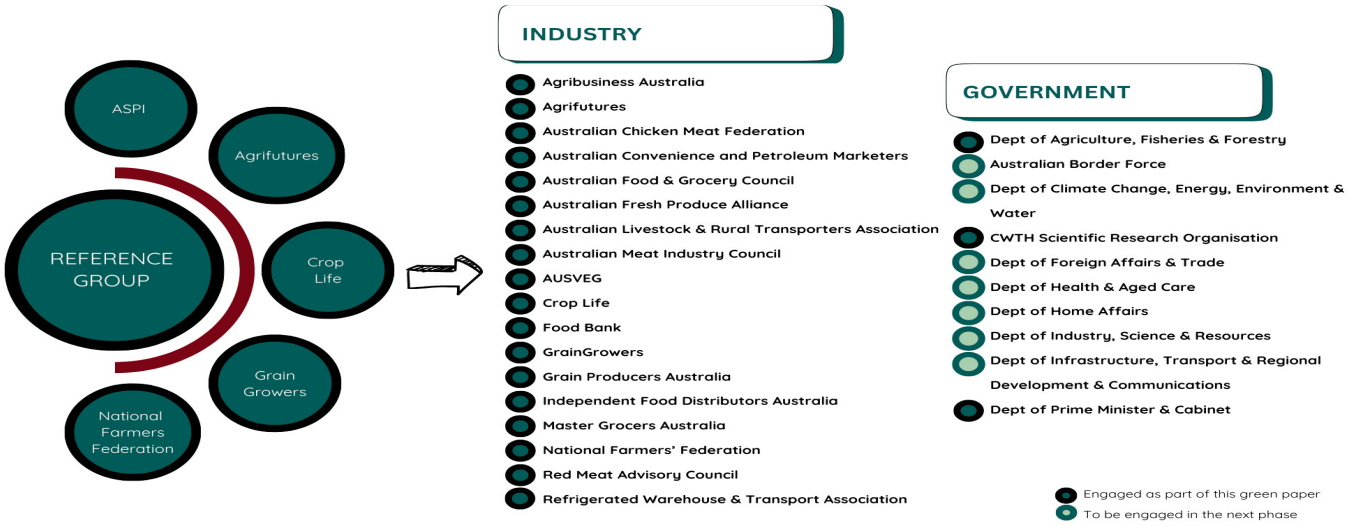
The objective of this Green Paper is to inform and stimulate policy discussion and offer up new policy options while also giving effect to several key recommendations of the 2023 House of Representatives Standing Committee on Agriculture's report, *Australian food story: feeding the nation and beyond*[10] (the AFS report) and other subsequent reports.[11] There's been broad support for the outcomes of those inquiries, but government and industry have grappled with how to start addressing their recommendations and the broader issues that they've raised due to the sheer scale and breadth of the agriculture sector and food system, and the many portfolio agencies that have roles in its governance.

This Green Paper was first conceived as an industry-driven initiative to offer a constructive starting point for the Australian Government's response and to pave the way to implement the additional comprehensive recommendations presented by those various reports. This paper sets out to do that by highlighting the breadth and complexity of the challenges facing Australia's food security, but focusing deliberately on the preparedness element of the Australian Government Crisis Management Framework (AGCMF) as a starting point for action.[12] That action can form the basis for whole-of-sector preparedness planning that can underpin a whole-of-government and whole-of-nation approach to food and agriculture policy that aligns with the priority of Australia's national defence.

Green Paper governance

This Green Paper was developed over a period of six months and has involved many consultations with industry and government. A key industry reference group was formed in 2024 comprising AgriFutures Australia, Crop Life, Grain Growers and the National Farmers' Federation. In addition to the industry reference group, Figure 2 identifies a broader group of stakeholders who have supported the Green Paper process, were consulted and provided their input. Capturing the breadth of industry groups was important in informing this Green Paper, as it represents the diversity of Australia's agriculture sector and the food system, each with their own motivations and unique stakeholders, but with a common objective of enhancing Australia's food security in the national interest.

Figure 2: Green Paper key stakeholders



Selected strategic assessments

In 2025, Australia faces increasing geopolitical instability abroad and rising inequality at home. While the nation currently produces enough food to feed over 70 million people,[13] that level of production is both enabled and affected by many intersecting factors. A selection of those factors is covered in this assessment, including domestic food insecurity, regional stability, domestic and international supply chains and the importance of climate and water. They are just some of those that expose and create food-system vulnerabilities within and beyond our borders, and they're now compounded by threats to national security. Those vulnerabilities and others, such as those related to biosecurity, threaten Australia's ongoing capability and capacity to deliver the stable, reliable and accessible food supply that's vital to our sovereignty and national power.

Domestic food insecurity

Food insecurity is a lingering crisis in Australia: over 30% of households experienced moderate to severe food insecurity in 2024.[14] This issue is a symptom of rising living costs and is deepening social inequities that could threaten stability, cohesion and the physical and mental wellbeing of society's most vulnerable.[15] Addressing food insecurity requires a system-wide approach that tackles inefficiencies in the food supply chain, particularly food loss and waste mitigation.

Approximately one-third of all food produced in Australia is lost or wasted each year.[16] Reducing waste can strengthen food security, reduce emissions, alleviate inequity and enhance national resilience. Activities that address those challenges are interconnected within the broader agriculture sector and food system and play an essential role

that can strengthen community resilience and food security at the grassroots level. If not addressed, such challenges will lead to more hunger, particularly at times when natural disasters or other crises are affecting a city or state. Food insecurity breeds discontent and can fuel instability—a reality that could undermine social cohesion, public trust and even democratic resilience.[17]

Regional stability

The Indo-Pacific is now defined by geopolitical competition in which Australia occupies a key strategic position. Our broad northern frontier affords us immediate operational access to both the Pacific and the Indian oceans. We're proximate to the major global trade routes that we rely on to import key inputs required for food production, processing and distribution and to export agricultural products, rural goods, minerals and energy commodities to the world's largest markets.

Australia is reliant on those global trade routes and is highly vulnerable to economic and geopolitical dynamics.[18] Shocks to the international system and international markets were demonstrated by the Covid-19 pandemic, which revealed the fragility of many supply chains that are critical for Australia.

In 2024, the Minister for Defence, Richard Marles stated that:

> Our national security and our national prosperity are based on a stable peaceful region where the global rules-based order is preeminent and respected. Indeed, the rules of the road at sea are everything for us. When the rules-based order is under pressure, Australia is under pressure.[19]

Rising geopolitical tensions complicate Australia's strategic circumstances. Any conflict within the region could severely disrupt supply chains, and the National Defence Strategy has clearly stated that there's no longer the traditionally assumed 10-year strategic warning time for conflict.[20] As with defence, there's now a time imperative for the agriculture sector and food system to satisfy themselves that they're prepared and resilient enough to meet those same future challenges, should they eventuate.

Australia's substantial economic relationship with China—a country also responsible for much of the pressure and coercion that exists in the region—is stretching the capacity and abilities of even our finest diplomats and political leaders. The Australia–China relationship has created a dichotomy for government and industry alike, as regional instability has the potential to affect the flow of exports and imports critical for the agriculture sector and food system.

As a safe and reliable supplier of food, Australia has a key role to play in maintaining regional stability.[21] That role is indispensable in addressing food security challenges across the Indo-Pacific, as one in every five people in parts of Southeast Asia and the Pacific are undernourished.[22] A failure to meet those basic regional needs could strain relationships and further destabilise economies at a time when Australia's support and influence are needed most.

Domestic supply chains

The prospect of Australia's maritime access to the world being cut off by conflict or heightened grey-zone activity has driven extensive commentary and has been the primary driver of the development of initiatives such as the Strategic Fleet Taskforce.[23] The lack of Australian sovereign shipping capacity highlights the relative fragility of Australia's domestic supply-chain infrastructure compared to that vulnerability.

Australian ports handle 99% of Australia's trade by volume[24] and are under increasing pressure from ongoing productivity challenges, including from recent industrial action[25] and infrastructure requirements needed to match the evolution of global shipping.[26] Industrial action highlights how disruption at critical choke-points can disrupt

national supply chains, reinforcing the need for greater resilience, modernised infrastructure and a more secure approach to trade logistics.[27]

Australia's road and rail infrastructure is vital to moving rural goods and critical inputs to and from ports and serves as the backbone of domestic supply chains.[28] While not subject to the same geopolitical pressures as maritime trade routes, road and rail systems face growing risks from increasingly frequent and concurrent extreme weather events,[29] as well as unpredictable shifts in policy priorities and investment.[30] Those challenges are compounded by Australia's current liquid-fuel security situation, threatening the reliability of transport networks that are essential to economic activity and regional food security.

As a heavily trade-exposed nation, Australia depends on that infrastructure to move imported agricultural inputs to where they're needed and to distribute food to domestic and overseas markets. With 30% of food production consumed locally and 70% destined for export,[31] any disruption to those transport corridors risks undermining both national food security and Australia's standing as a reliable global supplier.

Climate and water

Climate change adds another layer of complexity, as shifting weather patterns and more frequent extreme events disrupt traditional agricultural practices and domestic supply chains.[32] Reduced yields and increased production costs undermine food supply and competitiveness, threatening both domestic and regional food security. That highlights the need for a shift in how Australia approaches its sovereign food security, as reliance on stable climatic conditions and predictable trade flows is no longer sufficient in today's environment.

Water is fundamental to almost every aspect of Australia's food system, yet its security has been long overlooked within national-security circles. Beyond drinking and agriculture, water is critical for industrial processes, energy production, medical applications and the expanding demands of emerging technologies such as data storage, quantum computing and artificial intelligence. As the driest inhabited continent, Australia faces a stark reality: groundwater reserves are in decline,[33] yet water policy remains one of the nation's most contested public policy issues, presenting ongoing challenges to the food system. Water security is also a key issue across the Indo-Pacific[34] and represents another common challenge to regional stability.

Summary

This assessment, while not a complete evaluation of factors vital to Australia's food system, highlights how domestic issues intersect with geopolitical challenges to compound risks to domestic and regional food security. Food security is now a critical national concern, requiring proactive and strategic actions to address systemic vulnerabilities. Australia's food security has long been taken for granted in both civil and defence circles, fostering complacency despite mounting evidence of strategic vulnerabilities referred to in other reports. A succession of disruptive events, expert reviews and policy reports has reinforced the need for proactive measures,[35] yet meaningful action remains limited. Recent commitments to develop a National Food Security Strategy need to constitute a serious national commitment to addressing those risks. Otherwise, Australia's food security will become increasingly exposed to supply-chain disruptions, geopolitical tensions and climate-related shocks.

Part 1: National food security preparedness

Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.[36] Food security is an outcome of a functioning food ecosystem, not just a thriving or profitable industry sector. The concept of food security preparedness, viewed through the lens of an ecosystem, addresses the intersection of food security and national security, recognising that disruptions in food supply can have significant consequences for our nation's stability and wellbeing.

Australia's food security ecosystem encompasses both agricultural production and the entire food supply chain. The term 'ecosystem' is used here because it more effectively describes the complex relationships between all factors that influence food production, processing, manufacturing, distribution, sale and consumption. To maintain food security, developing a national vulnerability assessment framework that can continuously monitor and prioritise risks and threats to our food security ecosystem in its entirety is an important consideration.

Currently, Australia lacks a centrally coordinated approach that can anticipate, adapt and respond to realised risks and facilitate preparedness that aligns with the broader strategic imperatives of the Australian Government. Numerous initiatives and targeted mechanisms have sought to achieve that outcome but have often operated in isolation and been hampered by the complex nature of the system.[37]

That complexity stems from the food security ecosystem's composition of many public- and private-sector stakeholders, each with very different needs, perspectives and understandings of their role in maintaining food security. The ecosystem is overlaid with an equally complex governance framework that spans three tiers of government, various regulatory authorities and geographical regions that also have different needs and interpretations of their role in maintaining food security.

A fragmented approach to the food security ecosystem—treating its layers and domains in isolation—has led to poor coordination, limited visibility and policy misalignment across government and industry. That lack of synchronisation has created market inefficiencies, stakeholder frustration and a reactive policy environment, increasing the risk of critical vulnerabilities being overlooked. This has been reflected on by private- and public-sector stakeholders and is seen to heighten the risk of inaction against critical vulnerabilities, the consequences of which might become apparent only when it's too late to respond effectively.

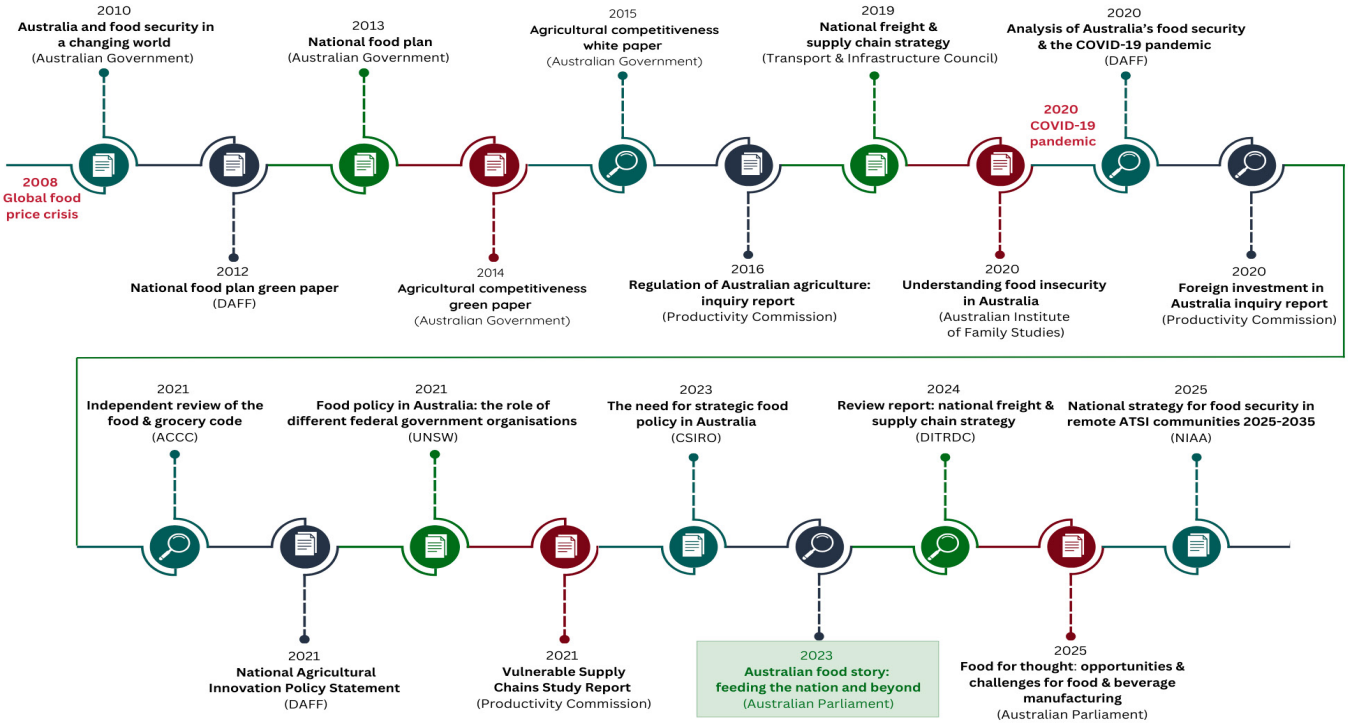
Synchronisation of effort must be proactively addressed, beginning with a laser-like focus on the preparedness element of the AGCMF.[38] That's necessary to ensure that Australia itself maintains and enhances food security and remains a cornerstone of food security in the Indo-Pacific.

Food security analysis in Australia since 2008

As far back as 2010, the Expert Working Group on Australia and Food Security in a Changing World recognised that 'for Australia, food security is inextricably linked to the political stability of our region and has the potential to affect our national security. Food security also affects our status as a premier food exporting nation and the health and wellbeing of our population.'[39]

Since the 2008 global financial crisis, at least 18 food security reports, reviews and inquiries have been commissioned or conducted by government, academia and industry, as illustrated in Figure 3. Among the latest of them is *Food for thought: the opportunities and challenges for Australia's food and beverage manufacturing industry*,[40] which was released in February 2025 following an inquiry conducted by the House of Representatives Standing Committee on Industry, Science and Resources. The stated aim of its report is to complement the 2023 AFS report, and its first recommendation is that the Australian Government develop a national food plan.[41]

Figure 3: Key reports, reviews and inquiries since 2008



The AFS report resulted from the inquiry of the House of Representatives Standing Committee on Agriculture into strengthening and safeguarding food security in Australia amid growing concerns over vulnerabilities in the nation's food system. It has served as a catalyst for further efforts across the agriculture sector and food system to advocate for stronger measures to build resilience into supply chains and prepare for an uncertain future. It was triggered by a combination of factors, including rising production costs due to global supply-chain disruptions, shortages of critical inputs such as fuel and fertiliser, labour constraints and the impacts of climate change on domestic supply chains and agricultural productivity. Volatile international markets and geopolitical tensions additionally exposed the need for a robust domestic food system capable of withstanding external shocks while ensuring affordability and accessibility for all Australians.

The inquiry received 188 submissions from a wide range of stakeholders, including governments, industry groups, farmers, researchers, community organisations and individual experts. The submissions highlighted critical issues across the food supply chain and informed the committee's deliberations.

The AFS report's central recommendation was the formulation of a comprehensive National Food Plan that would:

- engage the whole food system, from paddock to plate and beyond
- deal with the production and distribution of food, supply-chain resilience, access to food and good nutrition (diet and health)
- deal with food loss and waste
- address the health implications of the food system
- address the national-security implications of food security, identifying and addressing vulnerabilities, particularly regarding food-system infrastructure and vital inputs.

The National Food Plan would be overseen by a Minister for Food, residing within the Department of the Prime Minister and Cabinet (PM&C). The Minister for Food would be supported by a National Food Council, made up of industry and community experts, to advise on matters pertaining to the food system and support the development, implementation, monitoring and evolution of the National Food Plan. As part of that process, the inquiry also

recommended that the food supply chain be mapped, identifying supply-chain vulnerabilities for government to address.

The AFS report's recommendations have been broadly supported, but outcomes sought by private-sector stakeholders have been curtailed by the complex nature of the agriculture sector and food system, the machinations of bureaucracy, and the breadth of government agencies involved in its regulation and administration. Another impediment to progress has been the temptation to assume that the world will carry on as it always has, at least in living memory, and that markets will always remain stable.

A collective realisation of the implications of Australia's changed strategic circumstances is needed to achieve resilience against vulnerabilities detailed in previous reports, as well as those we currently face and may face in the future.

Public- and private-sector stakeholders have expressed a lingering doubt as to Australia's level of preparedness across the food system, despite all those published reports. The government has committed to an NFFS but is still considering its response to the rest of the 2023 AFS report, and it must also now focus on responding to the recommendations of the 2025 *Food for thought* report released by parliament. The overlapping nature of the primary recommendation to develop a National Food Plan from two separate house standing committees presents the familiar challenge of clarifying agency responsibility, again demonstrating the complexity of the food security ecosystem.

While it's difficult to definitively measure the impact of those initiatives on food security or preparedness, their recurrence suggests that Australia needs a more focused and coordinated approach, especially given the diminished strategic warning time for conflict.

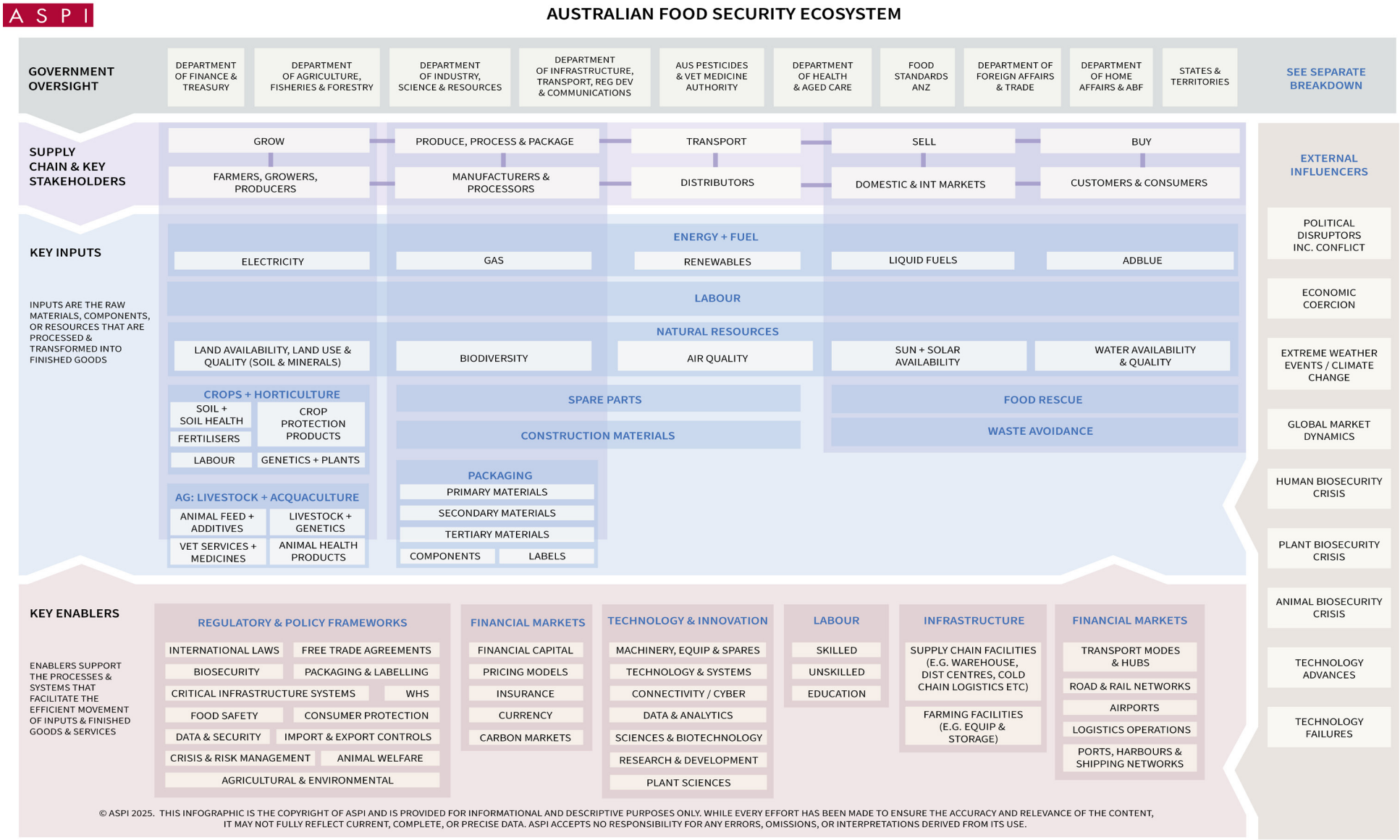
The national food security ecosystem

Australia's food security is founded on a complex and interconnected ecosystem that's been heavily influenced by globalisation and a reliance on 'just in time' supply chains. Figure 4 on page 14 has been developed by ASPI to provide a strategic overview of that ecosystem, illustrating the key components and external influences that affect the stability and resilience of our food supply chains. Each layer represents critical domains that contribute to food security, demonstrating how disruptions in one part can affect the entire system. To the side, external influences that can affect any part of the ecosystem are also shown. The ecosystem is depicted with both horizontal and vertical axes to capture its complexity and to visualise interdependencies:

- the horizontal axis maps the key stages of the food supply chain and identifies the key stakeholders in each stage.
- the vertical axis identifies the key critical inputs that underpin the functioning of the supply chain (note that not all are depicted).

The top section of the diagram lists the key Australian Government departments and agencies involved across the supply chain, which are listed in more detail in Figure 4 on page 14.

Figure 4: The Australian food security ecosystem



The food security ecosystem explained

This Green Paper defines the foundations of Australia's food security as enablers. They're the elements that allow processes, systems and stakeholders to operate efficiently and effectively. Regulatory and policy frameworks are fundamental, setting standards, maintaining biosecurity operations and facilitating trade, while financial markets provide the capital needed for investment in technology, infrastructure and innovation. R&D, technology, biotechnology and data play critical roles in innovation, enhancing production and processing productivity, supply-chain transparency, climate adaptation and waste reduction.

Critical inputs are the tangible and intangible resources required for producing, processing and distributing food along the supply chain. Affordable energy and fuel are critical for powering machinery, irrigation systems, food-processing facilities, storage, transport and logistics. Natural resources such as land and land-use availability, biodiversity, solar energy and water availability and quality are also critical to producing food and must be managed sustainably.

Access to domestic and international skilled, unskilled and seasonal labour is essential for producing, processing and distributing food. Labour is an enabler for some industries and a critical input for others, particularly in horticulture. Additionally, infrastructure such as roads, railways, ports and storage facilities underpin the movement of goods, while efficient transport, logistics and distribution networks ensure that food reaches domestic and international markets and consumers on time and in saleable condition.

Agricultural crops depend on soil health, and critical inputs such as genetics, seeds, plants, fertilisers, crop-protection products are keys to much-needed biotechnology innovations. Similarly, livestock and aquaculture industries require access to evolving genetics, feed and additives, veterinary services and animal-health products to maintain productivity and animal welfare.

Packaging materials, from the traditional to innovative biodegradable options, play a critical role in preserving food quality and extending shelf life. Additional critical inputs include spare parts for machinery and equipment and construction materials for building and maintaining infrastructure. Effective packaging and associated systems are also critical for food loss and waste avoidance and improving food-system efficiency and sustainability. Innovation in technology is also critical to facilitating food rescue and food reconstitution for human consumption.

The dependencies on those enablers and inputs creates systemic vulnerabilities within the food supply chain where there are geographical and/or commercial concentrations or dependencies. Examples of such vulnerabilities are fertilisers, crop-protection products and digital connectivity, examples of which are explored further in the case studies in the Appendix to this Green Paper. Disruptions in any area of the ecosystem can have cascading effects, undermining food availability, quality, accessibility and affordability. This paper proposes that viewing the Australian food system and the layers and domains within it as a food security ecosystem affords the private and public sectors a valuable perspective that emphasises the intricate web of interdependencies that sustain the system. That enables a holistic approach to preparing for and addressing vulnerabilities that's discussed further in parts 3 and 4.

National governance and legislation

Australia's food security ecosystem is subject to complex, multilayered and often competing regulatory frameworks and arrangements that are designed to uphold food safety, competition and consumer regulation, environmental protection and workplace health and safety standards and include meeting international trade obligations and protocols.

Figure 5 was created to provide an overview of Australia's national regulatory frameworks that govern the food security ecosystem. It illustrates just one level of the complex challenge of maintaining food security across local, state and territory and federal government, each of which have different responsibilities:

- the Australian Government provides the national policy frameworks and has a coordination and regulatory role directly and indirectly in food security, focusing on broader national issues such as national food standards and safety, biosecurity, international trade agreements and emergency-management and crisis-response arrangements.
- the state and territory governments focus on a more localised regulatory role. They're responsible for agricultural and environmental management, food safety and hygiene, biosecurity, food access and distribution, and public health and nutrition. They also have a role in national emergency-management arrangements.
- local governments operate at the most granular level, working to implement food-safety policies and regulations in local communities, providing access to local food initiatives and holding important planning and development powers.

Figure 5 shows that food security governance at a national level involves many Australian Government departments and agencies, each holding distinct responsibilities. The division of responsibilities seeks to ensure that food security is addressed comprehensively—but it also creates complexity due to the need for interagency coordination and communication and shared accountability, which isn't always achieved.

Day-to-day governance is overlaid with the AGCMF, which is the Australian Government's 'capstone' policy that frames Australia's national crisis-management arrangements.[42] The AGCMF introduces further complexity to governance arrangements for the ecosystem, as food security is interlinked with many crisis scenarios, such as:

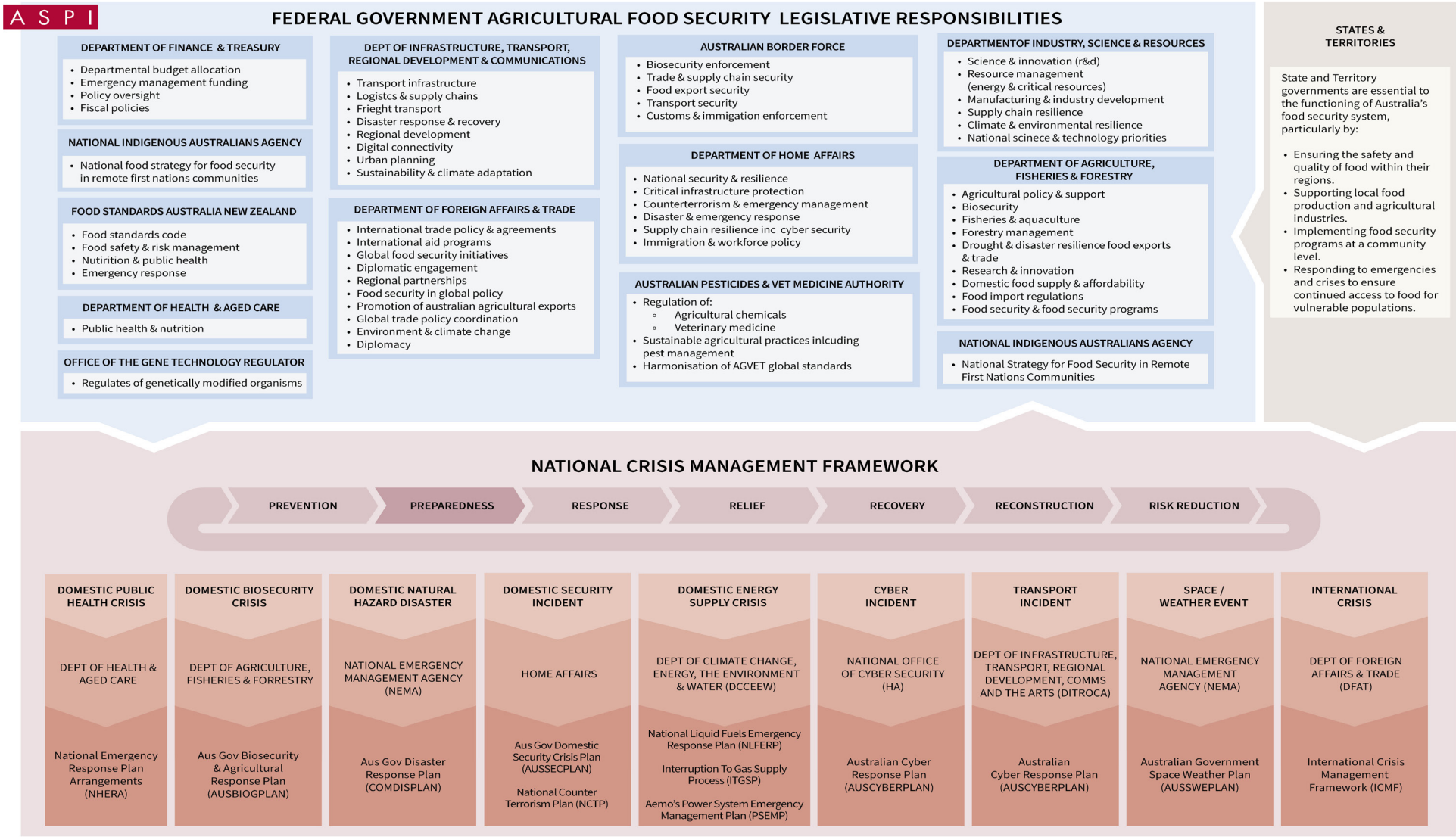
- biosecurity incursions that require containment and the protection of food production
- energy-supply disruptions affecting food production, storage and distribution.
- cyberattacks threatening digitised food-supply systems
- transport interruptions and international crises disrupting logistics and global supply chains.

That results in challenges, including:

- overlapping responsibilities among multiple agencies in areas such as biosecurity, food safety and environmental management
- cross-sector dependencies among energy, transport, trade and digital systems, so that disruptions in one sector can cascade into food-supply challenges
- geographical and jurisdictional variation between the actions of the federal, state and territory governments.

Like the Covid-19 pandemic, food security isn't a siloed issue; it intersects with health, energy, environment, trade, infrastructure and national security. But, as with the response to Covid-19,[43] food security tends to be approached in a siloed manner. Greater policy synchronisation is needed to manage that complexity, making clear communication channels, defined roles and interoperable policies across agencies and jurisdictions essential.

Figure 5: National legislative network for food security



Global approaches to food security

Sovereign food security policies and strategies around the world are shaped by each nation's unique circumstances, yet common themes do emerge across the global landscape. Globally, governments are increasingly focused on ensuring access to adequate, nutritious and sustainably produced food in the context of addressing growing risks posed by environmental, economic and geopolitical disruptions. Those policies aren't just about food production but about building resilience in supply chains, mitigating external shocks and securing long-term national stability.

As global food security challenges intensify, approaches by governments must balance immediate needs and the costs of policy and strategic interventions with future innovation, productivity and sustainability. Analysis of selected global approaches to food security reveals that they're defined by the following common themes:

- *sustainability and resilience:* A strong emphasis is placed on promoting sustainable agricultural practices and enhancing the resilience of food systems. That includes reducing environmental impacts, conserving natural resources and supporting the adoption of innovative farming techniques. Examples include Singapore's '30 by 30' initiative[44] on urban agriculture and Japan's Basic Law on Food, Agriculture and Rural Areas, both of which promote sustainable agricultural practices by leveraging smart technologies.[45]
- *self-sufficiency and reducing import dependence:* Many countries are prioritising food self-sufficiency and reducing reliance on imports to secure stable food supplies. For instance, China's Law on Ensuring Food Security was recently updated to include self-sufficiency in staple grains,[46] while Indonesia's Food Estate Program[47] is expanding agricultural land to reduce dependency on foreign food sources.
- *crisis preparedness and risk management:* The importance of preparedness for food security disruptions caused by crises such as pandemics, climate change and geopolitical conflicts is a recurring theme. The European Union's Contingency Plan for Ensuring Food Supply and Food Security in Times of Crisis[48] and many national strategies focus on the need for better preparedness, enhancing risk management, diversifying supply chains and fostering stronger coordination to develop robust crisis-response frameworks and the ability to adapt to emerging challenges.
- *legislative support:* Regular legislative updates are essential to maintaining food security by adapting to evolving challenges such as climate change, technological advances and economic shifts. In the US, the Farm Bill, updated every five years, is a key policy instrument addressing crop insurance, conservation, rural development, trade and agricultural research.[49] The Farm Bill framework directly supports farmers, promotes sustainable agriculture and strengthens food-system resilience. As global risks to food security intensify, governments must adopt similarly adaptive policies to safeguard agricultural stability and mitigate emerging threats.
- *diversification and innovation:* Technological advances and diversified production methods are central to many food security policies. That includes promoting the use of high-tech farming, aquaculture and other innovations to increase resilience. Singapore's investment in high-tech farming solutions, such as vertical farming and controlled environment agriculture, seek to maximise productivity within a limited land area. The European Union's Farm to Fork Strategy also seeks to support innovation across the food supply chain.[50]
- *inclusive and equitable food systems:* Many policies emphasise the need for equitable and inclusive food systems that seek to make sure that all citizens, including vulnerable sectors, have access to nutritious food. That includes supporting Indigenous communities in Canada[51] rural development in Japan and addressing food accessibility and affordability in Indonesia's free-meal program.[52] Public health and nutrition are prioritised, with a focus on fostering social safety nets and food assistance programs where necessary.
- *collaboration and coordination:* National approaches often stress the importance of collaboration across governments, sectors and stakeholders. Policies such as the UK's Government Food Strategy[53] and Canada's Food Policy highlight the need for a coordinated, multisectoral approach to food security. Such frameworks encourage collaboration between the agriculture, health and environmental sectors to improve resilience and promote sustainability.

- *improved food distribution and waste reduction:* Reducing food waste and improving food-distribution systems are also key objectives. Scottish Government's Food Security Taskforce stresses the importance of addressing supply-chain vulnerabilities and minimising waste.[54] Various countries have introduced measures to enhance food recovery and redistribute excess food to vulnerable populations, contributing to both sustainability and equity. That's evidenced by the European Parliament's recent adoption of mandatory food-waste reduction targets.[55]
- *international collaboration:* Food security is recognised as a global challenge, and most developed nations have recognised an imperative to assist developing nations in their efforts to become more food secure as a means of lifting people out of hunger and maintaining peace. Various UN programs focus on building resilience in food systems across the developing world,[56] as did the US Government through its Food for Peace Food Assistance and Food Security Strategy 2016–2025.[57] We note that the US's activities may now be at risk from changes to USAID programs.[58]

Such global themes are emerging through mostly unilateral approaches to safeguarding food security through a combination of sustainable production, government intervention and a focus on equitable access to food. They highlight the need for comprehensive and coordinated policy that addresses the environmental and economic drivers of food insecurity and the social and technological challenges that must be overcome to build resilient, sustainable food systems.

The global examples also highlight that Australia lacks a cohesive, whole-of-nation approach to food policy and security. That represents a critical vulnerability, hiding weaknesses that threaten national stability and social cohesion.

Green Paper policy options

- All levels of government and industry should conceptualise Australia's agriculture sector and food system as a food security ecosystem,[59] identifying each layer[60] of the ecosystem and the associated domains[61] of food security within them.

Part 2: National food security foundations

Globally, approaches to food security are built on foundations that are unique to each nation's strategic and geopolitical circumstances. Australia is no exception, and understanding our own unique drivers, threats and risks to the foundations of the food security ecosystem is the key to revealing vulnerabilities in each of its layers and domains. Once vulnerabilities are identified, decisions can be made about prioritisation, including what preparedness activities need to take place, by whom, with what resources, and under which mechanism of accountability. Those concepts are explored further in parts 3 and 4 of this Green Paper.

Food security drivers, threats and risks

Drivers

Food security drivers serve as foundational enablers within the broader food security ecosystem, shaping its resilience and sustainability over the long term. The drivers encompass both structural advantages and enduring conditions—such as climate, infrastructure, policy settings and technological capabilities—that facilitate the stable production, processing and distribution of food. Recognising and strengthening those drivers is essential to ensuring a secure and adaptable food system that can withstand evolving economic, environmental and geopolitical challenges. Some drivers include the following:

- *natural resources* include the availability and quality of arable land and water essential for food production. Extreme weather events can reduce those resources, leading to lower yields and higher costs.

- *strong agricultural production capabilities*, such as advanced farming techniques and favourable conditions, support food production. Disruptions can reduce output, threatening both domestic supply and exports.
- *robust food production, processing and manufacturing infrastructure* adds value to agricultural products. Disruptions, such as labour shortages, high energy costs, adverse investment and industrial relations policies, industrial action or trade barriers, can limit that capacity.
- *investment in agricultural R&D improves productivity and resilience.* Without ongoing innovation, Australia will struggle to cope with challenges such as climate change, pests and diseases, low productivity or low availability of critical inputs or alternatives, including novel technologies.
- *strong biosecurity protects against pests and diseases.* Failures in biosecurity systems can harm agricultural production and lead to trade suspensions, significant economic shocks and detrimental impacts to rural and regional communities.
- *well-developed supply-chain infrastructure*, including digital connectivity, underpins efficient supply chains and ensures timely food distribution. Disruptions such as cyberattacks and infrastructure breakdowns can cripple supply chains, incur significant costs and create long-term challenges to production.
- *resilient domestic and international supply-chain logistics*, such as reliable transport and distribution networks, keep critical inputs and food flowing. Disruptions, such as industrial action or liquid-fuel shortages, can limit access to inputs and food, raise costs and cause significant economic and social harm.
- *stable policy frameworks, regulatory environments and intergovernmental collaboration ensure a stable food system.* Political instability or inconsistent, inefficient or duplicative policies can create uncertainty, reduce investment and disrupt food production.
- *societal awareness of food value, such as public understanding of food security, supports sustainable practices.* Lack of awareness leads to food waste and reduced support for policies that protect food systems.

Threats

A threat in this context is defined as any actor or systemic vulnerability that has the potential to disrupt the availability and accessibility of food or the stability of the broader food security ecosystem.

A threat is assessed based on the combination of capability, intent and opportunity to cause harm or disruption to an individual, organisation or nation. It reflects the alignment of an actor's ability to carry out harmful actions (capability), their determination or motive to do so (intent), and the circumstances that enable them to act (opportunity). That triad underscores the dynamic nature of threats and the importance of assessing each component to understand and mitigate potential risks effectively.

In that context, threats to national food security could include:

- *an outbreak of a plant or animal disease in Australia or our region* that can devastate agriculture production, causing losses, trade bans, food shortages and cascading social and economic impacts on communities
- *the occurrence of a geopolitical event*, such as a conflict that disrupts trade routes, increases shipping costs and limits access to food imports and exports
- *a disruption to energy supply*, affecting food production, processing, refrigeration and transport, leading to food loss and waste, delays and higher costs
- *a failure of critical infrastructure in transport networks, ports or digital systems* that can disrupt food production, processing and distribution, reduce availability and increase prices
- *rising living costs reduce that food affordability for many Australians*, leading to increased food insecurity and reliance on cheaper, less nutritious options, degrading social equity in the community and damaging social cohesion.

Risks

The International Organization for Standardization (ISO) defines risk as 'the effect of uncertainty on objectives, whether positive or negative'.[62] It involves both short-term and long-term risks. Structured approaches are needed to identify, evaluate and manage risk.[63]

Some risks to food security include:

- *dependence on imported fertilisers, machinery and chemicals*, making Australia's food system vulnerable to supply-chain disruptions and price fluctuations, limiting competitiveness and sustainability
- *climate change* increasing the frequency of extreme weather events, reducing crop yields or water availability and damaging farm infrastructure and livestock health, which can destabilise food production and raise costs
- *urbanisation and land degradation*, reducing the area of land available for agricultural production, reducing supply and forcing an intensification of farming practices that might not be sustainable, affecting long-term food production
- *and unskilled labour shortages*, particularly of seasonal workers, which can delay or cancel harvests, reduce crop quality and increase costs, especially if immigration policies or global events disrupt the labour supply
- *biosecurity incursions by pests, diseases and invasive species*, which can damage crops and livestock, leading to production losses, market closures and trade restrictions and threatening food security
- *food loss and waste across the supply chain*, wasting critical resources such water and energy, reducing food availability and contributing to negative social and environmental impacts
- *trade conflicts and non-tariff barriers*, such as export bans or regulatory restrictions, which can disrupt market access, destabilise prices and limit both domestic and international food availability.

Collective assessment

The examples of drivers, threats and risks are snapshots that highlight the vulnerabilities across Australia's food security ecosystem. To improve resilience, it's essential to understand their interdependence. Understanding the combination of capability, intent and opportunity when assessing risks and threats to food security is a critical new approach for the agriculture sector and food system that is needed to meet current and future crises.

This approach challenges how public- and private-sector stakeholders currently assess risk and respond to both threats and risks to food security in practice. What's needed is a coordinated, whole-of-system, national-security-influenced approach that evaluates threats and risks across industries and supply chains, ensuring that vulnerabilities are identified and addressed. Clear priorities, preparedness measures and resource allocations need to be established with defined accountability across government and industry. How that approach will be applied is examined further in parts 3 and 4 of this Green Paper.

Emerging drivers, threats and risks

Australia's agriculture and food system has historically performed well, despite never having had consistent and ready access to intelligence capability that could help shape public policy and private-sector preparedness. Identifying and assessing emerging drivers, threats and risks to the foundations of Australia's food security ecosystem that are unique to our strategic circumstances is vital to inform the high-level areas of priority that governments and the private sector should be proactively focusing on. A semi-regular intelligence assessment dedicated to the food security ecosystem, informed by classified intelligence, open-source intelligence and consultations with key stakeholders in industry (who can often learn of developments before government) would be valuable and would help to inform the key parts of government responsible for preparedness activities. By introducing such a capability into the sector, all stakeholders, public and private, could be much better prepared to meet the challenges of a

rapidly changing world. The government should also consider publishing a declassified version of the assessment to help inform the agriculture and food sector and, importantly, the Australian public.

Green Paper policy options

- The ONI should conduct a dedicated biennial intelligence assessment of the threats to Australia's food security ecosystem to inform public- and private-sector preparedness activities and priorities through the FGSG and foster deeper engagement with DAFF.[64]

Part 3: National food security preparedness in practice

Understanding the drivers, threats and risks to food security to identify and prioritise vulnerabilities is essential. However, stakeholders report that it's proving difficult to translate that understanding into concrete actions for specific individual businesses or industries across the ecosystem in an open manner. That challenge is illustrated by the diverse range of awareness reported among private-sector stakeholders regarding the implications of the nation's current strategic landscape. Some stakeholders, particularly those integrated into platforms such as the TISN, demonstrate a strong grasp of threats, risks and associated vulnerabilities within their operational environments. Conversely, a significant portion of other stakeholders, while equally susceptible to disruptions, are managing risk through standard business-as-usual approaches, lacking a clear link to the Australian Government's preparedness initiatives.

Applying effective preparedness in Australia

This Green Paper proposes that a more open and accessible approach to assessing vulnerability in the context of drivers, threats and risks to the foundations of the food security ecosystem is needed to practically coordinate public- and private-sector preparedness activities. That approach would enhance and give effect to the framework that was offered by the Productivity Commission to identify vulnerable supply chains in the context of the Covid-19 pandemic.[65]

Clarifying the domains of the food security ecosystem makes the task of identifying and understanding vulnerabilities and the associated threats and risks easier to tackle. Stakeholders relevant to that domain can be empowered to undertake preparedness activities required to mitigate prioritised vulnerabilities with a better understanding of the resources available or that need to be obtained to complete that activity. For that to be possible, several questions need to be addressed:

- what method can be used to identify, assess and prioritise vulnerabilities in a business, industry or supply chain?
- what preparedness activities are then required?
- who should deliver a given preparedness activity?
- what resources are required to carry out the preparedness activity?
- what accountability mechanism exists to make sure that preparedness activities are being carried out effectively and in line with broader government preparedness priorities?
- what's the role of government versus industry in preparedness?

Each domain of the food security ecosystem should be equipped with an open and accessible method of identifying, prioritising and acting on vulnerabilities. The following section explores what that could look like, in the form of a repeatable methodology. Further sections on collaboration in Part 4 propose a list of policy options

to centrally coordinate preparedness activities and decentralise their delivery to make sure that the activities are implemented effectively.

Threat and risk assessment methodology

By framing food security through an informed vulnerability lens, combining threat and risk assessments, government and industry can develop more comprehensive, proactive strategies to safeguard food systems, strengthen resilience and protect the food security ecosystem and the community from emerging threats.

A threat assessment identifies and evaluates specific threats that could cause harm, focusing on external factors or adversaries. Its objective is to understand the capability, intent and vulnerabilities to potential impacts of adversaries that could pose harm to assets, people or operations and can answer questions such as:

- who or what poses a threat (for example, cybercriminals, terrorists, natural disasters or disease)?
- what are their capabilities and intentions?
- how likely is the threat to occur?

The output of a threat assessment is a detailed understanding of threats, often without directly considering mitigations.

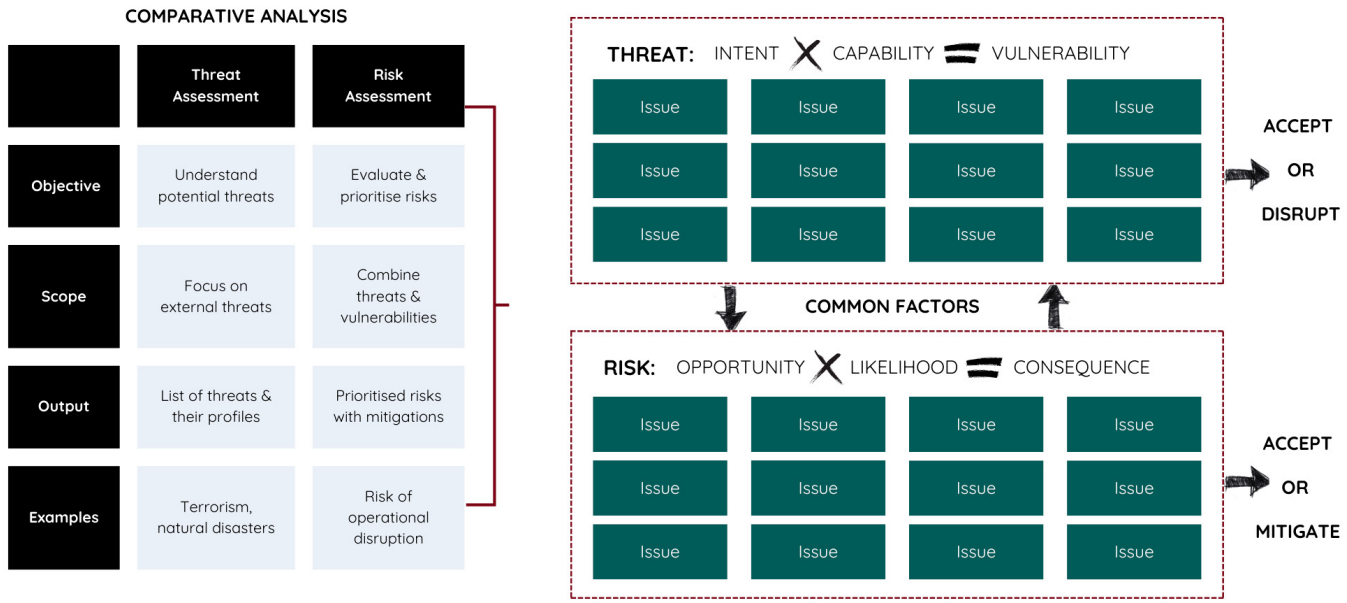
A risk assessment evaluates the overall level of risk by assessing the likelihood and consequences of potential risks. Its objective is to prioritise and manage risks by determining which ones are most critical and how they can be mitigated, and it can answer questions such as:

- what could go wrong (combination of threat + vulnerability)?
- what's the likelihood and consequence of an event?
- how can the risk be mitigated or managed?

The output of a risk assessment is a ranked list of risks with recommendations for controls or mitigations.

Figure 6 offers an example of a framework that combines a threat assessment with a risk assessment to analyse the vulnerabilities in Australia's food security ecosystem. The framework integrates both external threats (such as climate change or geopolitical instability) with internal vulnerabilities (such as inefficiencies in logistics, limited diversification or regulatory gaps).

Figure 6: Threat and risk assessment framework



This adapted threat and risk assessment methodology should be considered and developed as practical tool that can be used by all stakeholders to identify and prioritise vulnerabilities.

Three critical inputs to the food security ecosystem—phosphate, glyphosate and digital connectivity—have been selected as case studies to demonstrate how the methodology could be used in practice (see Appendix). Each case study lists three examples of risks or threats to those critical inputs.

The methodology has been applied to each threat or risk to arrive at an overall assessment of its impact, which then informs a decision on whether to mitigate it. Once a decision has been made to mitigate the threat or risk, potential preparedness activities can be considered, such as those listed in the three case studies.

In practice, a threat and risk assessment would be conducted at an individual stakeholder level and at a domain level across each layer of the food security ecosystem to identify vulnerabilities. Once vulnerabilities have been identified, they can be assessed using the methodology to ascertain their priority, their impact and whether mitigation is required. Preparedness activities can then be developed as potential mitigation measures, which also reveal who's best placed to conduct a preparedness activity and with what resources.

For example, in the phosphate case study, market manipulation is identified as a vulnerability that presents both as a threat and a risk. For the purposes of demonstrating the methodology, market manipulation is defined as behaviours including price fixing, hoarding or production cuts by dominant suppliers, artificially inflating prices, restricting supply, or creating uncertainty for fertiliser-dependent agricultural economies. Using the methodology, the assessment of the risk is rated as high, as is the threat assessment rating, leading to the overall decision to mitigate the vulnerability. A potential preparedness activity is then offered as a mitigation measure, such as industry and government collaboration on the establishment of strategic reserves to reduce short-term price shocks.

In the context of a coordinated, open and accessible assessment process applied to each stakeholder and domain of the food security ecosystem, it's possible that the preparedness activity could emerge as a mitigation measure relevant to multiple vulnerabilities across multiple domains. In such a circumstance, that would strengthen the case for that preparedness activity and potentially fast-track action and investment.

A structured methodology of this nature is essential to equip and empower all stakeholders across the food security ecosystem with the tools to identify, assess and prioritise vulnerabilities beyond current business-as-usual approaches to risk management. Many stakeholders report that they assume that government is managing threats and risks on their behalf or remain unaware of the need for proactive threat and risk assessment altogether in the context of increasing disruption stemming from Australia's current strategic circumstances.

The case studies in the Appendix are intentionally at a high level and are intended to serve as examples of how an open and accessible methodology could be applied in practice. However, achieving meaningful resilience requires a far more extensive, coordinated assessment process embedded within a trusted national framework. That would ensure that threat and risk identification and mitigation efforts are continuous, actionable and integrated across public- and private-sector stakeholders and critical supply chains.

To make this approach effective, Australia needs a robust, strategic coordination framework—one that's more open and ensures clear accountability, with structured collaboration and ongoing adaptation to emerging threats. Options for such a framework to secure Australia's food security against both immediate and long-term vulnerabilities are explored in Part 4.

Rethinking the economic policy framework

Australia's agricultural sector and food system are among the least subsidised in the world. The sector has prospered under a global rules-based system influenced by Western liberal values—but that system is now contested as the world experiences a rapid geo-economic transition. Economic policy frameworks that have guided us in the past

must be adapted to support the outcomes of a coordinated threat and risk assessment framework as well as to match Australia's current strategic circumstances.

Liberal and neoliberal doctrines of minimal government intervention, free markets, competition and productivity and capitalising on natural advantages in a globalised context have fostered immense prosperity. That's contrasted by a tendency to engage in Keynesian-influenced policy initiatives when droughts or market conditions have demanded it.[66] The result has been the application of an informal pragmatism that blends several approaches in a confused and inconsistent manner. That means that, while Australia remains one of the least subsidised countries globally, public policy has always tended towards some level of intervention, particularly in agriculture, when it's been politically expedient or otherwise necessary to do so.

The advent of government finance facilities and schemes in recent years, such as the Northern Australia Infrastructure Facility (NAIF), the Regional Investment Corporation, the Future Drought Fund, the Modern Manufacturing Initiative, the Emissions Reduction Fund, the National Reconstruction Fund, the Future Made in Australia initiative and many other schemes all demonstrate a willingness of government to intervene as and when required.

Each is premised on specific interventions. For example, the Northern Australia Infrastructure Facility focuses on community and economic development in the north, whereas the Future Made in Australia initiative is focused on incentivising critical-minerals processing and high-technology manufacturing in Australia. There's some overlap between schemes, but no higher order strategic structure or prioritisation, leaving cracks between initiatives with the potential to distort markets or create industry confusion. That raises fears, reported anecdotally by some stakeholders, of costly impediments to competitiveness that could outweigh the cost of a potential crisis, undermining legitimate interventions.

Australia's current strategic environment demands an urgent adaptation of the economic policy framework that guides agriculture and food-system policymaking. Supply-chain resilience requires up-front investment, even at the cost of short-term financial efficiency. While there may be opportunity costs to innovation and productivity, failing to act leaves Australia increasingly vulnerable to external shocks, undermining both long-term economic stability and national food security.

The Productivity Commission argued in 2021 that efficient supply-chain risk management balances the trade-off between the costs of a disruption and the opportunity cost of investing in risk management. To make effective decisions on the level of action to take, firms need to understand the nature of the potential disruption (likelihood, size and so on) and its impact to their supply chains. The Productivity Commission's starting point is that firms are best placed to manage their own risks, but it acknowledges there could be a more direct role for government in taking ownership of market-level risk management in a national-security context, noting that this risks 'crowding out' private activities, imposing greater costs on the community.[67]

The challenge of developing an economic framework that integrates the cost of legitimate preparedness activities while ensuring supply-chain resilience with minimal disruption to future innovation and productivity is a significant one. Such a framework must be relevant to Australia's current and future strategic circumstances and operate within a realistic, long-term time frame. It requires a more formal, pragmatic and coordinated approach—one that balances Australian cultural expectations, national-security priorities and economic sustainability.

An adapted economic framework should acknowledge and accept that there's an active role for government in the agriculture sector and food system to regulate deliberately and intervene in industries and markets proactively, but only when that's necessary; and, beyond that, to intervene in accordance with a strategic approach that aligns with the need to engage in preparedness activities across the food security ecosystem in line with Australia's current and changing strategic circumstances, not those of the past.

In laypersons' terms, that means that preparedness activities that require government intervention could be shepherded through the approvals processes of central agencies by an accepted economic framework without being rejected outright on principle. In practice, adopting such a framework could mean that the process of obtaining resources to fund preparedness activities through mechanisms such as the former government's Modern Manufacturing Initiative, the current Future Made in Australia initiative or the National Reconstruction Fund could be more easily justified and fast-tracked. That's because the need has been accepted as a legitimate mitigation measure that addresses a prioritised vulnerability across several domains of the food security ecosystem.

Economically empowering agriculture and the food system in Australia's national-security framework is vital. A new economic policy framework that balances short-term growth with long-term dependability is needed to meet our economic and national-security interests.

Green Paper policy options

- Each domain within the food security ecosystem should initiate a coordinated and systematic process to identify and understand its drivers, risks, threats and vulnerabilities in the context of Australia's current strategic circumstances. That requires the implementation of a structured threat and risk assessment methodology to guide a comprehensive vulnerability analysis. By doing so, stakeholders can prioritise preparedness activities, strengthen resilience and ensure that proactive measures are in place to mitigate emerging threats across all domains of the food security ecosystem.
- The Australian Government, led by Treasury and supported by DAFF, should redefine the economic policy framework that guides policy approaches and market interventions to support preparedness activities that reflect Australia's current strategic circumstances, guiding government intervention in the agriculture sector and food system in line with a higher order strategy that's in Australia's national interest.

Part 4: Collaborating for national food security preparedness

Enhancing synchronisation between public- and private-sector stakeholders and making more strategic government interventions to increase the security of Australia's agriculture sector and food system is critical. This part of the Green Paper asserts that achieving that outcome isn't the sole domain of governments; nor do governments have the capability, resources or at times the political will to do what's necessary to adequately prepare the community for a volatile future; nor can the private sector alone do what's necessary to prepare itself for the type of future that Australia's Defence organisation is preparing for. Options are offered in this section to discuss a preparedness framework of collaboration that's open and more accessible to stakeholders across the food security ecosystem, highlighting the geostrategic importance of the Indo-Pacific and the opportunity for Australia to collaborate with our neighbours and capitalise on each other's natural advantages for genuine mutual benefit.

A domestic collaboration framework for food security preparedness

Establishing the domains of food security as part of an ecosystem, explaining drivers, threats and risks in context, and offering a methodology to assess threats and risks to identify and prioritise vulnerabilities can empower stakeholders to act on those vulnerabilities. This paper has proposed the need to rethink the economic policy framework that's guided traditional policymaking and acknowledges that a great deal of targeted effort to build resilience has been made through existing mechanisms. It also proposes that existing approaches, such as the methodology employed by the Office of Supply Chain Resilience for monitoring and assessing current supply-chain vulnerabilities,[68] don't

reflect Australia's current strategic circumstances in a national-defence context. The market can no longer easily 'pivot' around inescapable geopolitical forces and the geo-economics game that's sweeping the globe.[69]

The threat and risk assessment methodology proposed in Part 3 of this Green Paper needs to be applied within a framework that ensures accountability. A model of centralised coordination with decentralised delivery of preparedness activities is well understood by some stakeholders and may offer the most effective approach, provided appropriate accountability is in place. That approach also allows preparedness activities to align with a broader strategic vision while being executed by those with the greatest expertise in their respective domains. The most practical way to implement that approach is by integrating it into existing structures, adapting and enhancing them where necessary to strengthen resilience and ensure a coordinated national response to food security threats and risks.

The SOCI Act has established a framework for identifying and protecting critical infrastructure across 11 critical infrastructure sectors and 22 asset classes, of which the food and grocery sector is one. One mechanism of collaboration within that framework is the FGSG, which forms part of the TISN. This function brings together most relevant stakeholders across the agriculture sector and food system, but some stakeholders believe that it's been underutilised in a preparedness context and is losing the confidence of members.

In line with the ambition to extend and enhance the TISN outlined in the 2023 Critical Infrastructure Resilience Plan,[70] the FSGS could be enhanced to become the central coordination mechanism for preparedness activities across the food security ecosystem. It could be extended to include RDCs, which bring extensive knowledge, resources and coordinating capability that could be deployed in line with their obligations under their Statutory Funding Agreements. The same could apply to other external entities such as the National Reconstruction Fund, the Northern Australia Infrastructure Facility and the Future Made in Australia initiative.

Aligning R&D investments with preparedness priorities would generate broader benefits in multiple domains of the food security ecosystem. Leveraging the full potential of the agriculture sector and food system's RDCs aligns with the findings of the independent panel leading the strategic review of Australia's R&D capability. The panel emphasises the urgent need to maximise R&D's value to diversify Australia's economic base and build a nation resilient to both local and global shocks.[71]

The FGSG can be expanded and adapted to serve as the primary coordination and accountability mechanism for delivering preparedness activities across the food security ecosystem. Strengthening its role would also require greater synchronisation with other key bodies, such as the Office of Supply Chain Resilience, and more effective use of tools such as the Critical Supply Chain Risk Dashboard to engage a broader range of stakeholders. That approach could provide a clear pathway to enhanced coordination, trusted information sharing and genuine accountability, ensuring that preparedness activities are aligned with national-security priorities and effectively implemented in all relevant domains.

If the food and grocery sector is recognised as critical infrastructure under the SOCI Act, then it follows that food security should be recognised as a legitimate domain of national security.

The FGSG secretariat currently sits within DAFF and, contrary to a common view in other agencies, it's an agency that reaches well beyond agricultural production. It's the agency with primary responsibility for the food security of Australia and facilitates the export of more than $200 million worth of food and rural goods every day to 165 markets.[72] DAFF is also responsible for the biosecurity system that cuts far beyond food, into the environment and to the protection of our way of life,[73] as well as holding responsibility for food security policy and programs.[74] Figure 5 reveals that DAFF bookends the food security ecosystem, and, as Australia's strategic circumstances evolve, so too should DAFF's role.

Stakeholders report that what the FGSG is missing is a clear line of accountability for the prioritisation and delivery of preparedness activities, up and into Australia's national-security framework. It's here that effect can be given to the intent of the 2023 AFS report's recommendation to establish Food as a distinct portfolio,[75] via the administrative arrangements orders of the Australian Government to align with existing arrangements.

To find the path of least bureaucratic resistance, the imprimatur for this portfolio responsibility must come via the administrative arrangements orders to DAFF, to move beyond its current responsibility for food security policy and programs and elevate it as the lead agency for the food system and food security preparedness.

The Minister for Agriculture, Fisheries and Forestry would take on the role of senior minister, supported by an assistant minister responsible for overseeing food security preparedness across all domains of the food security ecosystem. The senior minister would need to become accountable for the decentralised delivery of those activities. The assistant minister would provide oversight, ensuring coordination through the FGSG. That structure is a critical element of a National Food Security Strategy, reinforcing food security as a core domain of national security.

True accountability can only come from the National Security Committee of cabinet. Elevating the senior minister as a permanent member of the committee, with the DAFF Secretary also holding a permanent position on the Secretaries Committee on National Security, would establish the level of accountability demanded by Australia's deteriorating strategic circumstances.

Those circumstances require DAFF to be fully accountable for the food system and food security preparedness, and for that responsibility to be clearly recognised across all relevant portfolio agencies. That approach would meet the intent of establishing a dedicated Minister for Food without the disruption of creating a new department, instead leveraging DAFF's existing authority to drive coordination and reduce interagency conflict.

DAFF may need to be adapted and resourced to fulfil that expanded role—not just with funding, but with skilled personnel capable of bridging bureaucratic divides. Those steps are fundamental to building a credible National Food Security Strategy and ensuring that such initiatives deliver real outcomes, rather than becoming ineffective and costly exercises, at a time when action is urgently needed.

Green Paper policy options

- DAFF should be formally designated as the lead agency responsible for the food system and food security preparedness, and that role should be enshrined in the administrative arrangements orders of government. Elevating food security to a whole-of-government priority would enhance coordination, accountability and crisis-response capacity.
- The minister should be a full member of the National Security Committee of the federal cabinet. That would ensure that food security risks and strategic vulnerabilities are recognised at the highest level of government decision-making, alongside other key national-security issues.
- The minister should be supported by an assistant minister with dedicated responsibility for overseeing food security preparedness activities. That role would ensure focused leadership, cross-government coordination and operational implementation of strategic food security initiatives.
- The Secretary of DAFF should be included in the Secretaries Committee on National Security, reinforcing food security as a national-security priority. That would strengthen interdepartmental coordination, ensuring that food security risks are factored into broader national-security planning and decision-making at the highest levels of the Australian Public service.
- Stakeholder representatives across all domains of the food security ecosystem should be coordinated by an enhanced and expanded FGSG within the TISN.[76] That would align with the objectives of the 2023 Critical Infrastructure Resilience Plan[77] and strengthen the governance framework established under the SOCI Act, ensuring a structured, whole-of-system approach to food security risk management.

- The FGSG should be expanded to include RDCs and other key resourcing entities, ensuring that food security preparedness activities are supported by robust research, innovation and strategic investment. That integration would enhance data-driven decision-making and provide a critical bridge between industry, government and scientific expertise.
- The FGSG should remain under the Minister for Agriculture, Fisheries and Forestry, be staffed by DAFF officials and resourced appropriately. Funding should be realigned from existing siloed policy initiatives to ensure that food security preparedness is adequately funded without unnecessary budgetary expansion.

International collaboration for food security and regional self-reliance

This Green Paper proposes that food security is the ideal vehicle to achieve a greater level of stability and security through regional self-reliance. While the importance of Australia's international connections is well established, lessons learned on supply-chain resilience and trade diversification appear to be easily forgotten. Both world wars, the Covid-19 pandemic and trade disruptions provide apt warnings on the vulnerability of Australia's physical connection to the world. Ensuring long-term national stability requires moving beyond short-term economic efficiency and embedding resilience as a core principle in Australia's engagement with our region and the world beyond.

That reality was summed up in 2023 by Chief of the Defence Force, General Angus Campbell, when he stated that:

> As you know, Australian security and regional security are interdependent. So too security and prosperity. Each affected, to some considerable degree, by the presence or absence of the other.

Australia's Southeast Asia economic strategy to 2040[78] and *Trading north*[79] are the latest of many government reports to recognise the link between food security and deepening Australia's regional relationships. Both identify food and agriculture as critical in helping our neighbours meet their food security needs and facilitating trade in food is also a focus of several regional trade agreements.

Australia is trading in a highly contested environment that transcends the challenges presented by the Covid-19 pandemic. The trade volatility stemming from President Trump's early actions is a clear indication that Australia might no longer be able to rely on protections afforded to us by traditional trade agreements and dispute-resolution mechanisms. The role of food in international trade, however, remains vital for most countries around the world because food is a basic need of every country, whether the country is a democracy or an autocracy.

Strengthening food security preparedness and supply-chain resilience inevitably leads to the need for shorter, more reliable supply chains and deeper regional partnerships. While global trade remains vital, Australia can't assume that Northern Hemisphere trade linkages will always be available or as strategically important.

The FAO estimates that half of the world's undernourished population live in the Asia–Pacific.[80] A region grappling with food insecurity is one that's more vulnerable to instability, economic coercion and geopolitical influence from external powers. By prioritising regional food security, Australia can strengthen its own national resilience and reinforce Indo-Pacific stability to create a more secure and strategically favourable environment for the future.

Food security is the common denominator; a well-fed Indo-Pacific is a more stable one.

The DFAT is the lead agency responsible for Australia's international development programs, and its priorities are informed by the Australian Government's broader foreign-policy objectives, which in turn are influenced by geopolitical challenges and our strategic imperatives. While DFAT's administrative arrangements orders articulate its responsibility for international development and aid, they're silent on regional food security.[81]

Food security for Australia and our neighbours is a critical national-security imperative. DAFF has more to offer Australia's foreign policy in the Indo-Pacific, especially if charged with the responsibility for coordinating and

executing Australia's domestic food security preparedness activities. The activities of DFAT, DAFF and other agencies, such as ACIAR, intersect with the Australia's domestic preparedness imperative at this point.

Regional self-reliance is an approach that can guide Australia's regional statecraft with a food security imperative. That approach can be defined as achieving a level of regional stability and security through deeper cooperation and collaboration in agriculture and food production with less reliance on inputs external to the region.

Achieving regional self-reliance would require a coordinated and strategic approach to trade, investment and financing mechanisms, mapping competitive advantages, understanding threats and vulnerabilities and identifying opportunities for greater trust building and collaboration between nations, with a focus on genuine mutual benefit. Creating better alignment between the activities of multiple Australian Government agencies that operate across our international development programs may be needed to unlock the immense potential in the region to better integrate and complement each nation's food system's strengths and weaknesses.

Pursuing regional self-reliance shouldn't come at the cost of Australia's broader international relationships. Rather, it should strengthen those closer to home and make Australia a more resilient and reliable international partner, to our region and to the world. That may be non-negotiable, as questions over the future depth of US involvement in the region arise. A self-reliant approach can support the region to become an agriculture and food-production powerhouse, meeting not only regional food security needs but satisfying the increasing global demand for high-quality food and fibre. Dismantling intra-regional trade barriers in a carefully coordinated and strategic manner can support that approach through increased trade connectivity that's vital to the stability of the region.

All those activities can be founded on one very simple philosophy: food unites, while hunger divides. That's as true for addressing food insecurity at home as it is for our neighbours, and it's vital to achieve a safe and secure future for the Indo-Pacific.

Green Paper policy options

- Assign DAFF, as the lead domestic agency responsible for food systems and food security preparedness, the responsibility for developing a dedicated regional food security, trade and investment strategy. The strategy should be comprehensive, including mapping and analysis of natural advantages, be supported by DFAT, Austrade, Export Finance Australia, ACIAR and the CSIRO, and be adequately resourced to ensure its effectiveness. It should also align with the recommendations outlined in Australia's Southeast Asia Economic Strategy to 2040 to enhance regional cooperation and resilience.
- Establish dedicated food security funding and performance targets within Australia's international development program to support the regional food security, trade and investment strategy. That will ensure a sustained and measurable commitment to addressing regional food insecurity while strengthening Australia's strategic position in the Indo-Pacific.
- Expand access to concessional and blended financing mechanisms, such as the Australian Infrastructure Financing Facility for the Pacific, Export Finance Australia and Australian Development Investments, to support regional food and agricultural initiatives. Those investments should focus on enhancing supply-chain resilience, boosting agricultural productivity and addressing food insecurity across the region, reinforcing Australia's role as a trusted economic and security partner.

Conclusion

The intent of this industry-driven Green Paper is to offer policy options that will lay the foundation of a National Food Security Strategy, beginning with synchronised, whole-of-nation action on food security preparedness that aligns with the imperative of Australia's national defence. This Green Paper proposes feasible options for consideration and discussion, ranging from the granular assessment of vulnerabilities and coordinated delivery of preparedness activities to accountability for action at the highest levels of the Australian Government. Those options seek to thread together existing frameworks, mechanisms and lines of accountability that can lead to one outcome: a resilient Australian food security ecosystem that's ready to meet the challenges of the future.

Our food security ecosystem spans every aspect of food production, distribution and export. By using that context, public- and private-sector stakeholders gain perspective by seeing where they fit, their role and the interdependence of each layer. With that perspective, stakeholders are better placed to identify and prioritise their own vulnerabilities using an open and accessible threat and risk assessment methodology. Once vulnerabilities have been prioritised, decisions can be made as to how they're mitigated, by whom and with what resources. That process can be centrally coordinated through the TISN's extended and enhanced FGSG, domiciled within an empowered DAFF, as the lead agency responsible for the food system and food security preparedness.

This Green Paper has proposed that a deepened relationship between agencies and greater accountability can be achieved by elevating the senior minister responsible for food security into the National Security Committee of cabinet, supported by a biennial intelligence assessment specifically relating to the agriculture sector and food system. The lead agency can then coordinate whole-of-government efforts to create a secure and stable Indo-Pacific by leading a strategic approach to regional trade and investment—using food to deepen Australia's economic and security relationships with our neighbours.

Food insecurity is as much a regional concern as it is for the 30% of Australian families who are moderately or severely affected by food insecurity each year. Food security preparedness must start at home and expand to the Indo-Pacific to create a food-production powerhouse that can meet the demands of a hungry and increasingly divided world.

Food security preparedness isn't a one-time action but a continuous process—a foundational process that must be constantly strengthened and adapted to meet evolving threats and risks. Resilience in the food security ecosystem underpins every other national priority, from mitigating climate change to reducing social inequality. When disruptions occur, it's society's most vulnerable who feel the impacts first and hardest. At a time when Australia's social cohesion is under strain, ensuring that all citizens have access to affordable, quality food isn't just an economic or social issue—it's a national-security imperative.

Finally, this Green Paper is a call to action: to implement a National Food Security Strategy with preparedness as its immediate starting point. Australia has taken its food security for granted for too long, operating under the false assumption that the world will stay the same as it's been in living memory. Australia's food security preparedness has to be elevated to the same level of strategic importance as Australia's national defence—because one can't exist without the other.

Appendix

Case study 1: Phosphate as fertiliser

Context

Over the past two decades, Australia has become increasingly reliant on imported fertilisers to meet the needs of our agricultural production systems. That change has been a product of price pressures on producers at the retail and wholesale levels.

Australian soils are ancient, weathered and naturally deficient in phosphorus. Phosphorus is essential for all life and is vital to plant cell division, the development of the growing tip of crops, nutrient conversion, photosynthesis, energy transfer, water-use efficiency and more. It's a key ingredient in synthetic fertilisers, including superphosphate, monoammonium phosphate, diammonium phosphate and ammonium polyphosphate.

There are no available figures that offer an understanding of exactly how much agricultural production can be attributed to fertiliser use, due to the diversity of fertiliser types and their application across production systems. However, fertiliser use has been vital contributor to increases in production volume and the quality of outputs from Australia's agriculture sector. Livestock and crop production in many regions are reliant on the addition of fertiliser to overcome soil deficiencies and to maximise production volume and quality. Phosphorus is the second most used form of fertiliser in Australia and is derived in its natural form from finite reserves of phosphate rock.

Australian phosphate supply

Australian farmers use about 1,500,000 metric tonnes of phosphorus annually[82]. Despite Australia having domestic reserves of phosphate rock, domestic supplies account for only 30% of industry consumption. About 70% of our phosphorus consumption is imported from China, Saudi Arabia, the US and Morocco.[83]

Phosphate rock must be processed to create usable forms of phosphorus-based fertilisers.[1] Australia's phosphorus production is diminishing due to the depletion of high-grade phosphate rock reserves, rising extraction costs and increased environmental regulations. Historically, phosphate mining in areas such as Christmas Island and western Queensland played a key role in domestic supply, but many deposits are now exhausted or are becoming economically unviable. Additionally, global market competition, particularly from major producers such as Morocco and China, has reduced Australia's competitiveness. Stricter environmental policies also limit new mining operations.

Australian manufacturing capacity is largely attributed to two corporate stakeholders. Australia's largest fertiliser importer and manufacturer is Incitec-Pivot Limited (IPL), under its subsidiary Incitec Pivot Fertilisers, which was subject to a takeover bid in 2024 by Indonesian company PT Pupuk Kalimantan Timur. Most phosphorus is imported by the same stakeholders via just-in-time supply chains, and there's limited domestic storage capacity.

Australia's domestic supply of phosphate rock currently comes from Phosphate Hill in western Queensland. The annual production volume of phosphorus-based diammonium phosphate and monoammonium phosphate is estimated at 790,000–860,000 tonnes, but the facility has an uncertain future.

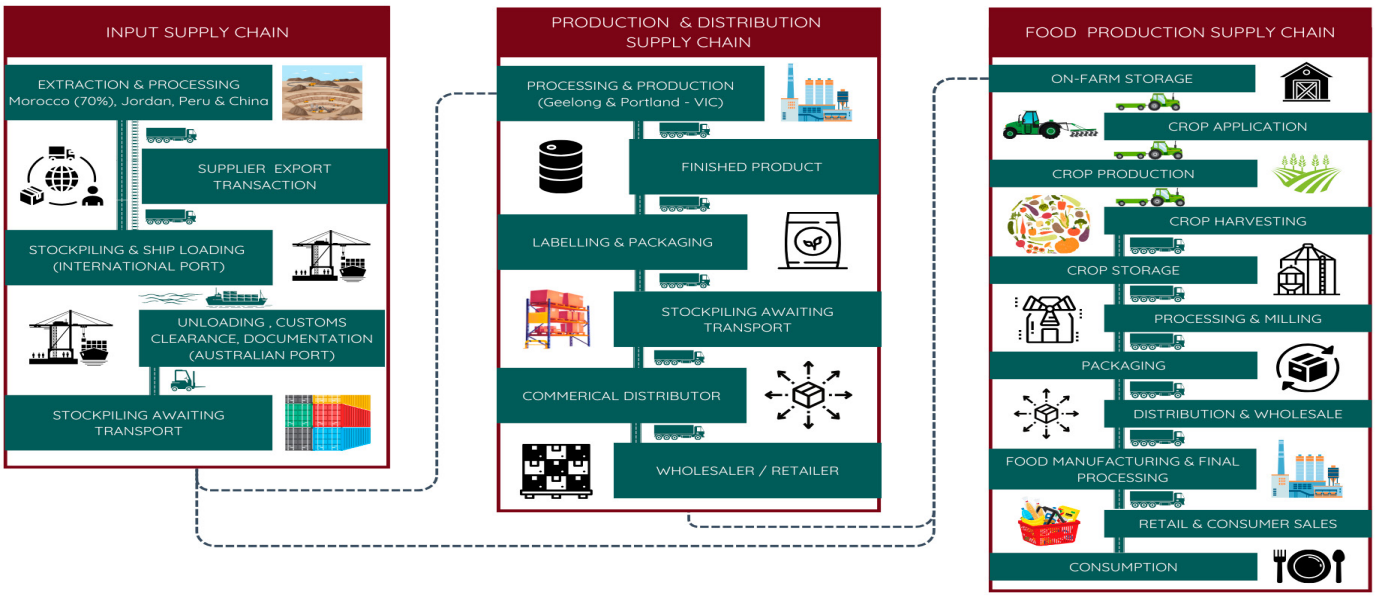
That uncertainty is driven by several factors. First, declining phosphate reserves and the rising cost of extraction challenge long-term viability. Second, global market competition, particularly from lower cost producers like Morocco and China, impacts profitability. Third, environmental regulations and energy costs constrain operations, while volatile fertiliser demand and fluctuating international phosphate prices create financial uncertainty. Production is also subject to extreme weather events and the availability of energy, as well as the operations of other mining operations in the region.

Alternative fertilisers are available and in use in various applications, but there currently no commercially viable alternative ways to produce phosphorus-based fertilisers at the scale needed to sustain Australia's agricultural production. While organic sources such manure, compost and biochar can supplement phosphorus needs, they lack the concentration and consistency required for large-scale agriculture. Recovering phosphorus from wastewater or mining lower grade deposits are promising but remain costly and inefficient. Additionally, synthetic and bio-based alternatives are still in early development and can't yet match the efficiency of diammonium phosphate and monoammonium phosphate fertilisers in sustaining agricultural productivity.

Supply-chain overview

The end-to-end phosphate supply chain has many interconnected steps. Figure 7 traces the journey from the extraction of phosphate to its use in agricultural and industrial applications, demonstrating its critical role in crop production and ultimately in food security.

Figure 7: The phosphate supply chain



Because the supply chain involves a wide range of international and domestic stakeholders, reliance on phosphate as a key component of the food security ecosystem exposes the ecosystem to multiple risks, threats and vulnerabilities at every stage. At the time of writing, it appears that no Australian federal, state or territory government is currently tracking national fertiliser stocks.

Hybrid threat and risk assessment

Table 1 doesn't constitute a complete threat or risk assessment. Rather, it's an example of how a hybrid threat and risk assessment can be applied to identify and mitigate vulnerable supply chains.

Table 1: Hybrid threat and risk assessment for phosphate

Economic coercion										
Description	Economic coercion in phosphate markets could involve export restrictions, price manipulation or supply-chain disruptions by dominant producers such as China or Morocco, affecting global fertiliser availability and prices.									
Hybrid assessment	Type	Risk rating			Threat					Decision
					Capability		Intent		Threat rating	
		Likelihood	Consequence	Risk rating	Resources	Knowledge	Desire	Expectance		
	Threat	Possible	Major	High	Certain	High	Certain	Certain	Very High	Mitigate
Potential mitigations	• DAFF and the Department of Industry, Science and Resources work with industry to develop policy and industry measures to promote the diversification of phosphate suppliers (for example, trade agreements and strategic partnerships). • Federal government considers subsidies for the development of domestic phosphate mining and manufacturing capabilities (for example, tax benefits). • Industry and government collaborate on the establishment of strategic reserves to buffer against supply shocks.									
Supply-chain disruption										
Description	Supply disruptions in phosphate markets could occur due to export bans, geopolitical tensions or logistical challenges (industrial relations issues, natural disasters and so on), leading to price spikes and fertiliser shortages that within a short time contribute to heightened food security risks globally.									
Hybrid assessment	Type	Risk rating			Threat					Decision
					Capability		Intent		Threat rating	
		Likelihood	Consequence	Risk rating	Resources	Knowledge	Desire	Expectance		
	Risk	Possible	Major	High	n.a.	n.a.	n.a.	n.a.	n.a.	Mitigate
Potential mitigations	• Industry and government collaborate on the establishment of strategic reserves to reduce short-term price shocks. • DAFF and DFAT seek to strengthen diplomatic relations with key phosphate-exporting nations. • DAFF explores possible investments in alternative sources, such as phosphate recovery from waste streams. DAFF works with the Department of Industry, Science and Resources to develop supply-chain risk management strategies similar to those used by oil companies.									
Market manipulation										
Description	Market manipulation in phosphate markets could involve price fixing, hoarding or production cuts by dominant suppliers, artificially inflating prices, restricting supply and creating uncertainty for fertiliser-dependent agricultural economies.									
Hybrid assessment	Type	Risk rating			Threat					Decision
					Capability		Intent		Threat rating	
		Likelihood	Consequence	Risk rating	Resources	Knowledge	Desire	Expectance		
	Risk and threat	Possible	Major	High	High	High	Medium	Medium	High	Mitigate
Potential mitigations	• Industry and government collaborate on the establishment of strategic reserves to reduce short-term price shocks.									

Case study 2: Glyphosate

Context

Glyphosate is a non-selective, systemic herbicide that's played a crucial role in shaping Australian agriculture and forestry practices. Since its introduction in the 1970s, it's been a cornerstone of modern weed management, improving productivity, reducing input costs and supporting sustainable farming practices. Its widespread use, particularly in broadacre cropping, has enabled the adoption of minimum and zero-till farming, reducing soil erosion and improving moisture retention.

Manufacturing glyphosate is a complex, highly specialised process that requires key chemical inputs, including phosphorus from phosphate rock, glycine and other industrial compounds. Its effectiveness lies in its systemic action—once applied through spraying or direct application, it's absorbed through plant leaves and stems, moving throughout the plant and disrupting protein synthesis by inhibiting the shikimic acid pathway.

Despite increasing controversy in recent years, glyphosate remains essential to Australian agriculture, underpinning over $31 billion in annual agricultural output. Its contribution to efficiency and productivity can't be overstated. Without it, farmers would need to return to more labour- and resource-intensive methods, leading to higher fossil-fuel consumption, greater soil disruption and increased erosion—ultimately threatening the sustainability and competitiveness of Australia's agricultural sector.

Australian glyphosate supply

Most of the world's glyphosate is produced in China, which accounts for approximately 60% of global supplies.[84] While some production also occurs in the US, Australia has only limited manufacturing and formulation capacity, which is heavily dependent on imported synthesised ingredients—primarily from China.

In Australia, Bayer Australia and Accensi Pty Ltd import formulated glyphosate. Nufarm Ltd and Accensi also formulate glyphosate domestically, but their operations rely on the import of glyphosate technical, the core active ingredient. As a result, domestic production is inherently vulnerable to international supply-chain disruptions. During the Covid-19 pandemic, anecdotal evidence suggests that glyphosate supply, along with the supply of its core ingredients, reached critically low levels.

Without continued access to imported raw materials, Australia's domestic manufacturing could only sustain operations for a short period—an estimated 12 weeks of supply under average consumption.

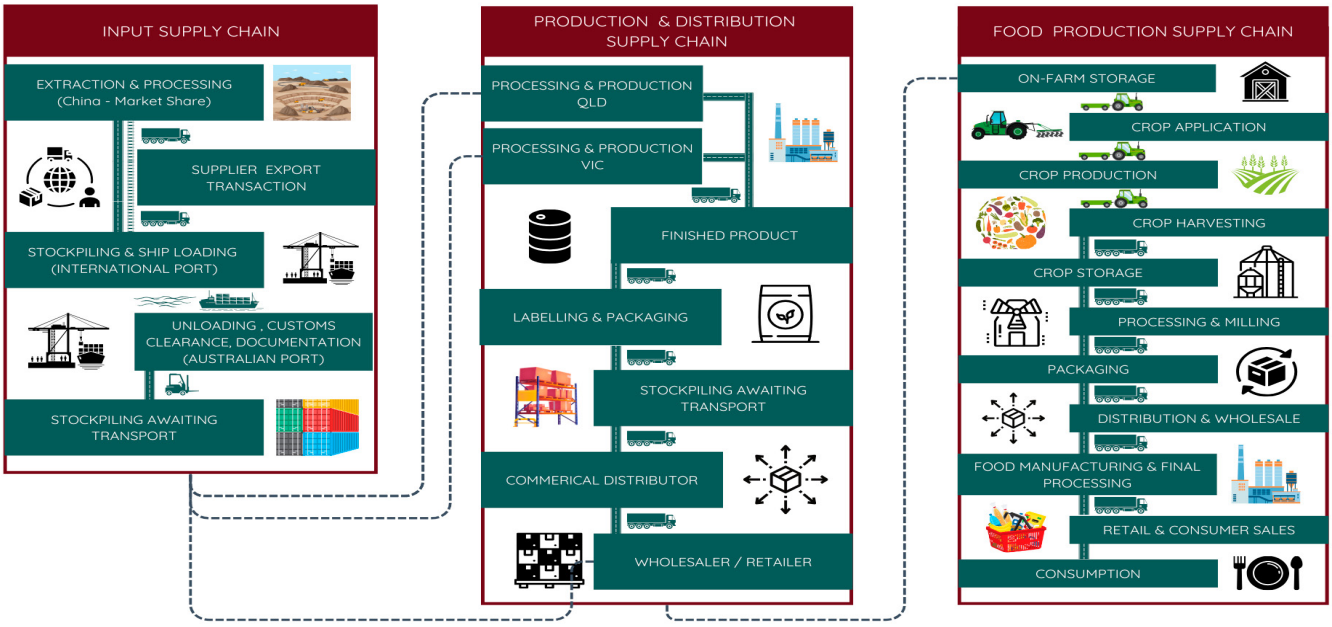
While alternative weed-control techniques exist, few, if any, currently available products or practices can replace glyphosate in commercial applications. Its effectiveness, cost efficiency and ease of use make it an integral component of modern Australian agriculture. There's no clear substitute that can match its scale and impact.

Supply-chain overview

The end-to-end glyphosate supply chain has many interconnected steps. Figure 8 traces the journey from extraction to its final use in agricultural and industrial applications, demonstrating its critical role in Australian agricultural production and ultimately in food security.

Figure 8 provides a concise overview of Australia's glyphosate supply chain, highlighting the key stages and challenges involved in ensuring a reliable and sustainable supply of this essential herbicide for Australian farmers.

Figure 8: The glyphosate supply chain



Hybrid threat and risk assessment

Table 2 doesn't constitute a complete threat or risk assessment. Rather, it's an example of how a hybrid threat and risk assessment can be applied to identify and mitigate risks in a supply chain.

Table 2: Hybrid threat and risk assessment for glyphosate

Supply-chain disruption										
Description	Supply disruptions in glyphosate markets could occur due to export bans, geopolitical tensions or logistical challenges (industrial relations issues, natural disasters and so on), leading to price spikes and shortages that within a short time would lead to lower agricultural efficiency and production.									
Hybrid assessment	Type	Risk rating			Threat					Decision
					Capability		Intent		Threat rating	
		Likelihood	Consequence	Risk rating	Resources	Knowledge	Desire	Expectance		
	Risk	Possible	Major	High	n.a.	n.a.	n.a.	n.a.	n.a.	Mitigate
Potential mitigations	• Industry and government collaborate on the establishment of strategic reserves to reduce short-term price shocks.									
Glyphosate resistance										
Description	Glyphosate resistance poses a growing threat to Australian agriculture, driven by decades of repeated use. As resistant weed strains spread, glyphosate's effectiveness declines, forcing farmers to adopt costlier and more labour-intensive alternatives. Increased reliance on mechanical tillage threatens soil health, accelerating erosion and reducing moisture retention. Alternative herbicides may have higher costs, regulatory constraints or environmental risks.									
Hybrid assessment	Type	Risk rating			Threat					Decision
					Capability		Intent		Threat rating	
		Likelihood	Consequence	Risk rating	Resources	Knowledge	Desire	Expectance		
	Risk	Likely	Major	High	n.a.	n.a.	n.a.	n.a.	n.a.	Mitigate
Potential mitigations	• The Australian Government, in collaboration with industry, should establish a national glyphosate-resistance management strategy to coordinate resistance-management efforts. That could include research funding, farmer education programs and regulatory incentives to promote integrated weed management practices, such as herbicide rotation, mixed cropping and non-chemical weed-control methods. • Government and industry should increase funding for research into new herbicide chemistries, including open-source molecule discovery processes, novel technologies and non-chemical weed-control technologies, including robotics, targeted spraying systems and biological controls, to reduce reliance on glyphosate and the development of resistance. • Industry and government agencies should implement stricter monitoring of glyphosate-resistant weed populations and enforce best practice guidelines for herbicide use. That could involve increasing targeted extension services, resistance mapping and incentives for farmers to adopt sustainable or alternative weed-control strategies.									

Economic coercion										
Description	Economic coercion in glyphosate markets could involve export restrictions, price manipulation or supply-chain disruptions by dominant producers such China affecting global fertiliser availability and prices.									
Hybrid assessment	Type	Risk rating			Threat					Decision
					Capability		Intent		Threat rating	
		Likelihood	Consequence	Risk rating	Resources	Knowledge	Desire	Expectance		
	Risk	Possible	Major	High	n.a.	n.a.	n.a.	n.a.	n.a.	Mitigate
Potential mitigations	• The Australian Government and industry should prioritise securing alternative suppliers of glyphosate and its key ingredients, reducing reliance on dominant producers such as China. That could involve trade agreements, domestic stockpiling or incentivising production domestically or in allied nations to ensure a more stable supply chain. • Increasing investment in domestic production capacity to encourage growth or at least maintaining local manufacturing of glyphosate and its precursor chemicals, including targeted investments to increase manufacturing throughput and automation, would mitigate the risks of economic coercion. Government grants, tax incentives and regulatory streamlining could boost current domestic processing facilities to enhance supply-chain resilience, as could the development of new facilities with additional manufacturing capabilities and output. • Establishing national stockpiles of glyphosate and strengthening trade agreements with multiple suppliers would buffer Australia against potential export bans or price manipulation. That could be complemented by international partnerships to counter market distortions and ensure long-term access to critical agricultural inputs.									

Case study 3: Digital connectivity

Context

Digital connectivity is a foundation of Australia's agriculture sector and food system, without which they can't function. Nearly every part of the food security ecosystem is in some way reliant on some form of digital connectivity to function effectively. The system has evolved from a reliance on traditional forms of communication such as radio and telecommunications systems to internet-based platforms, cloud services and direct-to-handset technology all via the publicly owned National Broadband Network (NBN) or low-Earth orbit satellite technology such as Starlink.

While the NBN and Starlink both provide broadband internet, they do so with very different methods. The NBN uses and mix of fibre, fixed wireless and satellite via Sky Muster, whereas Starlink uses a low-Earth orbit satellite constellation. The NBN has sought to provide coverage to the entire Australian population, while Starlink targets users in low-connectivity areas, mostly in regional and remote Australia.

Australia's food security ecosystem is almost entirely dependent on digital connectivity, which enables importation systems, production, processing, manufacturing, cold-chain logistics, transport and distribution systems, biosecurity, traceability and food-safety systems and export-certification systems in both government agencies and private enterprises.

Digital communications and systems are provided by the NBN, but with increasing competition from and reliance on critical communications infrastructure and platforms owned by foreign corporations, such as Starlink, Microsoft, Amazon Web Services, Google, Meta and others. More than 200,000 individuals now rely on Starlink, and there's increasing integration of its services into government agencies, emergency-management authorities and community organisations.

Australian digital connectivity supply

The agricultural digital supply chain operates through a network of interconnected technologies that enable data-driven decision-making. Farmers are increasingly using digital platforms for precision agriculture, employing GPS-enabled machinery, soil sensors and drones to optimise planting, irrigation and fertiliser use. Evolving technology is facilitating advances such as real-time tracking of livestock health and movements, as well as automated irrigation systems that improve water efficiency.

Further along the supply chain, real-time logistics tracking enhances supply-chain visibility, the monitoring of transport routes, spoilage reduction and improved efficiency. Traceability systems ensure transparency in food safety, allowing consumers and regulators to verify product origins and handling. Digital marketplaces and e-commerce platforms have further expanded market access, allowing Australian farmers to connect directly with domestic and international buyers.

Connectivity providers are critical for the food security ecosystem; telecommunications companies such as publicly owned Telstra, Singaporean-owned Optus and Australian-owned Vodafone provide essential communication infrastructure. NBN, the primary provider of wholesale fixed broadband, enables access to online resources and services. Satellite providers such as Starlink, owned by American company SpaceX or French-owned Eutelsat OneWeb are vital for remote connectivity that's critical for monitoring and communication in areas with limited terrestrial infrastructure, especially since the shutdown of the 3G network.

The digital connectivity supply chain in Australia faces significant vulnerabilities. Many regional and remote farming and production areas still suffer from inadequate internet coverage, limiting the adoption of advanced digital tools. The 3G network shutdown has exacerbated that vulnerability. Increasing digitisation of the sector has also heightened cybersecurity risks, exposing businesses across the ecosystem to potential data breaches and

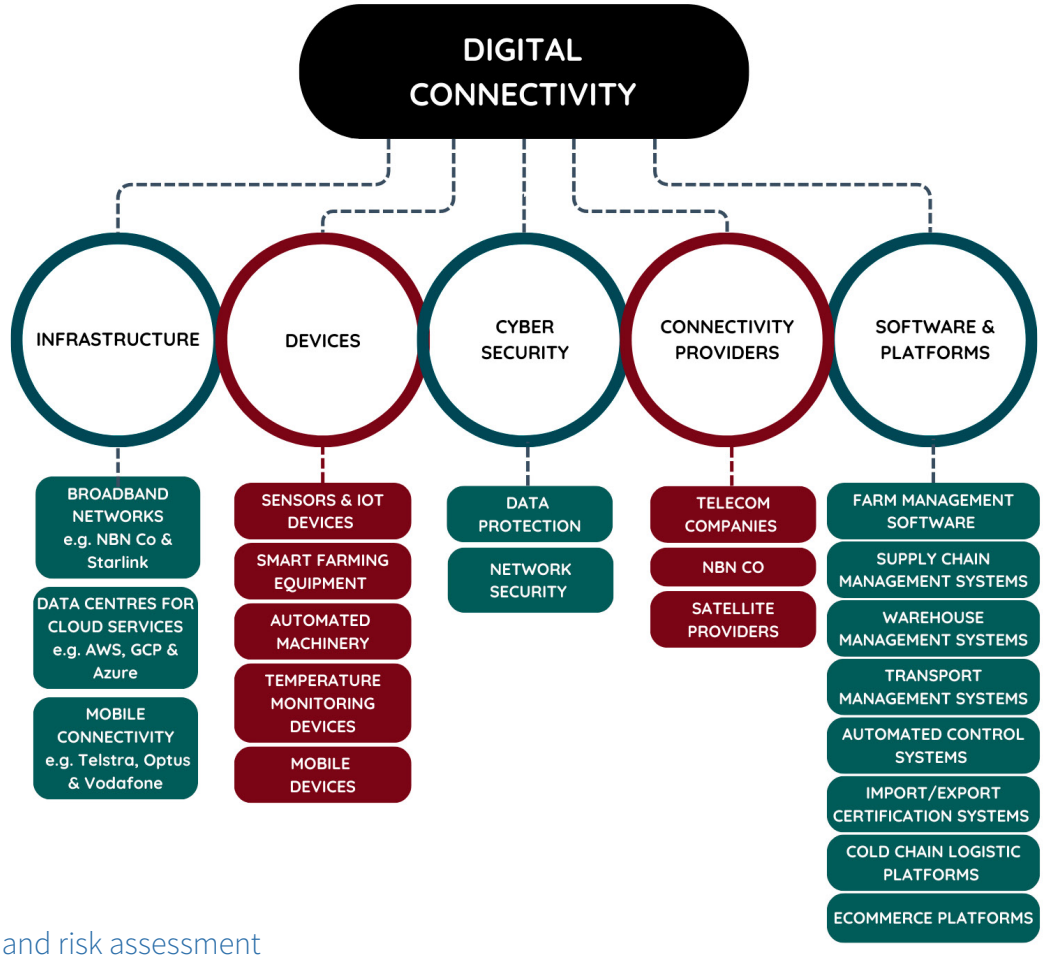
cyberattacks. Foreign ownership of telecommunications infrastructure raises concerns about data security, while reliance on cloud-based platforms leaves systems vulnerable to cyber threats. The cost of implementing digital solutions also remains a barrier, particularly for smaller farms and businesses that may struggle with the financial burden of investing in new technology. Additionally, problems of interoperability between different platforms and devices complicate data sharing across the supply chain, reducing efficiency.

Digital connectivity presents enormous ongoing opportunities for Australian agriculture and the food system, but ongoing investment in rural internet infrastructure, improved cybersecurity measures and greater collaboration between industry and government will be essential. Ensuring that businesses have access to affordable and reliable technology, along with the necessary training and support, will be critical in securing the long-term success and resilience of the agricultural supply chain.

Supply-chain overview

The digital connectivity supply chain in Australia is a complex network of interconnected components that enables the delivery of digital services to individuals and businesses (Figure 9). It involves various stakeholders, including telecommunications companies, infrastructure providers, technology vendors and government agencies.

Figure 9: The digital connectivity supply chain



Hybrid threat and risk assessment

Table 3 and Table 4 don't constitute a complete threat or risk assessment. Rather, it's an example of how a hybrid threat and risk assessment can be applied to identify and mitigate risks in a supply chain.

Table 3: Hybrid threat and risk assessment for geopolitical instability and natural disasters

Geopolitical instability										
Description	Geopolitical instability threatens Australia's agricultural digital connectivity by disrupting global technology supply chains, restricting access to essential telecommunications infrastructure and increasing cyber risks. Tensions with key technology suppliers, trade restrictions or foreign interference in critical networks could compromise agricultural data security, disrupt smart farming systems and weaken supply-chain resilience.									
Hybrid assessment	Type	Risk rating			Threat					Decision
					Capability		Intent		Threat rating	
		Likelihood	Consequence	Risk rating	Resources	Knowledge	Desire	Expectance		
	Risk	Possible	Major	High	Certain	Certain	Medium	Medium	High	Mitigate
Potential mitigations	• The Australian Government and agriculture sector should reduce reliance on foreign technology providers by sourcing telecommunications and digital infrastructure from a broader range of suppliers, including trusted domestic and allied partners. Trade agreements should prioritise secure and reliable access to critical digital components. • Increasing government and industry investment in Australian-owned telecommunications and cloud services would enhance resilience. Supporting regional connectivity projects and secure data centres will reduce vulnerabilities associated with foreign-controlled networks and strengthen agricultural digital supply chains. • A dedicated taskforce focused on increasing awareness about stricter cybersecurity standards for all digital infrastructure in the agriculture sector and food system, including encrypted data transmission, network redundancy and real-time threat detection, would mitigate risks. Government agencies should enhance collaboration with the agricultural sector and food system to build increased awareness and more robust cybersecurity frameworks. • Strengthening partnerships with trusted international allies, particularly through agreements on digital infrastructure security and intelligence sharing, would safeguard Australia's access to secure agricultural technology and connectivity. • The agriculture sector and food system should implement business continuity plans that include redundancies for digital systems, offline operational capabilities and alternative communication networks to ensure ongoing functionality in the event of geopolitical disruptions affecting digital connectivity.									
Natural Disasters										
Description	Natural disasters such as bushfires, floods and cyclones can severely disrupt Australia's agricultural digital connectivity by damaging telecommunications infrastructure, cutting power to digital farming systems and impairing data transmission. Those disruptions hinder real-time monitoring, automated irrigation and supply-chain logistics, leading to reduced efficiency, productivity losses and delayed market access.									
Hybrid assessment	Type	Risk rating			Threat					Decision
					Capability		Intent		Threat rating	
		Likelihood	Consequence	Risk rating	Resources	Knowledge	Desire	Expectance		
	Risk	Almost Certain	Major	High	n.a.	n.a.	n.a.	n.a.	n.a.	Mitigate
Potential mitigations	• The Australian Government should lead efforts to harden telecommunications infrastructure in regional areas by mandating fire-resistant, flood-proof and cyclone-rated designs for mobile communications towers and fibre networks. It should expand underground cabling in high-risk areas and offer targeted grants for infrastructure reinforcement. Additionally, government-backed energy-resilience programs should provide funding for farmers and agribusinesses to install solar power with battery storage and microgrid solutions to maintain operations during power outages. • Telecommunications providers (Telstra, Optus, Vodafone and NBN Co.) must enhance redundancy by expanding low-Earth orbit satellite internet services such as Starlink, OneWeb and Sky Muster as alternative connectivity options. The government should mandate mobile network roaming agreements to ensure uninterrupted service in disaster-affected areas. Providers must also commit to deploying emergency mobile base stations, satellite uplinks and portable communication hubs as part of a national disaster response plan. • The agriculture sector, including industry bodies such as the National Farmers' Federation, must promote regional cloud storage hubs to decentralise critical agricultural data and ensure that farmers can access farm-management software, logistics platforms and supply-chain tracking systems even if connectivity is lost. Agribusinesses should adopt offline-capable software to maintain operational continuity.									

Table 4: Hybrid threat and risk assessment for industrial control systems and supervisory control and data acquisition

Industrial control systems (ICSs) and supervisory control and data acquisition (SCADA)										
Description	ICS and SCADA systems manage critical food-system infrastructure, including automated irrigation, livestock monitoring, food processing and supply-chain logistics. A targeted attack could disrupt water and fertiliser distribution, disable storage and transport networks, or compromise real-time monitoring, leading to crop failures, food shortages and financial losses. Given the sector's reliance on foreign-owned telecommunications and cloud services, vulnerabilities in ICS/SCADA systems could also expose sensitive data, affecting national food security and economic stability if not properly safeguarded.									
Hybrid assessment	Type	Risk rating			Threat					Decision
					Capability		Intent		Threat rating	
		Likelihood	Consequence	Risk rating	Resources	Knowledge	Desire	Expectance		
	Risk	Likely	Major	High	Certain	Certain	High	High	Very High	Mitigate
Potential mitigations	• The Australian Government should increase awareness about mandated minimum cybersecurity standards for ICS/SCADA systems in all digital infrastructure in the agriculture sector and food system, ensuring compliance with best practices such as network segmentation, real-time monitoring and multifactor authentication. That could be supported through industry guidelines and incentives for businesses adopting robust cybersecurity frameworks. • Telecommunications providers should prioritise secure network architecture, including 5G security enhancements, encrypted data transmission and redundancy measures to mitigate cyber threats. Government investment in regional connectivity upgrades should integrate cyber-resilience measures to protect agricultural ICS/SCADA systems. • Establishing a cybersecurity taskforce specifically for agriculture and the food system specific involving government, industry and telecommunications service providers would facilitate real-time intelligence sharing on emerging threats. A national incident response framework tailored for agriculture's digital infrastructure should be developed to rapidly contain, investigate and mitigate cyberattacks. • The government and industry bodies should educate farmers, agribusiness operators and supply-chain stakeholders on cybersecurity best practices. That includes recognising phishing attacks, securing remote access, updating software and implementing network segmentation to protect ICS/SCADA systems. • Reducing reliance on adversary-sourced and monopolised foreign-sourced telecommunications and industrial-control components by investing in secure Australian-made digital infrastructure will strengthen supply-chain resilience. Public–private partnerships should drive local innovation in secure network technologies tailored to Australia's agricultural sector and food system.									

Notes

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4 The food security ecosystem is the complex web of relationships between all the interacting living and non-living factors that influence food production, distribution, access and utilisation. Viewing food security through this lens highlights the complex interplay of environmental, economic, social and governmental elements crucial for achieving food security.
5 A 'layer' within the food security ecosystem refers to a distinct level within the system, such as a key enabler or input. The layers interact with each other and contribute to the overall functioning of the food system. Analysing the food system by layers helps us to understand how activities at one level affects others and to identify potential leverage points for improving food security.
6 A 'domain' within the food security ecosystem is a specific area of focus within a layer that contributes to or is affected by overall food security. Identifying domains allows for targeted analysis and intervention within the complex food system to address specific challenges and improve outcomes.
7 The TISN is the primary way for industry and all levels of government to work together to enhance the security and resilience of critical infrastructure. Through the TISN, members of the critical infrastructure community collaborate to strengthen the resilience of their organisations and industry sectors in the face of alll hazards.
8 Australia's Critical Infrastructure Resilience Plan 2023 is part of the Critical Infrastructure Resilience Strategy 2023 and outlines the Australian Government's approach to protecting critical infrastructure from all hazards, focusing on strengthening resilience through partnerships, improved information sharing and proactive risk management. It sets strategic objectives and guiding principles for safeguarding essential services and systems upon which Australians depend.
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Acronyms and abbreviations

ACIAR	Australian Centre for International Agricultural Research
AFS report	*Australian food story: feeding the nation and beyond*
AGCMF	Australian Government Crisis Management Framework
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DFAT	Department of Foreign Affairs and Trade
FAO	Food and Agriculture Organization of the United Nations
FGSG	Food and Grocery Sector Group
ICSs	industrial control systems
ISO	International Organization for Standardization
NBN	National Broadband Network
ONI	Office of National Intelligence
PM&C	Department of the Prime Minister and Cabinet
RDC	research and development corporation
R&D	research and development
SCADA	supervisory control and data acquisition
SOCI Act	*Security of Critical Infrastructure Act 2018*
TISN	Trusted Information Sharing Network
UN	United Nations

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