



Australia's National
Science Agency

Convening missions

A playbook for collective implementation
of mission-oriented innovation

FIRST EDITION



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CSIRO acknowledges the Traditional Owners of the lands that we live and work on across Australia and pay their respect to Elders past and present. CSIRO and the participants recognise that Aboriginal and Torres Strait Islander peoples have made and will continue to make extraordinary contributions to all aspects of Australian life including culture, economy and science.

This report was researched and written by a multi-disciplinary CSIRO team of researchers and mission practitioners. The team would like to acknowledge the contributions of Natasha Dames, Jesusa Aguilar-Mana, Lisa Little, Rosie Strickleton, Cass Erbs, Peat Leith, Andy Hall, Tracy Henderson, Graham Bonnett and all mission teams to this playbook and the processes and frameworks described herein.

Cover image: Big-eye trevally (*Caranx sexfasciatus*) at Osprey Reef, Coral Sea Marine Park. © Matt Curnock

1 Introduction

Mission-oriented innovation – an approach to science, technology and innovation epitomised in the 20th century by the space race – has re-emerged as a vehicle for transformational change in addressing the challenges of this century.

Responding to climate change and the risk of biodiversity collapse, ensuring water and food security, maintaining human health and wellbeing, addressing regional instability and tackling the decline in public trust and social cohesion are complex and interdependent challenges. The level of complexity and urgency of these challenges requires new thinking and new forms of collaboration from public institutions, industry, the research sector, civil society and the community.

Mission-oriented innovation was once described as ‘big science solving big problems’. It is now being reimagined as a mobilisation of coordinated and sustained efforts across disciplines and sectors, incorporating a broad range of perspectives and interests, to deliver impact and build innovation system capability for the long term.

In establishing CSIRO’s Missions Program in 2019, Australia’s national science agency joined a growing global community of policy practitioners, researchers and leaders experimenting with models to make good on the ambitious promise of mission-oriented innovation.

Following experimentation with different frameworks for mission-oriented innovation, CSIRO has arrived at an ‘agency convened’ model of missions. This model seeks to accelerate the diffusion of solutions by ‘crowding in’ existing and new policy initiatives, investment, research activities and innovation system actors around a shared objective.

This playbook, *Convening missions*, represents CSIRO’s key insights from three years of delivery about designing, implementing and governing missions, and proposes areas of future focus for this emergent practice.

Convening missions in Australia

Other regions and economies, in particular the EU and Japan, have developed their approaches to mission-oriented innovation by building on policy priorities and funding decisions that are pre-determined for multiple years ahead. As a result, they have established strong government-led approaches to delivering missions, supported by a substantial injection of public investment or an overarching mandate for a single institution to lead.

By contrast, Australia's innovation system operates at different speeds, across multiple jurisdictions and with many significant actors responsible for setting the policy direction. Policy settings and incentives arise from multiple levels of government and departments, often with a strong sectoral focus but limited view of the systemic interactions of responses.

Other key factors shaping Australia's innovation system are:

- An economy that has become relatively less complex over the past 20 years, moving from 26th to 82nd position in the OECD's rankings of economic complexity for trade.
- An R&D spending decline over the last decade across all sectors (business, government, higher education and private non-profit), falling from 2.11% of GDP to 1.79% by 2020.

- An export economy dominated by resources and agriculture and trade with a concentration of trading partners, some of whom are increasingly focusing on decarbonising their value chains. This leaves Australia exposed to accelerated decarbonisation efforts, climate-related impacts to agricultural productivity, and geopolitical shifts.
- A large, competitive research sector recognised for its research excellence accounting for 3.3% of the global research output but struggling to translate world-class research into outcomes.

CSIRO's role

CSIRO is Australia's national science agency and one of the largest and most multi-disciplinary research and technology organisations in the world. It is Australia's most trusted research institution and most connected innovator, working with government, the research sector, Australian businesses of all sizes in all major sectors and communities.

CSIRO is a challenge-led organisation. Informed by a long-term national outlook developed in consultation with Australia's innovation system, CSIRO has a vision for solving national challenges that shapes and creates new markets in the process.

Missions in Australia are being developed in response to this context



-0.41

Rank 82 of 131

**Economic complexity
(Trade)**



1.11

Rank 13 of 96

**Economic complexity
(Technology)**



2.08

Rank 4 of 140

**Economic complexity
(Research)**

Ref: Australia Country Profile, Observatory of Economic Complexity, 2023

CSIRO's Challenges Framework

Developed in 2016, CSIRO's Challenges Framework focuses the organisation's capability and resources on solutions to grand problems that are interconnected and interdisciplinary in nature, and which require a multi-stakeholder solution.

It directs the organisation's approach to mobilising science and technology, framing its engagement with key stakeholders, partners and customers on how to implement large-scale impact initiatives. The Framework also assists us to define priority areas for investment to capture new opportunities and build research capability.

After extensive analysis of global trends and risks, the UN Sustainable Development Goals, national policy and science priorities, and CSIRO's differentiated capability, we arrived at six key challenges: Health and wellbeing; Food security and quality; Secure Australia and region; Resilient and valuable environments; Sustainable energy and resources; and Future industries.

Health and wellbeing

Enhance the health and wellbeing of all Australians.

- Support healthier lives
- Infectious diseases prevention and preparedness
- Digital transformation of healthcare
- Health technology solutions

Food security and quality

Grow the triple bottom line value of Australia's agri-food and fibre industries.

- Profitable agricultural production
- Improved crops and animals
- High value foods and feeds
- Sustainable and trusted value chains

Secure Australia and region

Safeguard Australia and our region from threats.

- Biosecurity
- Defence and national security
- Sovereign resilience
- Stable and prosperous region

Resilient and valuable environments

Enhance the resilience and value of our natural and built environments.

- Resilience to climate risks
- Healthy ecosystems
- Resilient communities and built environments

Sustainable energy and resources

Lower emissions to net zero while sustaining Australia's prosperity.

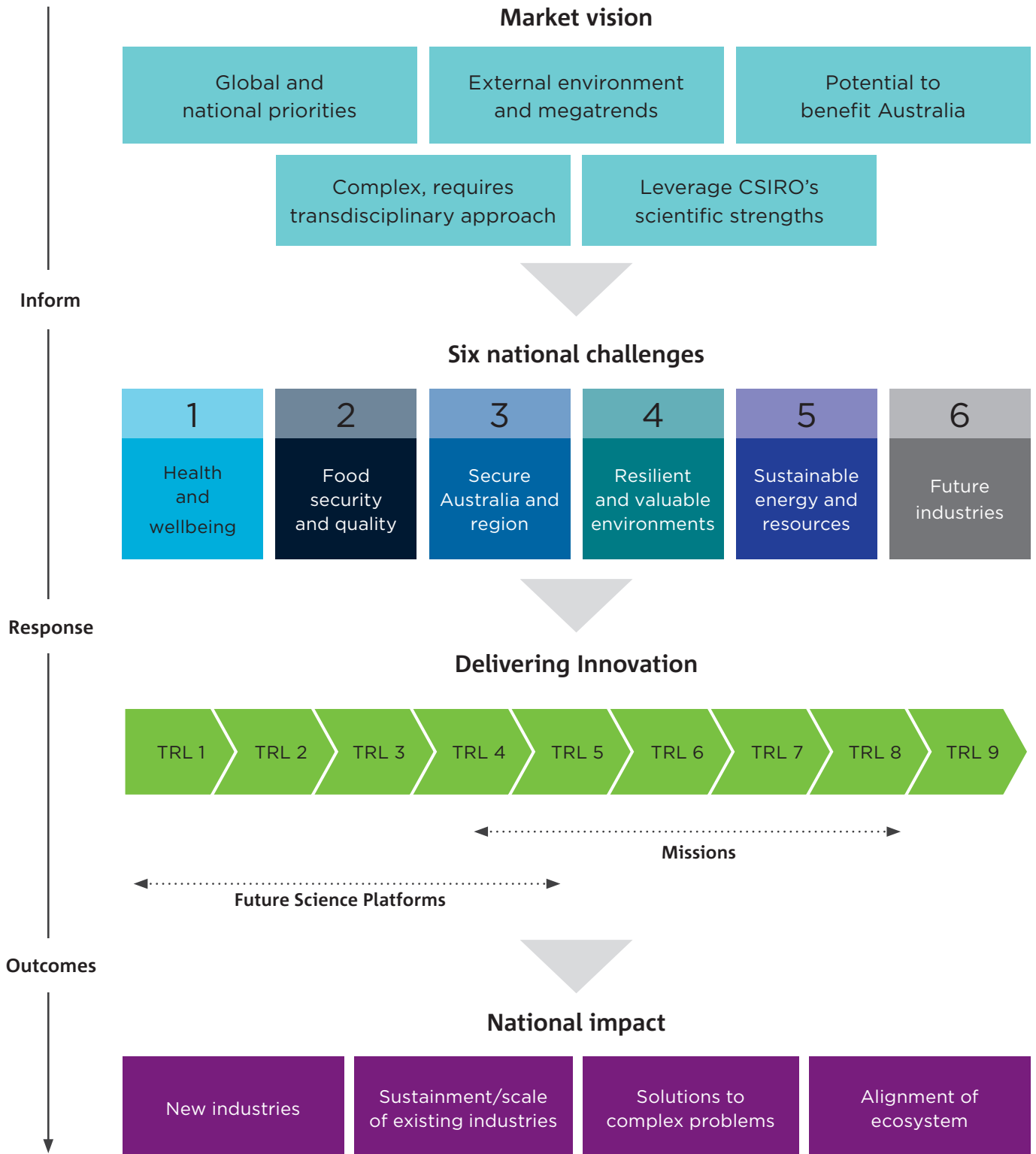
- Electricity transition
- Industry and transport decarbonisation
- Sustainable prosperity from resources
- Value-added critical minerals

Future industries

Create Australia's future sustainable jobs and industries.

- Future high-tech industries
- Transition to sustainable industry
- Strengthen the innovation system

Impact through innovation – CSIRO approach



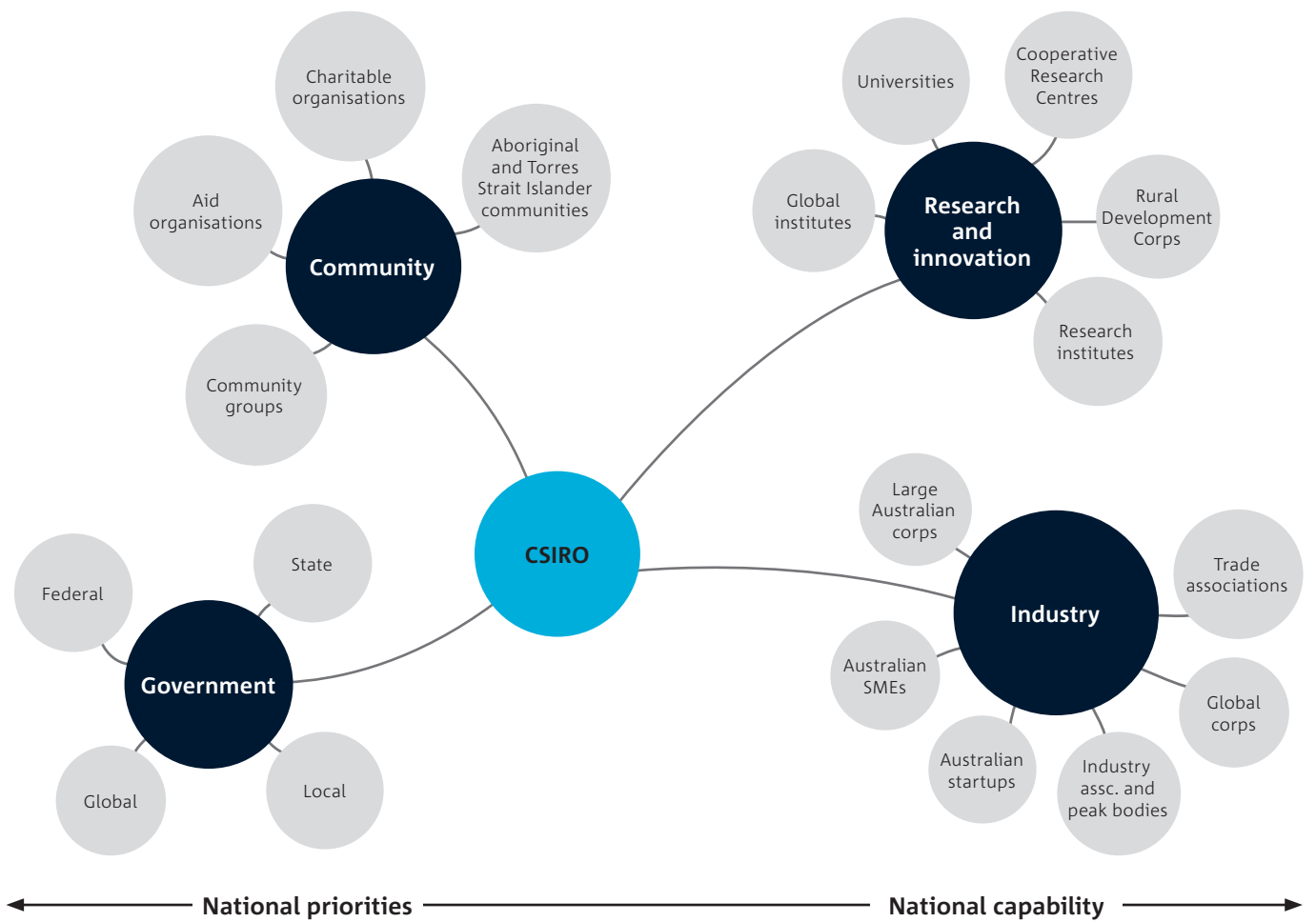
CSIRO's convening ability

CSIRO's ability to convene key actors in the innovation system rests on its unique role. Founded in 1916, CSIRO's remit is to carry out scientific research to assist Australian industry; further the interests of the Australian community; contribute to the achievement of Australian national objectives; and to support Australia's obligations under the Paris Agreement.

In carrying out this remit, CSIRO is well placed as an interface between government and the market and is one of Australia's most trusted institutions – by government, industry and the community.

With 6,000 people and an expansive physical footprint across the country, CSIRO leverages cross-disciplinary expertise in environment, health, digital, agriculture, minerals, manufacturing, and space sectors deploying and monitoring solutions on the ground.

CSIRO's role in Australia's innovation system



CSIRO Missions Program

The CSIRO Missions Program was established in 2019 as the key delivery vehicle to coordinate our interdisciplinary science capability, catalyse new forms of collaboration in the innovation system, and to address its six identified challenges.

The Missions Program builds on our long history of undertaking impact-oriented science and technology and drawing on breakthrough science delivered through

our Future Science Platforms program – a program focused on boundary-pushing science to underpin innovation of the future and invent the foundations of tomorrow’s breakthroughs.

The CSIRO Missions Program builds on this foundation by incorporating capabilities from within and outside CSIRO, fostering entirely new constituencies of actors, and envisaging more sophisticated pathways to adoption.

Missions Portfolio

Health and wellbeing	Food security and quality	Secure Australia and region
Infectious Disease Resilience – stopping the next pandemic by building resilience to zoonotic infectious disease	Trusted Agrifood Exports – growing export premiums of Australian grown food	Catalysing Australia’s Biosecurity – future proofing Australia’s biosecurity threats of pests, weeds and diseases
Minimising Antimicrobial Resistance – securing a future where antimicrobials still save lives	Future Protein – helping capture high-growth global protein markets	Critical Infrastructure Protection and Resilience – growing the resilience of our critical infrastructure systems

Enabling Mission Programs

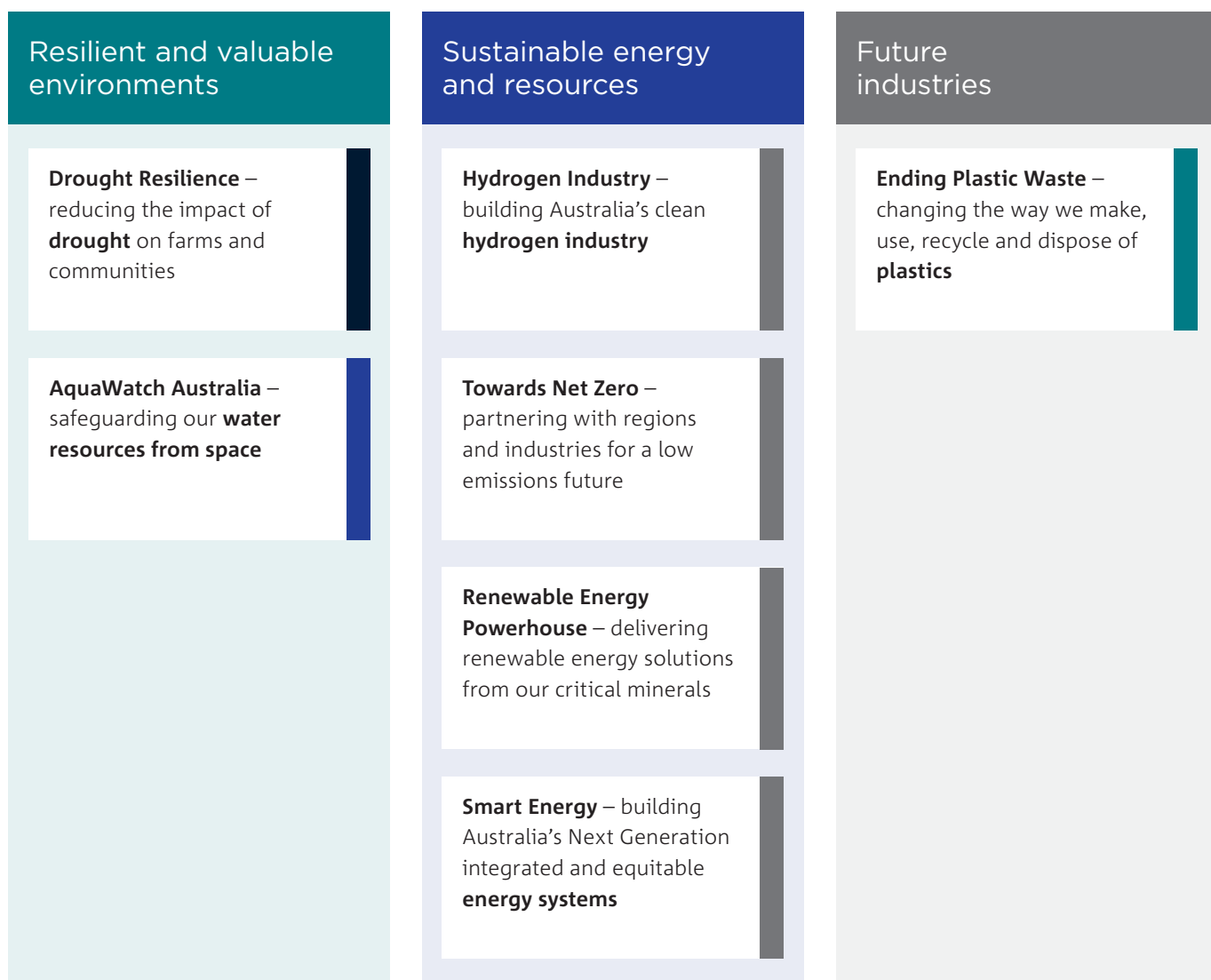
Capturing the opportunities of the **Circular Economy**

CSIRO is seeding a shift towards mission-oriented innovation across the national innovation system by ‘crowding in’ investments of over \$200 million per annum by 2025. As part of accelerating its own strategic change agenda, CSIRO is investing internally over \$50 million per annum.

Crucially, establishment of our Missions Program has taken place without any structural changes to the organisation. Instead, it draws from the impact driven science capability housed in business units within CSIRO.

The Missions Program is designed to align, coordinate and integrate the capability of these business units to achieve a sum greater than its parts.

Guided by a shared goal, the process of crowding in limited resources is necessary to build internal scale within CSIRO and facilitates discussion with external stakeholders about how to cooperate, collaborate and co-invest in solving shared challenges.



Leveraging Australia’s significant **AI** expertise

Strengthening Australia’s **SME Collaboration** with the research ecosystem

2 Choosing missions

Design features

As a multi-disciplinary science agency, CSIRO is engaged in thousands of research and translation activities, including many large-scale and long-term efforts. The choice to pursue a mission rests on considerations of impact, scale and collaboration potential.

A mission is a highly visible, highly participatory portfolio of coordinated science, technology, policy, regulatory and sociotechnical activities, and innovation practices. It aims to deliver scaled solutions to societal challenges, while bolstering the capacity of the innovation system to respond effectively to future shocks by catalysing new capabilities and new forms of collaboration.



Challenge led

A mission responds to an urgent and/or complex aspect of a 'wicked' challenge.



Timebound

A mission has a specific and timebound impact objective, shared by all actors.



Outcomes focused

Mission outcomes are understood in terms of achievement of substantial impact, re-orientation of the innovation system and spillover benefits.



Shared direction

All relevant actors are moving in concert towards the same objective, contributing complementary activity as well as directly collaborating.



Scaled solutions

Missions intervene into the innovation system at scale, incorporating dozens of activities and marshalling over \$100m in investment in their lifetimes.

Selecting new missions

To be considered for initial investment, a mission idea must satisfy CSIRO's Mission Design Principles. The idea must:

- explicitly address a national challenge in line with CSIRO's Challenges Framework
- address a well-defined complex, urgent and systemic problem
- propose solutions proportionate to the problem articulated
- have a credible chance of success
- demonstrate key stakeholder interest in collaborating
- require cross-disciplinary and cross-sectoral collaboration
- explain why CSIRO is the right convener for the mission, and
- draw on and build CSIRO's science, technology and innovation system leadership.

The Hydrogen Industry Mission includes establishing a specialised research facility and capability to handle and process hydrogen at cryogenic conditions. This work is supporting the Hydrogen Energy Supply Chain (HESC) Project which achieved a world-first by demonstrating that liquid hydrogen could be safely produced and transported from Australia to Japan. Credit Vicky Au.



Mission types

Rather than selecting a small number of very large-scale missions to pursue, CSIRO and its partners currently have more than a dozen, either launched or in development, each operating on a 5–7 year timeline.

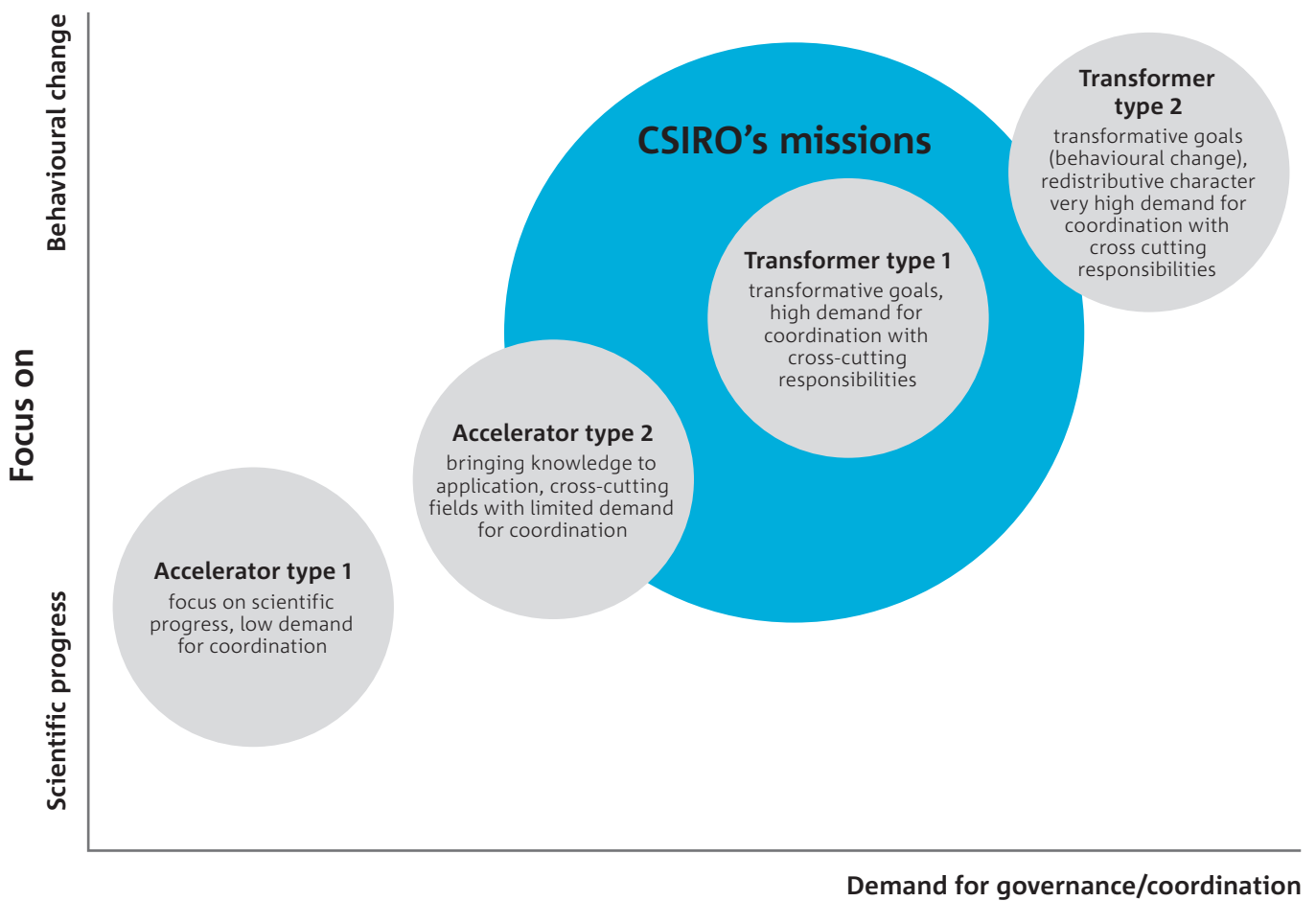
Our experience suggests there are missions of different ‘types’, and the scale of their interventions vary. They also need not act in isolation from one another; they can coordinate to develop complementary interventions and even collaborate on activities and partnerships.

The ‘type’ of mission is not binary; missions exist on a spectrum between those that seek to accelerate the deployment of solutions into the system (**Accelerator missions**) and those that seek to transform how the system itself is configured (**Transformer missions**).

Regardless of which type, both are driven by foundational science and technology that mobilises change beyond these domains.

The mission ‘type’ may not be known from the outset and may shift as the network of mission actors expands, and new perspectives and interests are considered.

Applying ‘mission types’



Adapted from Edler, Wittmann et al (2020). Developing a Typology for Mission-Oriented Innovation Policies.

Case study: Addressing sustainable energy and resources with different mission ‘types’

The challenge of decarbonising our energy systems and industries is exceptionally complex, interdependent and urgent. Rather than seeking to support a response to this challenge with a single mission, CSIRO’s approach has been to invest in both ‘accelerator’ and ‘transformer’ missions. These mission work in concert with one another, focusing on different facets of the challenge and drawing on different scientific and technological capability.

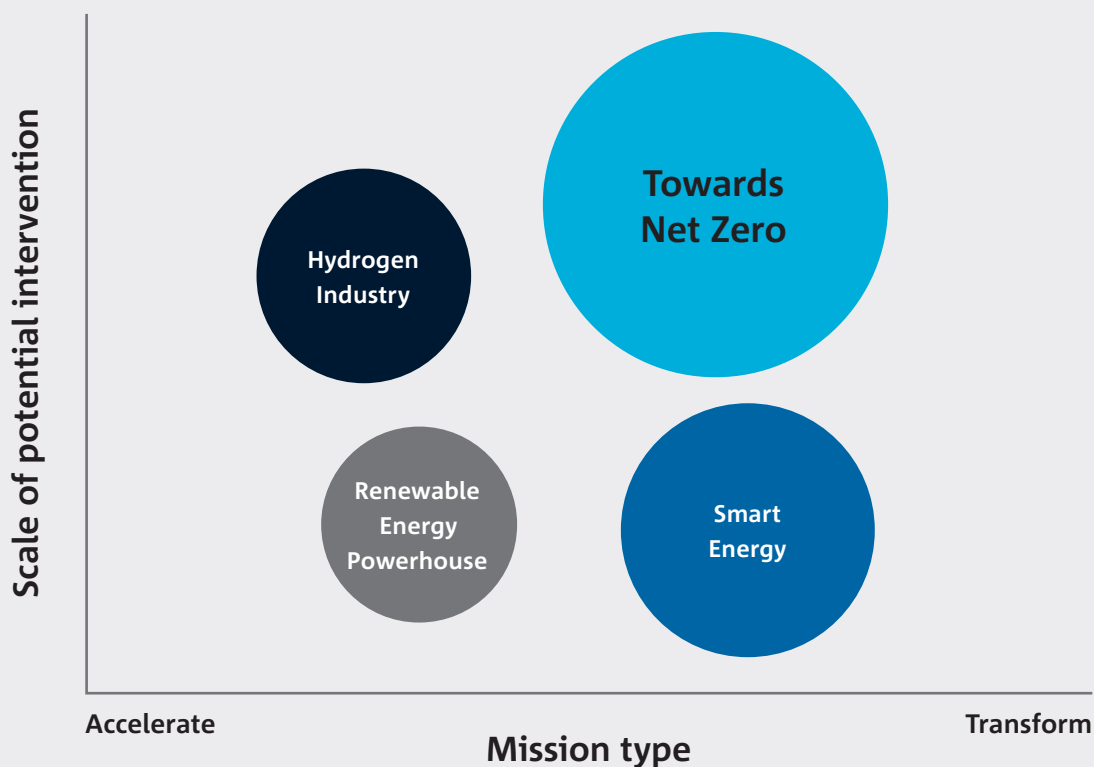
The Hydrogen Industry and Renewable Energy Powerhouse Missions are mobilising science and technology and collaborating across the system to accelerate the creation of new, sustainable resources industries that will be essential to Australia’s energy security and export economy. The Towards Net Zero and Smart Energy Missions are intervening with others to transform existing systems, create new institutional capabilities and deliver social, environment and economic benefit.

In addition to each of these missions having their individual Theories of Change (see p 13) and their own implementation plans, this ‘cluster’ of missions also shares an overarching Theory of Change and several activities are being implemented that cut across these missions.

This approach enables missions to pursue modes of collaboration, investment models and governance arrangements best suited to the facet of the challenge they are solving for. At the same time, it allows CSIRO to identify trade-offs between mission interventions; identify new scaled collaboration opportunities; and understand the impact the missions are having as a collective.



Silicon for solar PV, nickel, lithium, and cobalt for batteries, and rare earth magnets for wind turbines, are all key areas of opportunity.



3 Co-designing missions

As missions in Australia have not emerged through a nationally directed program or with a mandate for a single institution to lead, there are some potential challenges in the design and implementation.

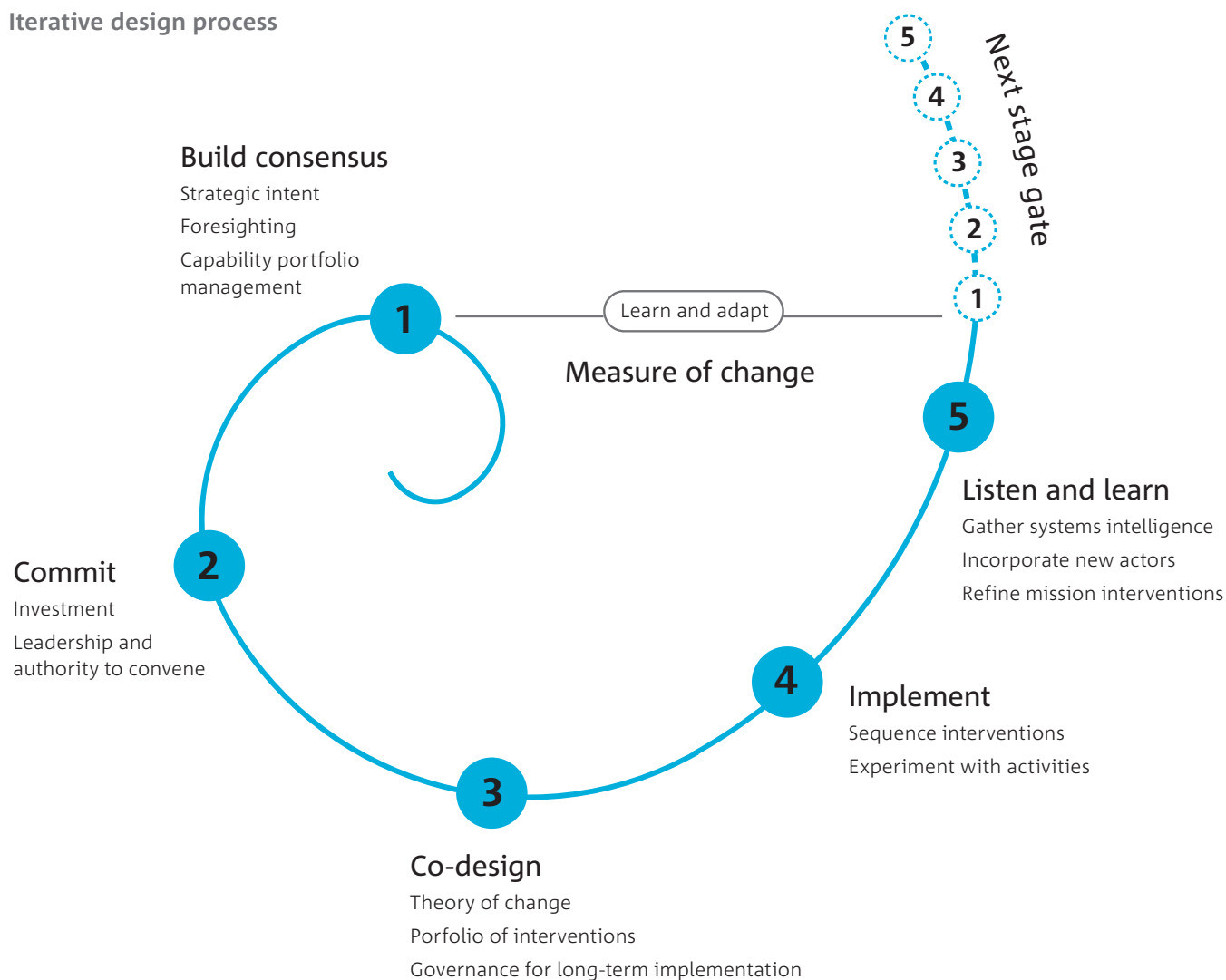
Some of these challenges are:

- an initial bias in the problem framing which tends to preference science and technology pathways over other innovation system strengthening roles
- a need to crowd in substantial investment from a diversity of sources, including investment to fund foundational R&D work, which risks favouring engagement with incumbents and which can make it hard to seek out disruptors, and
- a need to identify and execute on ‘quick wins’ and ‘sure bets’ to deliver returns on investment and show continual progress.

The iterative co-design process seeks to overcome these challenges and mitigate risks of technology lock in, capture by incumbents and implementation bias. This is achieved by the creation of Design Frameworks for missions which prioritise a theory of change process that is regularly re-visited to ensure mission interventions are increasingly effective over time.

This iterative approach is the key distinguishing feature from more traditional frameworks in addressing national challenges.

Iterative design process



Mission design frameworks

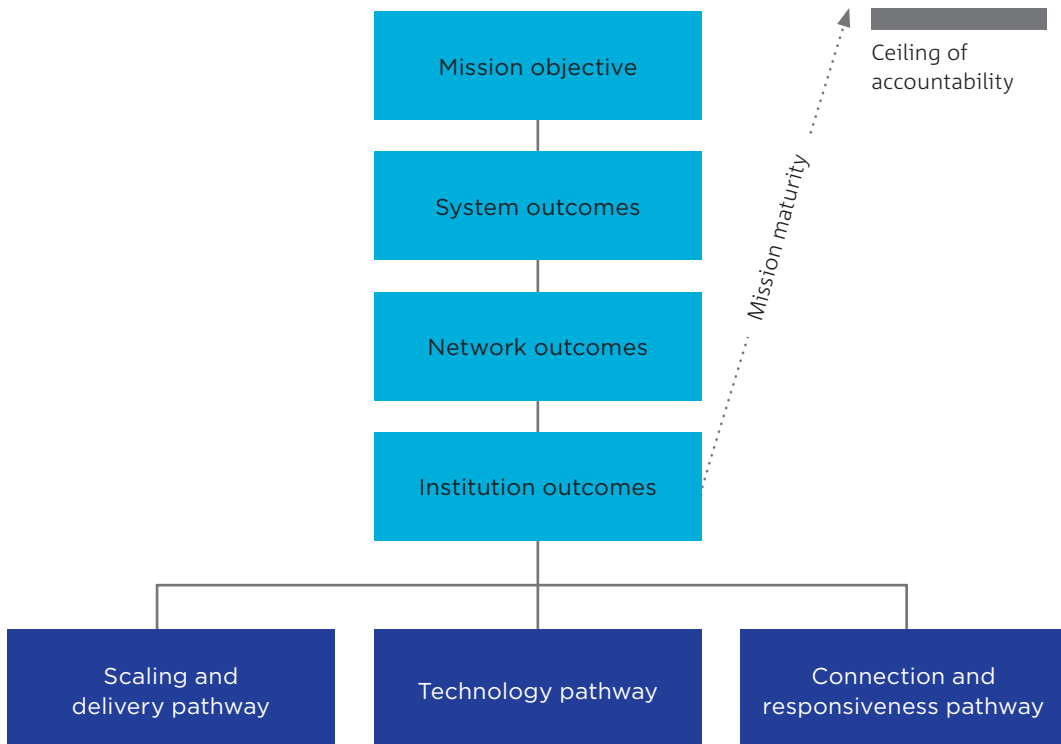
To give structure to the iterative design process CSIRO's Missions Program has adapted existing impact and design tools to address mission-oriented innovation. The Theory of Change framework focuses mission teams on defining the timebound and specific mission objective and describing how the innovation system will need to function to achieve the objective. Intervention pathways are then described. The Mission Design Canvas assists to define the activities that will need to be undertaken to execute the intervention pathways; what resources and capability will be needed; what outcomes are intended. This framework also helps to surface any dependencies or trade-offs between or within interventions.

Theory of Change is an explicit process of thinking through and documenting how a program or intervention is supposed to work, why it will work, who it will benefit (and in what way) and the conditions required for success. It defines long-term goals and then maps backward to identify necessary preconditions.

Theory of Change

- defines the mission objective
- articulates the system, network and institutional outcomes required to achieve the object
- defines multiple pathways to impact
- locates the 'ceiling of accountability', and
- identifies trade-offs, blockers and key risks.

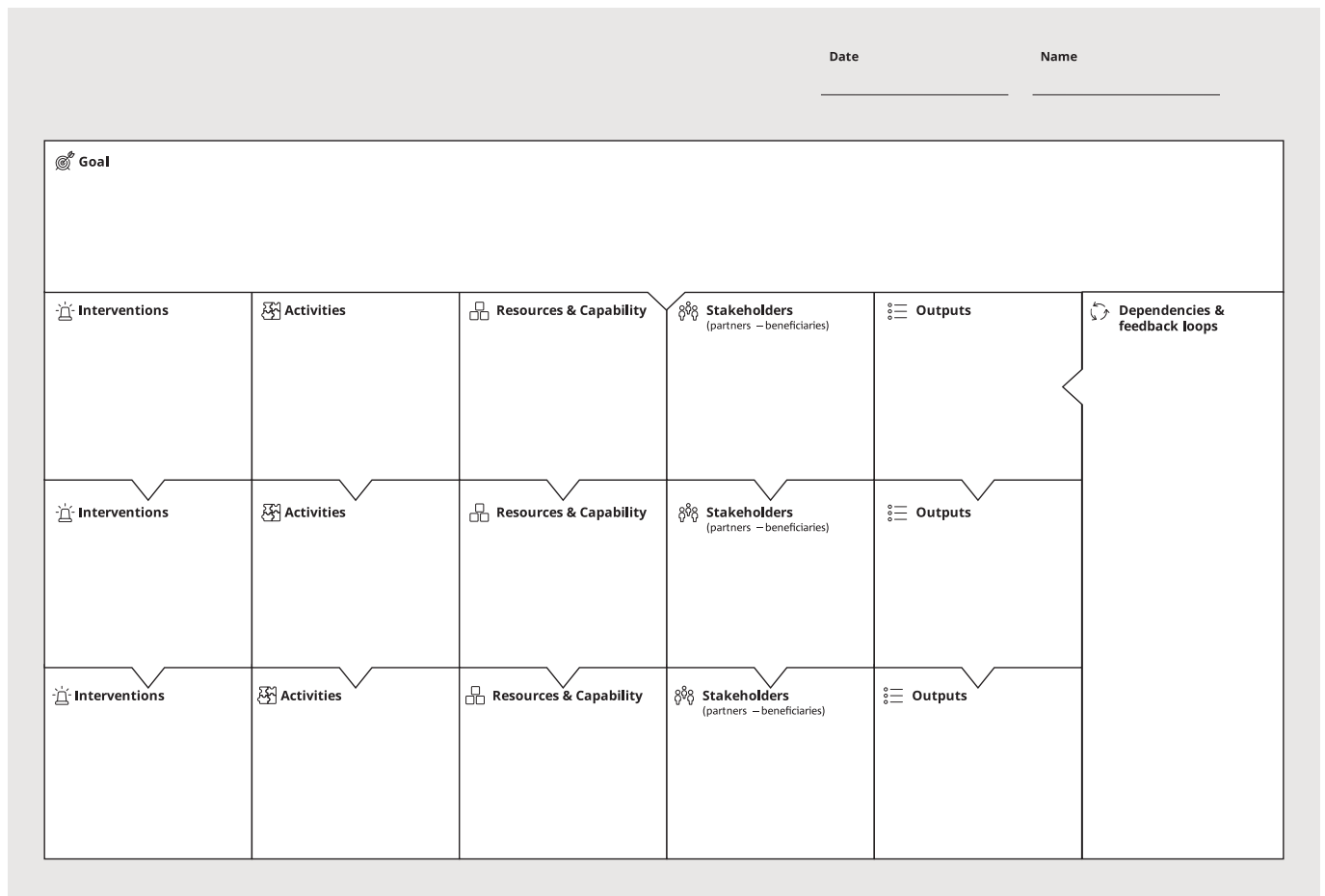
Mission Theory of Change structure



Mission design canvas

- Outlines work packages to operationalise the impact pathways.
- Identifies activities under those work packages in terms of what foundational R&D is required; what is required to scale and deliver solutions and what is required to coordinate activities and respond to system shifts.
- Determines sequencing of activity.
- Outlines key capabilities and resources required (including investment).

Mission design canvas



Iterative design

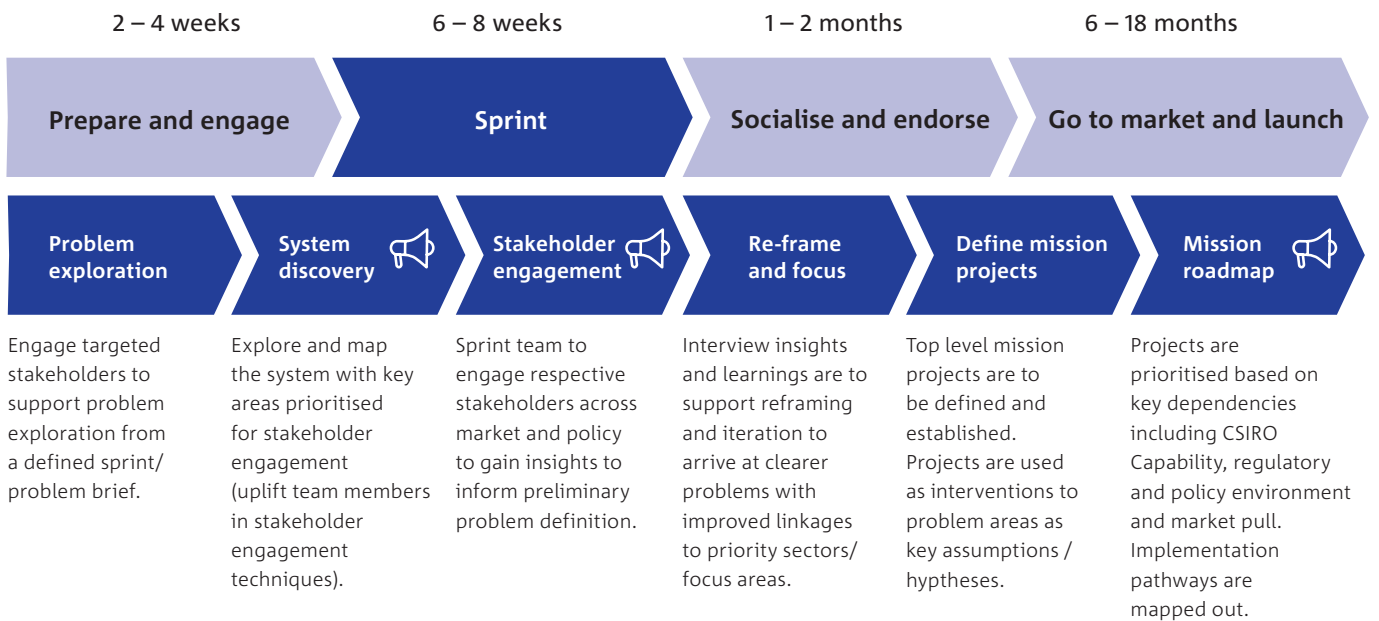
The iterative co-design process is fundamental to ensuring CSIRO Missions effectively mature and scale to include the socio-technical interventions necessary to achieve impact, incorporate new perspectives into their mission design and respond to shifts in the innovation system.

Initial sprint

The first stage of co-design brings together researchers from across CSIRO’s disciplines for an intensive, seven-week design sprint to scope the initial mission concept. The initial sprint intentionally facilitates consensus building among internal stakeholders, validates the mission idea for initial investment and accelerates the mission idea toward launch readiness.

It encompasses problem exploration, system discovery, targeted stakeholder engagement, choices about which facet of the problem to consider, consideration of pathways to impact and concrete interventions required. The output is a proposal presented for initial investment consideration by CSIRO decision makers.

Sprint process



Iterative design to avoid ‘mission drift’

To mitigate against implementation bias and ensure new stakeholders and types of activities are incorporated and interrogate the performance of the mission, CSIRO has implemented a timebound stage gate framework. Ongoing investment is contingent on satisfying design requirements. As outlined in our Mission Design Stage Gates Framework, this builds in a cycle of implementation, evaluation and re-design. The cycles increase in length as missions mature.

Mission design stage gates framework



Case study: Hydrogen Knowledge Centre

A key pillar of CSIRO’s Hydrogen Industry Mission is the Hydrogen Knowledge Centre, a collaboratively designed and developed knowledge-sharing resource to support and inform the development of a clean and competitive Australian hydrogen industry.

The mission has united stakeholders through the shared provision of validated and trustworthy content for the Centre. Collaboration on the first iteration of the Centre helped to secure foundational mission partners from the Australian government, research and industry, and enabled the organic formation of coalitions of organisations active in hydrogen innovation.

The platform’s early success gave the mission visibility and legitimacy. As new collaborators connect with the mission through the Centre, they in turn help to shape thinking, contribute content, and evolve the model.

The Centre amplifies hydrogen activity, including projects that are taking place without direct involvement from the mission or CSIRO, while remaining aligned with the shared purpose of the mission and supporting system-wide coordination.



Hydrogen projects map on Hydrogen Knowledge Centre provides a snapshot of Australia’s hydrogen projects as included in the industry.

Co-designing with collaborators

The design cycle, combined with the stage gates framework, provides clearly signposted opportunities to convene new partners and collaborators, and engage existing partners and collaborators in new ways.

As the mission direction becomes clear through the implementation phase, and as it gains traction and visibility with the external market, mission teams can deliberately engage new partners and re-engage existing ones to refine their ambitions. In the ‘concept’ and ‘planning’ phases this is a high-tempo cycle, growing less so as the mission matures.

Our hypothesis is that this sustained and progressively more inclusive collaboration model enables long-term and meaningful reconfiguration of institutions and supports greater coordination across the innovation system than actors collaborating on the basis of short-term incentives.

Mission partners and collaborators are key agents for change, bringing capability, resourcing, and authority to contribute to the development and legitimacy of solutions. This engagement can expand, depending on the mission, to span policy practitioners, universities and research institutions, businesses, third sector participants and end users in communities.

The involvement of stakeholders throughout the concept and planning phases ensures the design of programs of work, areas of focus and interventions are both feasible and supported by critical constituencies and delivery partners. This serves to increase the legitimacy and likelihood of uptake or translation, and reduce the risk involved in introducing new solutions.

Inclusive engagement, partnership and collaboration

CSIRO delivers research and technology needed to address national challenges. However, missions are focused on complex problems that demand broader sociotechnical responses and capability. CSIRO Missions leverage capacity across the innovation system by convening, partnering, and integrating with others to achieve holistic solutions.

CSIRO Missions are flexible in their collaboration approach. These approaches are specified by the activities and stakeholder preferences for the problems being tackled. By being flexible, the intention is to limit barriers for engagement with actors in the system who have a critical role in building solutions.

There are no formal criteria for affiliation or pre-ordained threshold for partnership in CSIRO Missions. Rather, the model enables various forms of engagement with external organisations committed to supporting and delivering activity consistent with the mission objectives and the underpinning theory of change. This includes in-kind and sponsored contributions spanning:

- **System engagement:** Mission teams are convening trusted international and national sector networks to share information, resources, and drive collaboration.
- **Co-design:** External organisations working with missions as foundational partners, co-designing work packages/activities.
- **Project partnership and translation of innovation:** Mission teams engaging in single and multistakeholder projects with trusted partners, testing and implementing new solutions to be translated to market or embedded into systems of use.
- **Trusted advice from, and for, partners:** Formal and informal mechanisms for providing technical, regulatory, cultural and other advice are informing the activities of missions and partners.
- **Participation in collaborative initiatives:** Strengthening the innovation landscape in Australia through other programs supporting system coordination, missions are involved in collaborative schemes like Cooperative Research Centres, Trailblazer University Program, precincts, and other initiatives.

Critically, each of these relationships can change over time provided there continues to be a shared agenda to solve the challenge identified by the Mission.

Case study: Indo Pacific Plastics Innovation Network

The Ending Plastic Waste Mission formed the Indo-Pacific Plastics Innovation Network (IPPIN), a collective of researchers, innovators and investors who are redefining the lifecycle of plastic from production to recycling. IPPIN is supported by government agencies in Australia, Thailand, Vietnam and Indonesia.

IPPIN emerged through a bilateral commitment between the Australian and Indonesian government to address marine plastics in 2020, which launched the development of an innovation hub linking researchers and industry across both countries. The establishment of the hub

kick-started a conversation with the Mission, which has built on the success of the work with Indonesia and expanded the focus across the region through establishing the Indo-Pacific Plastics Innovation Network.

A co-design process and pilot program was launched in Vietnam in 2022 through the Aus4Innovation program, alongside a broader Mekong sub-regional co-design process with the support of Australia's Department of Foreign Affairs & Trade. In 2023, programs will run in Indonesia, Vietnam and Thailand.



Within the Indo-Pacific region, it is estimated there are between five and ten billion pieces of plastic on the coastline. By 2040, global plastic production is forecast to double. GTM, an Australian-Indonesian team who participated in IPPIN's innovation programs are finding ways to recycle previously unrecyclable plastics and rubber through advanced recycling techniques.

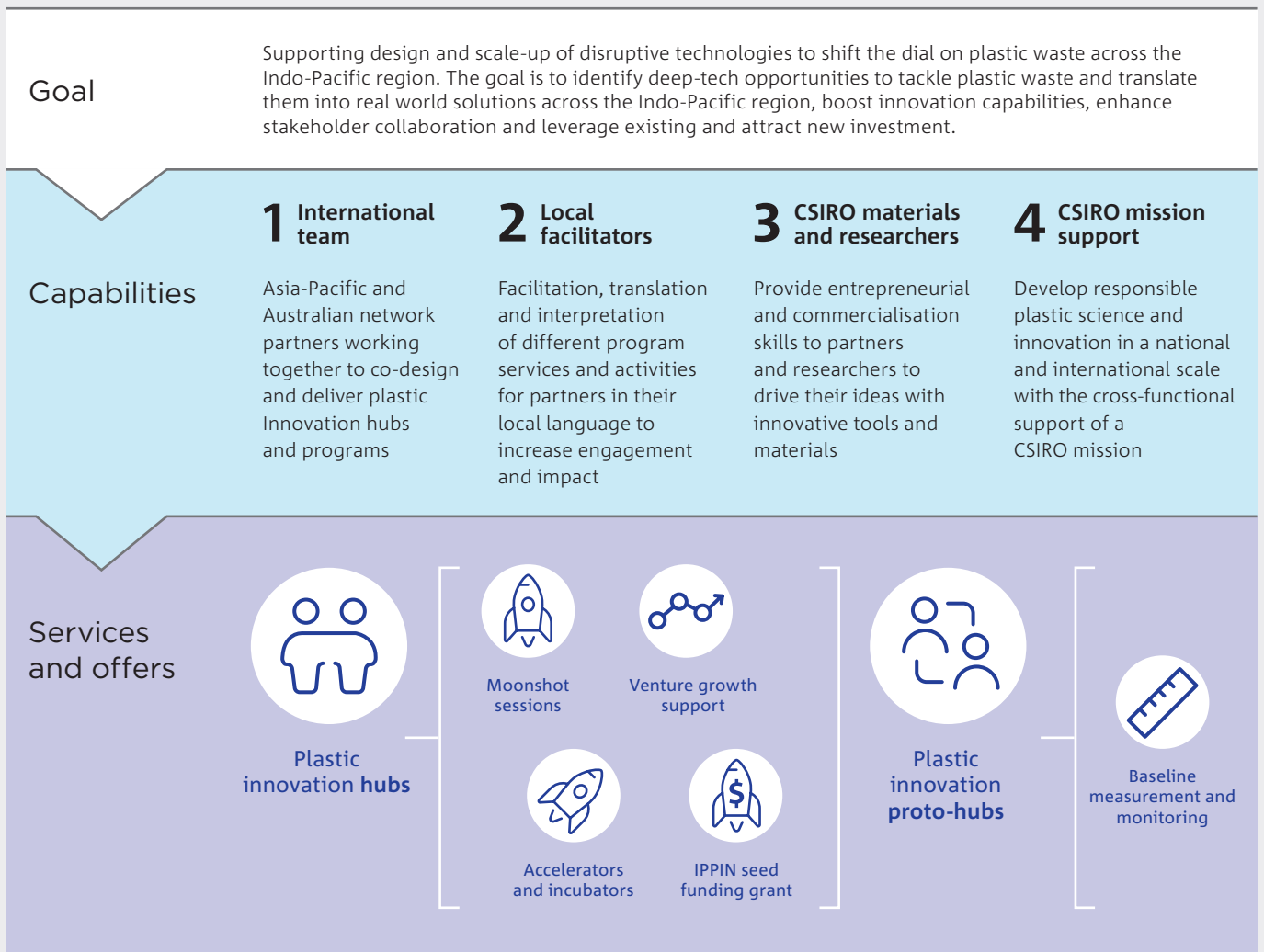


90 billion tonnes of primary materials are extracted and used globally for plastics each year, with only 9 per cent recycled.



CSIRO's Ending Plastic Waste Mission aims to change the way we make, use, recycle and dispose of plastics by transforming them into valuable products.

Indo-Pacific plastics innovation network overview



4 Implementing and sustaining missions

Missions as a portfolio

CSIRO's 'agency-convened' implementation model has allowed the organisation to manage missions as a portfolio, rather than separate and otherwise uncoordinated research programs. This approach is designed to build flexibility and reflexivity into the ongoing management of the program.

The benefits of this approach include:

- **Agility:** The operational insight allows the organisation to respond in an agile way to opportunities and risks for individual missions, as well as identify emerging overlaps, contradictions or pathway dependencies between missions.
- **Deliberation:** The ability to make deliberate trade-offs (between mission scale and type; between the relative emphasis on seeking financial contributions from partners vs seeking impact delivery; and between riskier plays and safer bets) to maintain a robust and legitimate set of interventions.
- **Reflexivity:** The ability to rapidly validate and fast fail new mission ideas without disrupting the overall cohesion or performance of the program.
- **Balance:** The ability to accelerate the deployment of several discrete solutions, but maintain a whole of system view of their impact.
- **Prioritisation:** The ability to plan for new cohorts of missions building on the impact and innovation system conditions created by previous cohorts.

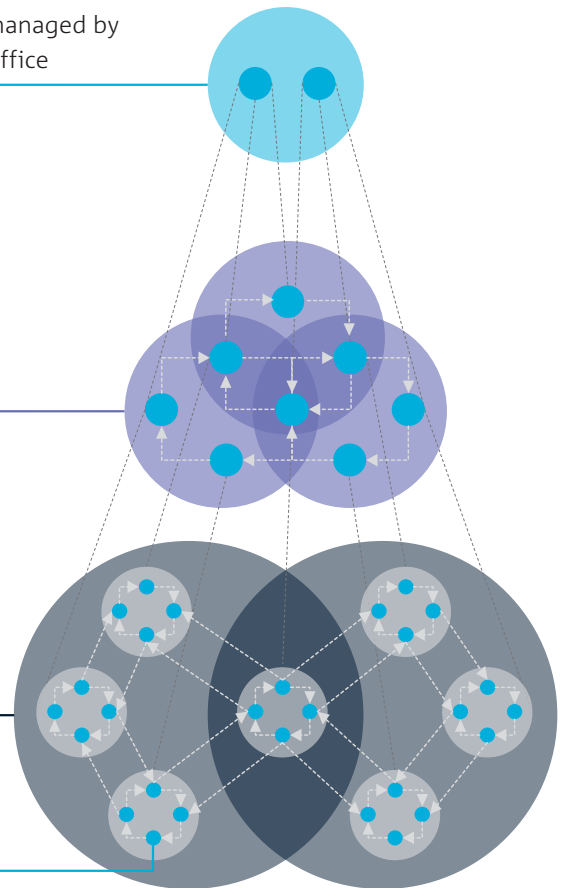
Mission structure

Missions Portfolio managed by Missions Program Office

Mission managed by Mission Lead

Work Package managed by Work Package Lead

Activities managed by project lead



Case study: Future Protein Mission

The Future Protein Mission aims to leverage increasing global demand for high quality protein and create new Australian protein products and ingredients that will earn an additional \$10 billion in revenue by 2030. It balances a portfolio of industry creation opportunities in animal protein, plant protein and novel protein that require different levels of risk, technology development and infrastructure investment. Its work packages allow the mission to target different industry segments, advocate for industry newcomers, and reassure incumbents there is room in the market for complementary products.



Supercharging the plant-based protein industry is an area of focus for the Future Protein Mission. Dr Sally Buck is working on developing nutritious plant-based proteins as part of our Future Protein Mission.

Mission structure

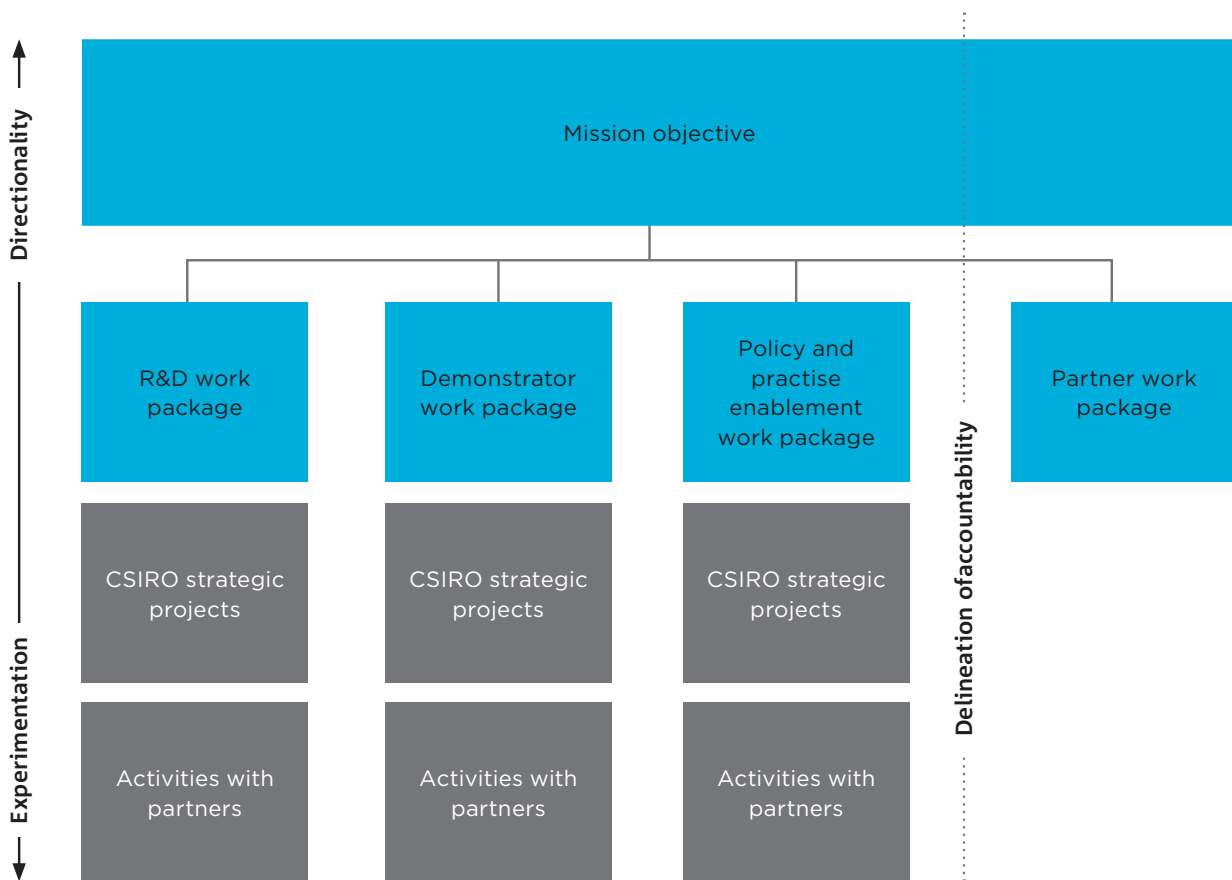
CSIRO missions are structured as ‘portfolios within portfolios’. The mission objective is served by a portfolio of mutually reinforcing work packages or focus areas, which in turn are made up of a portfolio of discrete activities – both existing and new.

This ‘nesting’ allows for a stable overarching mission objective that provides necessary directionality to the efforts of mission actors, while allowing for experimentation in terms of the composition and nature of the work packages and the activities that sit under them. In turn, high risk and experimental activities and work packages can be balanced against more predictable and stable ones without jeopardising the entire endeavour.

This portfolio approach also allows for sequencing of work packages so some pathway dependencies are accounted for (for example, foundational R&D or feasibility studies that create the necessary preconditions or knowledge for future interventions).

It also correlates with the Mission Theory of Change, with pathways to impact mirrored in the nature of the activity undertaken in a work package. The delineation of delivery responsibility between partners reflects the ‘ceiling of accountability’, allowing each organisation to effectively manage its resources and risk appetite while still contributing to the mission objective.

Mission structure



Managing missions

Mission team

A mission's team structure often mirrors the design structure of the mission itself. Each CSIRO mission is helmed by a Mission Lead, a research leader with exceptional stakeholder engagement and business skills, as well as the ability to define the mission's strategy and implementation plan.

To deliver the mission's activities, the Mission Lead must convene interdisciplinary research teams – the source of internal science and technology capability – in circumstances where they have no formal management responsibility for those researchers. In this respect, convening internally is not dissimilar to the task the Mission Lead must perform in the external system. In both cases it is critical that the Mission Lead can articulate a clear and compelling vision for change and strategy for the mission.

Arrangements differ by mission, but often the Lead is supported by a Deputy, who shares responsibility for the mission strategy and stakeholder engagement, and by Work Package Leads who manage their discrete portfolios of activities. Again, Work Package Leads are often overseeing Project Leads without any formal management responsibility.

Each mission is supported by personnel from CSIRO's enabling functions, including those with expertise in communication, business development and external engagement.

Missions Program Office

The Missions Program Office supports each mission from inception to offboarding with strategy, design, implementation, and evaluation – acting as an interface between the mission teams and CSIRO leadership. The Office is not 'mission control' but has three distinct functions: empowering mission teams with consistent approaches to their program design; management of missions within the portfolio of the CSIRO Missions Program; and supporting individual missions to articulate their strategic intent, pursue implementation and facilitate culture change.

The Missions Program Office is itself guided by a **Cross-Mission Steering Committee**. This committee has oversight of the Missions Program and is responsible for decisions regarding the number and scale of missions that can be supported within the portfolio. The Cross-Mission Steering Committee also plays a portfolio management role where it makes assessments on which missions need more or less support and considers trade-offs with other organisational priorities.



Members of the Drought Resilience Mission team who are reducing the impact of drought on farms and communities.

Governance bodies

Governance arrangements for missions have been established to balance the need for shared vision and accountability against the prerogative of each individual mission actor to make investment and resourcing decisions. Each governance body also gives legitimacy to the choices made in the mission strategy.

Each launched mission has an **external advisory group**, comprising key stakeholders, foundational partners, subject matter experts and system disruptors. The role of the advisory group is to advocate on behalf of the mission, influence other innovation system actors, provide strategic advice and synthesise key systems intelligence.

The **internal steering committee** is responsible for endorsing the case for CSIRO to invest in the mission. It comprises key CSIRO executives who oversee the resource and capability allocation necessary for mission success. Without buy-in from the owners of the capability and the programs of work that can either be deployed in or shaped to support the mission, each mission would fall over.

The steering committee provides ongoing strategic advice, identifies and resolves risks, dependencies and barriers to success, supports the mission partnership efforts and advocates internally for effective resourcing.

The formation of this steering committee unlocks access to the seed investment each team receives to enable them to operate their mission.

Funding missions

Each mission receives seed funding from CSIRO, which is determined based on performance of the Missions Program's Stage Gate Requirements. Mission teams have a degree of latitude about the use of seed funding, but it is intended to support the delivery of activities and hiring of staff not otherwise covered through CSIRO's existing research and enterprise business units. It also signals to internal and external stakeholders that we are committed to the mission, which allows stakeholders to plan with a degree of confidence in ongoing investment from CSIRO. This funding allows missions in the later stages of their maturity to administer small grants to facilitate greater real-world deployment of activities to support each mission's objectives.

Missions also have access to the Missions Co-Investment Fund, a separate allocation of CSIRO funding to be used for high risk, high impact activities that are critical to the missions' strategies, have an external partner willing to co-invest funding, and would otherwise not be undertaken by CSIRO. Applications for this funding are accepted and assessed as part of a regular funding call, and determinations made by the Cross-Mission Steering Committee.

5 Understanding mission performance

Understanding the change missions are catalysing in complex and dynamic systems – and answering what of that change is attributable to the mission itself – is one of the biggest challenges facing mission implementation.

Conceptual challenges include effectively baselining the characteristics of dynamic and complex systems, and attributing change in these contexts to a given activity or strategy. ‘Directionality’ is also hard to define and requires clearly articulating the distinctions between indicators of innovation system alignment, coordination and integration.

Practical challenges result from the sheer scale of mission interventions, with multiple portfolios of projects and engagements being undertaken simultaneously. Keeping track of all of the outputs and outcomes from CSIRO’s mission activities and understanding the interactions, feedback loops and trade-offs between them is challenging enough, but mission teams also encounter knowledge barriers about their external partners’ contributions.

Given this complexity, there is a risk of defaulting to indicators that are merely easiest to quantify and track – namely direct financial investment into missions and the impact of scientific publications.

While these are important indicators, they constitute only two aspects of value creation.

To address this, the Missions Program Office developed a framework for understanding mission performance across four key areas:

- **Strategic impact:** How aligned is the portfolio to key national priorities and how well are individual missions delivering the outputs and outcomes theorised as necessary to achieve impact?
- **Portfolio health:** What is the level and kind of investment into missions? By whom and over what time period? Are missions on a growth trajectory?
- **Internal alignment:** Are CSIRO’s people committed to missions? What kind of resources are being contributed internally? Are missions delivering on the organisation’s priorities?
- **External collaboration:** Is the innovation system engaged in the mission? Are stakeholders actively contributing?

Individual missions contribute to twice-yearly reporting on the progress of the whole portfolio by reporting on their own progress against their Impact Pathway indicators, which track progress towards defined environmental, social and economic outcomes.

Nevertheless, as missions have moved to implementation phase and the program overall has matured, it has become apparent that existing arrangements need to be optimised to better capture the ‘additionality’ of missions and to understand how mission design may be improved.

The Missions Program Office's approach is still developing, but work has begun to define five dimensions of additionality, grounded in the essential premise that by orchestrating system directionality, missions can accelerate the achievement of the desired impact:

- **Acceleration:** What accelerated progress towards achieving mission objectives can be discerned?
- **Orchestration:** In what ways is innovation system function improving? Are we seeing indications of aligned, coordinated and/or integrated action from system players?
- **Spillovers:** What are the fortuitous scientific, technical, societal and organisational innovations that have emerged as a result of mission implementation?
- **Mission configurations:** What are we learning about how different mission 'types' intervene differently to achieve impact, and how might that inform current and future missions?
- **Mission Portfolio configurations:** In what ways are our missions coordinating with one another to orchestrate system directionality or hindering one another's efforts and how should this inform decisions about the redesign of existing missions or design of new ones?

In navigating the practical complexity of setting and measuring indicators, the Office will be guided by what is most important to understand about missions progress and what is most feasible to track and will seek to implement a rapid and reflexive learning system. This approach recognises that not all change is capable of being quantified or attributed, especially in complex and dynamic systems, and that understanding mission progress is important not just for accountability but for enacting what has been learnt, through the iterative design process.

Implementing this change will require the development of new organisational attitudes to performance and risk. We will need to incorporate new knowledge systems and be comfortable with a degree of uncertainty and change in our approaches.

This is very much in keeping with the mission ethos; a constructive challenge to status quo approaches and attitudes, open to new perspectives and focused on collective impact.

Case study: Indigenous cultural indicators of drought

CSIRO's Drought Resilience Mission aims to reduce the economic impacts of drought in Australia by 30%. Aboriginal and Torres Strait Islander peoples have unique ecological knowledge of the land and water systems across Australia that are central to understanding the impacts of drought, and innovations to build drought resilience.

Indigenous data, information and knowledge are key to managing Australia's environment and ongoing stewardship of country. This has implications for building drought resilience and achieving the mission's goal.

The Drought Resilience Mission is working with Indigenous scientists and communities to establish a baseline of cultural indicators of drought impacts; understand what is needed to build resilience; inform decision making; and measure the impact of the mission.



Vegetation loss and soil erosion from drought can lead to hazardous dust storms and poor air quality.

6 Tools and resources

Mission design principles

The CSIRO Mission principles provide a defined set of parameters to guide and inform the development, prioritisation and investment in missions.

Should we?

Challenge aligned

Missions explicitly address National Challenges

How does the mission respond to one or more CSIRO Challenges?
How does the mission respond to national policy priorities?
What future trends/strategic priorities does it address?

Complex, urgent, systemic problem

Missions solve our most complex, urgent and systemic problems

What is the precise nature of the problem the mission seeks to solve?
How is the problem complex, urgent and/or systemic?
What other interrelated problems and/or dependencies exist?

Big, bold and ambitious solution

Missions are big, bold and ambitious

What scale of solution is required to solve the problem?
How long will it take? (solution must be time-bound)
What is the estimated lifetime expenditure?
If successful, how will it shape Australia's future and who will benefit from it?
What is the risk if we don't do it?
How will it inspire Australians, our people, our partners?

Credible impact

Missions must have a credible chance of success

How is this mission game-changing for CSIRO and Australia, and how will it provide a sustained impact?
What is the specific issue being addressed, what does success look like and how will the goal be measured?
Why is this mission the best or only way to achieve the desired outcome?
What are the key milestones to assess performance and how will we know if we are on track to achieve the mission objective?

Collaborative

Missions involve cross discipline, cross sector and cross-system collaboration

Why is cross-discipline / sectors /actors collaboration required?
Which BUs are collaborating across CSIRO – what is their role?
Who are external partners and how will they co-design / contribute? How will bottom-up innovation across the system be encouraged?

CSIRO right catalyst

CSIRO is the right convener of the innovation system for this mission

What role does CSIRO have in convening the stakeholders to deliver the Mission?
Do we have legitimacy to lead today or would this require CSIRO to co-lead in partnership with another significant stakeholder?
Why is public-sector involvement required in terms of creating new value or addressing market failure?

Science and tech leadership

Missions draws on and builds science and technology leadership

What scientific breakthroughs are required to deliver on the mission?
What scientific capabilities do CSIRO and the broader Australian research ecosystem require to deliver on the mission?
Can these scientific capabilities be brought to bear on other problems/opportunities?
What is the current state of research in the field(s)?

Can we?

Funding

Funding is critical to the success of missions

What funds have / will BUs deploy? What other funds are sought? Why will it 'crowd in' funding, who are potential external funders? What has been secured? What are we doing to make the case?

Resourcing

Missions need the right people and infrastructure to succeed

Who is best placed to lead the mission and why?

What capabilities / infrastructure (data, HPC, physical) are needed to achieve this mission?

What capabilities and infrastructure has been secured?

What are the gaps and what is the plan to fill them? Why do you think we will succeed in securing what we need? What are the risks?

Momentum

Missions need to get off the drawing board and get traction

Where is the mission at today?

What do we need to do to progress? What are we waiting for?

What are the barriers to action – how will we overcome them?

What are the go or-no-go checkpoints?

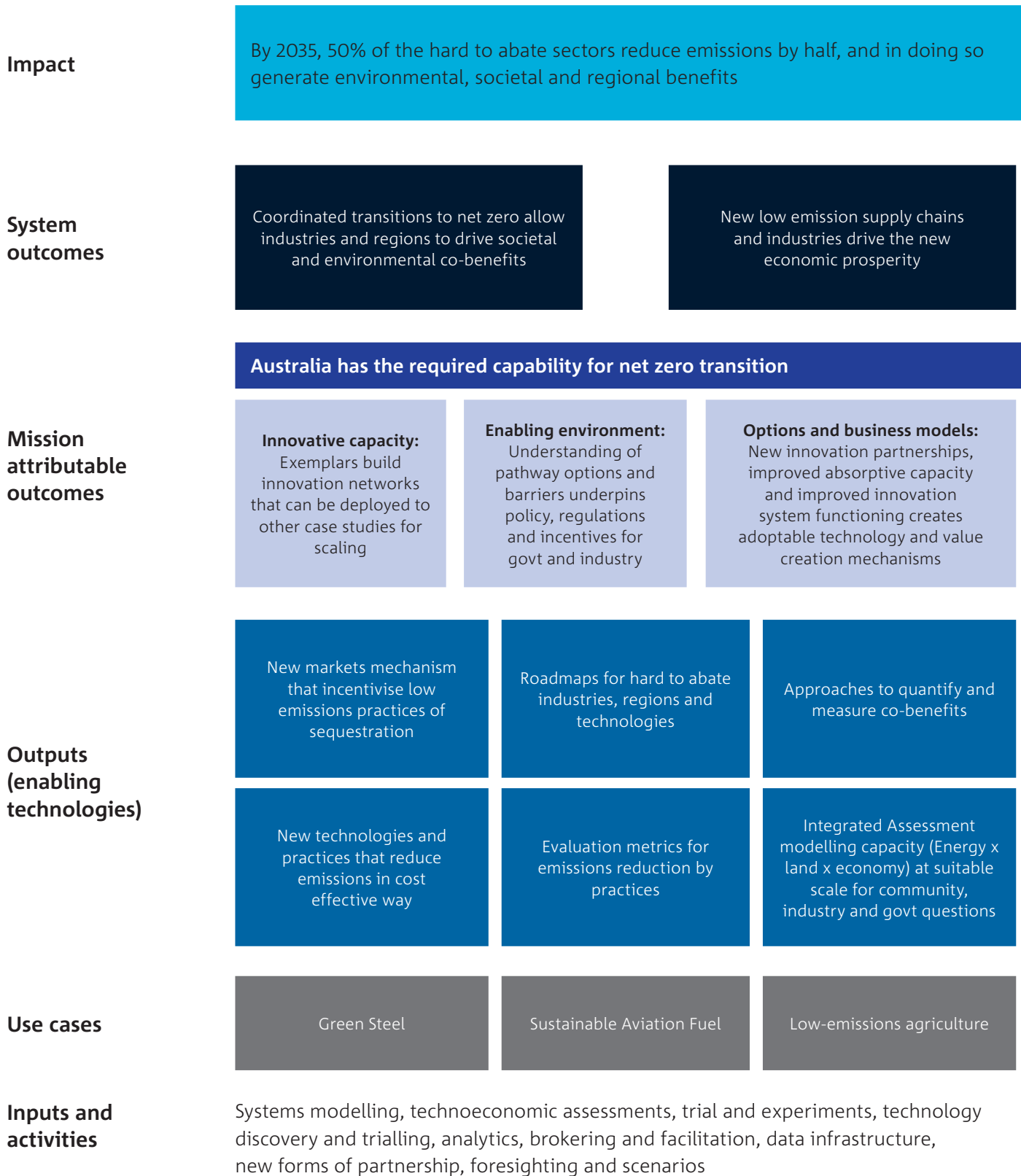
Risk

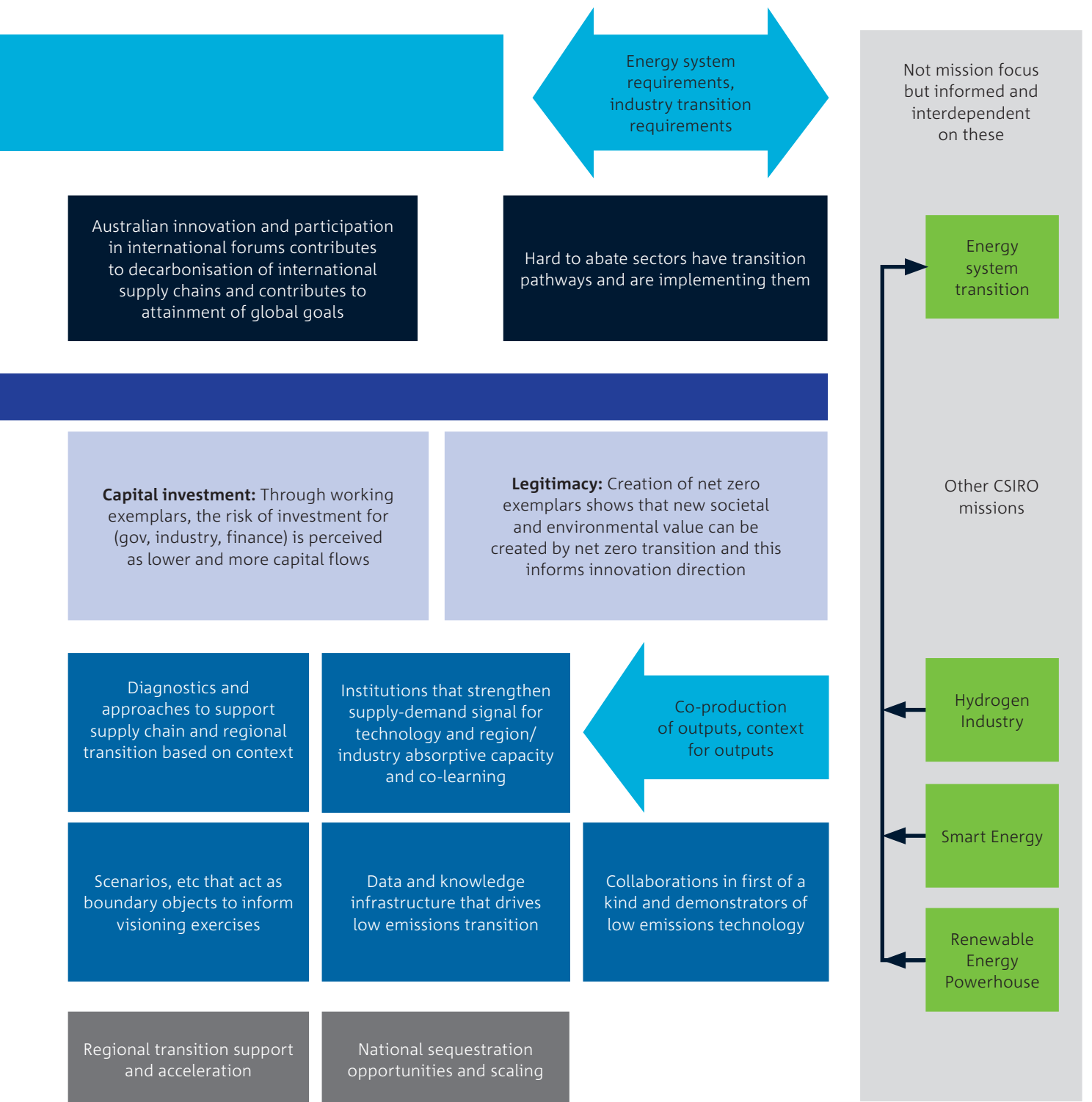
Missions by their nature carry high risk to be managed

What are the key risks?

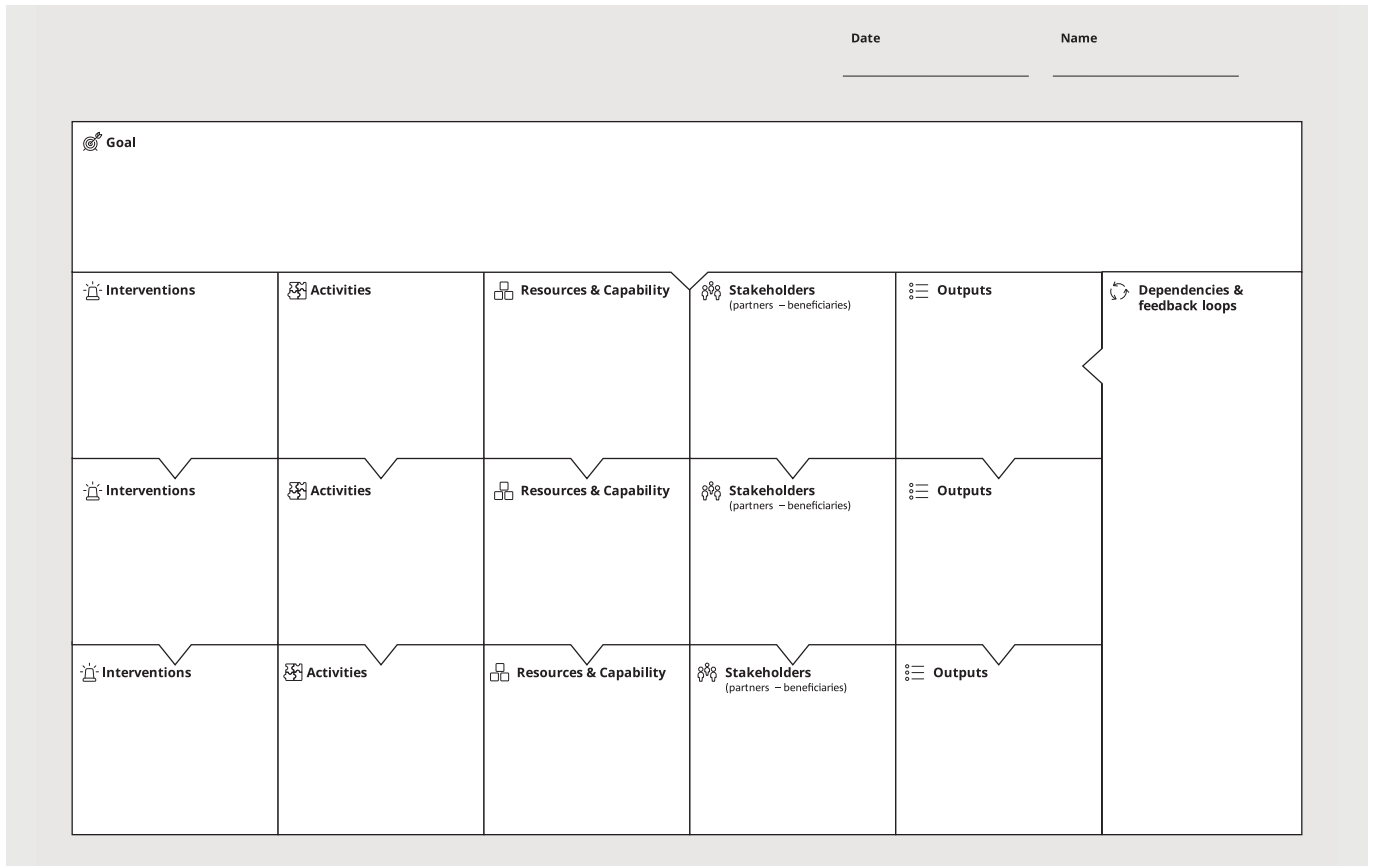
What are the limitations of the science (if resources were unlimited)?

Theory of Change framework – worked example using Towards Net Zero Mission

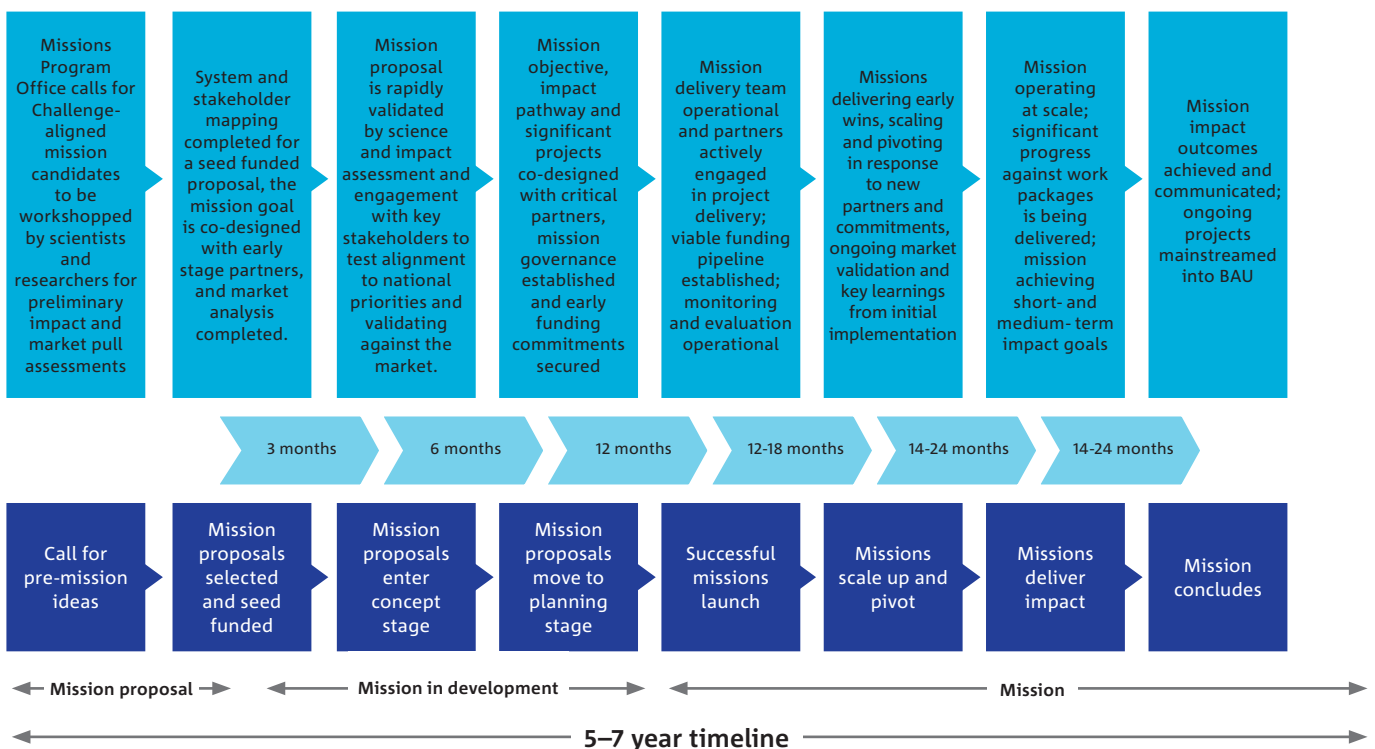




Mission design canvas



Stage gates framework



Glossary of terms

Challenge: A difficult but important, systemic and society-wide problem with no ‘silver bullet’ solution.

Cooperative Research Centres (CRC): Australian Government Grants provided funding for medium to long-term, industry-led research collaborations. They are a collaboration between at least one Australian industry organisation and one Australian research organisation.

Future Science Platforms (FSPs): CSIRO’s investment into boundary-pushing science that will underpin innovation of the future and has the potential to help reinvent and create new industries for Australia. FSPs focus on Horizon 3, frontier science beyond the CSIRO’s business as usual activity.

Measurable: Quantifiable with existing metrics, or achievements that are evidently yes or no.

Mission: A concrete target, achievable step towards a challenge that contextualises projects.

Mission Lead: Leading the design and build of the mission.

Project: A single, isolated, clearly defined innovation activity.

Sector: A defined category or subdivision of economic activity.

Spill-over: Technological, intangible or other innovation finding a use and value beyond that originally intended.

Time-bound: Constrained by a hard deadline.

Trailblazer University Program: An Australian Government funded program to build new research capabilities, drive commercialisation outcomes and invest in new industry engagement opportunities.

Resources

Observatory of Public Sector Innovation Toolkit Navigator (<https://oecd-opsi.org/toolkit-navigator/>)

Transformative Innovation Policy Consortium Online Resources (<https://www.tipconsortium.net/learning/online/0>)

United Nations Development Program’s Strategic Innovation Unit Toolkit (<https://unstuck.systems/system-approaches-toolkit/>)

United Nations Development Program’s Strategic Innovation Unit Medium page (<https://medium.com/@undp.innovation>)

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