

# The Value of CSIRO

## The Broader Impact of CSIRO's Portfolio of Activities

2024 Update



*Prepared for*  
**CSIRO**  
GPO Box 1700  
Canberra ACT 2601  
Australia



*Prepared by*  
Harmeet Kaur

**Tractuum**  
Ridgewood Drive  
Brookwater QLD  
4300 Australia



Amanda C. Walsh  
Jonathan Merker

**RTI International**  
3040 E. Cornwallis Rd.  
Research Triangle Park, NC  
27709, USA

---

# Contents

<b>SECTION</b>	<b>PAGE</b>
<b>ES EXECUTIVE SUMMARY .....</b>	<b>1</b>
CSIRO's Economic Impact.....	1
CSIRO's Impact Maturity.....	1
Current Performance .....	2
Key Lessons for Guiding Future Improvements .....	2
Priority Action Items.....	4
Conclusion.....	4
<b>1 INTRODUCTION.....</b>	<b>5</b>
1.1 Background .....	5
1.2 Report Objectives .....	8
1.3 Methodology.....	8
Data Collection .....	8
Data Analysis .....	9
Limitations.....	9
1.4 Report Structure.....	9
<b>2 ESTABLISHING THE VALUE OF CSIRO .....</b>	<b>10</b>
2.1 Quantifying the Value of CSIRO .....	10
2.2 Additional Metrics of Impact .....	12
<b>3 CSIRO'S IMPACT CAPACITY: AN ECOSYSTEM ANALYSIS .....</b>	<b>15</b>
3.1 Impact Maturity Model.....	15
3.2 Internal Environment – Resource Capitals Framework Analysis.....	15
3.3 Impact Translation – Engaging with the External System .....	27
3.4 Striving for Continuous Impact Maturity Growth.....	29
<b>4 FUTURE DIRECTION.....</b>	<b>34</b>
<b>A APPENDIX.....</b>	<b>35</b>
A.1 Impact Case Study Portfolio Details.....	35

---

# Figures

<b>SECTION</b>	<b>PAGE</b>
E.1: CSIRO’s Impact Maturity Analysis Based on the IMM: From Identification to Progress .....	1
1.1: CSIRO’s Impact Maturity Model.....	6
2.1: CSIRO Staff per State and Territory.....	13
3.1: CSIRO’s Impact Maturity Analysis Based on the IMM: From Identification to Progress ....	29
A.1: Benefit and Cost Data for Each Study by Year and Type (Actual vs. Projected).....	41

# Tables

<b>SECTION</b>	<b>PAGE</b>
E.1: Strengths and Areas for Development Relating to CSIRO’s Impact Maturity .....	2
E.2: Five Key Lessons to Inform the Continued Growth of CSIRO’s Impact Maturity .....	3
E.3: High-Priority Action Items to Improve CSIRO’s Impact Maturity .....	4
1.1: CSIRO’s Impact Maturity Model – Six Capitals for Determining Impact Capacity.....	7
2.1: Number of CSIRO Impact Analysis Case Studies Reviewed and Included in the Analysis for Each Value of CSIRO Report Since 2020 .....	10
2.2: Summary of Impact Case Study Portfolio Analysis Results for the 2020, 2022, and 2024 Value of CSIRO Reports .....	11
3.1: Areas of Strength and Development for CSIRO’s Impact Maturity.....	30
3.2: Five Key Lessons to Inform the Continued Growth of CSIRO’s Impact Maturity .....	32
3.3: High-Priority Action Items to Improve CSIRO’s Impact Maturity.....	33
A.1: High-Level Summary of CSIRO Impact Case Studies.....	35

## LIST OF ACRONYMS

<b>ACDP</b>	Australian Centre for Disease Preparedness
<b>ACOLA</b>	Australian Council of Learned Academies
<b>APaIR</b>	Annual Performance and Investment Reviews
<b>APSIM</b>	Agricultural Production System sIMulator
<b>ARISA</b>	Applied Research and Innovation System in Agriculture
<b>ASKAP</b>	Australia Square Kilometre Array Pathfinder
<b>ATNF</b>	Australia Telescope National Facility
<b>AUD</b>	Australian Dollar
<b>BCA (also CBA)</b>	Benefit-Cost Analysis (or Cost-Benefit Analysis)
<b>BCR</b>	Benefit-Cost Ratio
<b>BRTOBP</b>	Benchmarking of Research and Technology Organisations' Business Processes
<b>CETO</b>	Cylindrical Energy Transfer Oscillator
<b>CIE</b>	Centre for International Economics
<b>CPI</b>	Consumer Price Index
<b>CRI</b>	Commercial Readiness Index
<b>CSIRO</b>	Commonwealth Scientific and Industrial Research Organisation
<b>DAA</b>	Dietitians Association of Australia
<b>DAE</b>	Deloitte Access Economics
<b>DAP</b>	Data Access Portal
<b>EAD</b>	Emergency Animal Disease
<b>EASI</b>	Earth Analytics Science and Innovation
<b>ECR</b>	Early Career Researcher
<b>EO</b>	Earth Observation
<b>EU</b>	European Union
<b>FMD</b>	Foot-and-Mouth Disease
<b>FSP</b>	Future Science Platform
<b>FTE</b>	Full-Time Equivalent
<b>FY</b>	Financial Year
<b>GDP</b>	Gross Domestic Product
<b>GHG</b>	Greenhouse Gas
<b>GRDC</b>	Grains Research and Development Corporation
<b>IMM</b>	Impact Maturity Model
<b>IP</b>	Intellectual Property
<b>IRL</b>	Investment Readiness Level
<b>IRR</b>	Internal Rate of Return

<b>KPI</b>	Key Performance Indicator
<b>LCA</b>	Life Cycle Assessment
<b>M&amp;E</b>	Monitoring and Evaluation
<b>MDI</b>	Medical Developments International
<b>MEL</b>	Monitoring, Evaluation, and Learning
<b>MICE</b>	Medical Image Communication Exchange
<b>MNF</b>	Marine National Facility
<b>MSV</b>	Main Sequence Ventures
<b>N&amp;SFS</b>	Northern and Southern Farming Systems
<b>NBDL</b>	National Biodiversity Library
<b>NEMA</b>	National Emergency Management Agency
<b>NPV</b>	Net Present Value
<b>NRCA</b>	National Research Collections Australia
<b>ODC</b>	Open Data Cube
<b>PET</b>	Polyethylene Terephthalate
<b>PV</b>	Present Value
<b>R&amp;D</b>	Research and Development
<b>R&amp;I</b>	Research and Innovation
<b>RAAEM</b>	Research Assessment in Australia: Evidence for Modernisation (report)
<b>RAFT</b>	Reversible Addition-Fragmentation chain Transfer
<b>RD&amp;E</b>	Research, Development, and Extension
<b>ROI</b>	Return on Investment
<b>RTO</b>	Research and Technology Organisation
<b>RV</b>	Research Vessel (Investigator)
<b>SEA-MES</b>	Southeast Australian Marine Ecosystem Survey
<b>SIEF</b>	Science and Industry Endowment Fund
<b>SKA</b>	Square Kilometre Array
<b>SLAM</b>	Simultaneous Localisation and Mapping
<b>SLO</b>	Social Licence to Operate
<b>SMEs</b>	Small and Medium Enterprises
<b>STEM</b>	Science, Technology, Engineering, and Mathematics
<b>TBL</b>	Triple Bottom Line (i.e., economic, social, and environmental – in relation to impact)
<b>TICP</b>	Tensions in the Commercialisation Process (Report)
<b>TRL</b>	Technology Readiness Level
<b>TWD</b>	Total Wellbeing Diet



# Executive Summary

The 2024 Value of CSIRO (Commonwealth Scientific and Industrial Research Organisation) report provides an assessment of CSIRO's current impact, drawing on an expanding portfolio of externally validated impact case studies. This study represents an advancement over previous analyses, as it continues to evaluate CSIRO's direct and indirect contributions to national and international innovation systems while adding a focus on the internal and external factors that influence the organisation's capacity for optimising its impact.

The report offers a holistic analysis of CSIRO's internal operations and the external engagement necessary to maximise its social, environmental, and economic contributions to the nation. Central to this analysis is the Impact Maturity Model (IMM), developed and refined by CSIRO since 2020. The IMM offers an integrated approach that provides a nuanced and targeted assessment of CSIRO's impact capacity, identifying areas of strengths and opportunities for further development, enabling the organisation to enhance its performance and achieve higher levels of impact maturity.

The report highlights CSIRO's purpose to tackle the nation's most significant challenges through cutting-edge science and technology, with the ultimate vision of creating a better future for Australia. CSIRO focuses on four primary objectives to deliver on its purpose: impact translation; purpose-driven science and technology; engaging and empowering talent; and world-class infrastructure. The organisation deliberately targets six key Challenge areas crucial to Australians: health and wellbeing; food security and quality; secure Australia and region; resilient and valuable environments; sustainable energy and resources; and future industries.

## CSIRO'S ECONOMIC IMPACT

The assessment results indicate that by 2034, the CSIRO activities covered in the portfolio of 84 case studies (representing \$3.7 billion in funding) will accrue \$32 billion in benefits (present value [PV]), which indicates a net present value (NPV) of \$28.4 billion in benefits generated beyond the dollars invested. The benefit-cost ratio (BCR) is 8.8-to-1, meaning for every dollar invested in the CSIRO activities covered in the case studies, \$8.80 in benefits are accrued.

If these same returns can be expected across the rest of the portfolio of CSIRO activities (i.e., initiatives not yet covered in case studies), this implies that CSIRO's 2024 operating expenditure of \$1.7 billion will generate PV benefits of \$14.96 billion, for an NPV of \$13.26 billion.

## CSIRO'S IMPACT MATURITY

This report provides an analysis of CSIRO's impact maturity, highlighting core strengths and areas for development. It outlines key lessons learnt to guide future improvements and provides priority action items aimed at driving growth. The findings offer insights into how CSIRO can continue to improve its impact maturity and contribute more effectively to Australia's national innovation system (see Figure E.1). These findings are summarised below.

**Figure E.1: CSIRO's Impact Maturity Analysis Based on the IMM: From Identification to Progress**



## Current Performance

CSIRO's impact maturity reflects its ability to strategically position itself within Australia's research and innovation landscape. While CSIRO has made significant strides in understanding its strengths in contributing to impact realisation, key areas were identified through the current assessment which require further investigation and development, as highlighted in Table E.1 below.

**Table E.1: Strengths and Areas for Development Relating to CSIRO's Impact Maturity**

STRENGTHS	AREAS FOR DEVELOPMENT
<p><b>Strategic planning and impact considerations:</b> CSIRO has enhanced its strategic planning by incorporating impact considerations into investment decisions and conducting impact planning workshops.</p> <p><b>Employee capabilities:</b> CSIRO employees exhibit strong absorptive capacity, proactivity, versatility, and adaptability, which are essential for impactful solutions.</p> <p><b>Multidisciplinary expertise:</b> The organisation's diverse and multidisciplinary team strengthens its capacity to tackle multifaceted challenges both effectively and efficiently.</p> <p><b>Innovation and entrepreneurship:</b> Initiatives such as SME Connect and the ON Program support entrepreneurship and start-ups, contributing to Australia's economic growth.</p> <p><b>Reputation and credibility:</b> CSIRO's strong reputation for scientific excellence supports its strategic alliances and funding opportunities.</p>	<p><b>Commercialisation:</b> Misaligned key performance indicators (KPIs), a low risk appetite, and inadequate reward systems affect CSIRO's ability to commercialise research effectively.</p> <p><b>Collaboration:</b> Effective collaboration with both external parties and internal teams needs improvement to better enable impactful outcomes.</p> <p><b>Infrastructure:</b> Fit-for-purpose infrastructure and sustained financial support for key infrastructure require further consideration.</p> <p><b>Market understanding:</b> Despite progress, further refinement is needed to strengthen commercialisation and expand staff expertise in relation to market-driven commercial impact pathways.</p> <p><b>Cost of services:</b> CSIRO's services are considered expensive for SMEs, limiting collaboration opportunities.</p> <p><b>Funding and financial resilience:</b> Better alignment with market demands is required to improve realisation of impact and financial sustainability.</p>

## CSIRO'S RESEARCH AND INNOVATION (R&I) ENVIRONMENT – EVALUATION AGAINST SYSTEMIC CHALLENGES

This report also presents the systemic weaknesses identified in the recent *Research Assessment in Australia: Evidence for Modernisation* report by the Australian Council of Learned Academies (ACOLA), and discusses how CSIRO's processes, including the potential adoption of the IMM, address these gaps (see Section 3.4.1 for details).

### Key Lessons for Guiding Future Improvements

Table E.2 highlights key lessons identified through the review process, offering a roadmap to guide future improvements in CSIRO's impact maturity.

**Table E.2: Five Key Lessons to Inform the Continued Growth of CSIRO's Impact Maturity**

THEME	LESSONS LEARNT
<p><b>Strategic planning &amp; impact focus</b></p>	<p>CSIRO has made significant strides in strategic planning by integrating impact-focused thinking and data into its investment decisions. Regular planning workshops have been instrumental in aligning projects with both strategic objectives and societal needs, ensuring the organisation remains adaptable to regulatory changes, global trends, and funding challenges.</p> <p>To truly embed an impact-oriented approach across the organisation, it is essential to extend this focus equally across all research areas and programs, ensuring consistent alignment in planning, decision-making, and performance management.</p>
<p><b>Commercialisation &amp; risk appetite</b></p>	<p>CSIRO's capacity to deliver impact can be improved by increasing its risk appetite for commercialisation, aligning performance metrics with societal and market benefits, and learning from failures through broadening initiatives such as the Missions Program's 'Lessons Learnt' database across the organisation.</p> <p>Raising and embedding these areas into processes such as the Board Strategy Day and CSIRO's Risk Framework, as well as the annual planning and performance cycle, will establish a more transparent, objective, and longer-term impact evaluation schedule to ensure all investments are set to be assessed.</p>
<p><b>Human capital &amp; absorptive capacity</b></p>	<p>CSIRO employees demonstrate strong absorptive capacity, translating fundamental research into practical applications through their proactive, versatile, and adaptable approach, essential for providing impactful solutions.</p> <p>However, CSIRO staff need to play a stronger role in raising the awareness and absorptive capacity of the end users for their solutions (from both industry and government). This not only benefits the end users but also contributes to impact realisation by accelerating innovation and technological transfer and mobilisation.</p>
<p><b>Financial structure &amp; funding challenges</b></p>	<p>CSIRO's funding is diverse, with 60% from direct appropriation, 28% from research and development (R&amp;D) contracts, and 13% from grants and other sources. However, securing financial investment during the final stages of significant funding periods remains challenging, particularly for commercial testing or deployment.</p> <p>Investors frequently hesitate to commit additional funds without clear evidence of a return on investment (ROI) or proven market demand. Additionally, the costs involved in these final phases can be substantial, further complicating the decision-making process for both investors and CSIRO. Expanding the use of ex-ante impact assessments at earlier phases of a research program's value chain (e.g., as demonstrated by Future Science Platform [FSP] case studies) can provide credible and rigorous data and analyses to attract investment partners and support decision-making.</p>
<p><b>Importance of research infrastructure</b></p>	<p>CSIRO's advanced infrastructure supports high-precision research in critical areas, enhancing research quality and efficiency. However, the lack of fit-for-purpose infrastructure in emerging fields increases costs and causes delays, affecting project viability and impact capacity.</p> <p>Expanding the success of centralising facilities and the effectiveness of collaboration hubs at CSIRO can further reduce resource duplication, foster partnerships, and enable improved access to advanced infrastructure and multidisciplinary expertise. Growing the digital enhancements driven by the Digital Steering Committee has potential to improve data integration and global collaboration, streamlining processes and increasing research efficiency for greater impact.</p>



## Priority Action Items

Finally, the report highlights the top priority actions for CSIRO to continuously enhance its impact capacity maturity, as detailed in Table E.3 below.

**Table E.3: High-Priority Action Items to Improve CSIRO's Impact Maturity**

AREAS	HIGH-PRIORITY ACTION ITEMS
Enhancing commercialisation & impact	Increase CSIRO's and partners' risk appetite for commercialisation, implement impact-focused reward systems, and ensure the translation of scientific excellence into tangible end-user benefits to enhance CSIRO's overall impact.
Strengthening internal cooperation & governance	Strengthen strategic planning, governance, and internal cooperation to improve response times to external requests and ensure alignment of efforts to maximise impact.
Fostering stakeholder engagement	Prioritise effective engagement with stakeholders, including SMEs and Traditional Owners, and implement robust feedback mechanisms to improve the adoption and relevance of solutions.
Developing sustainable funding models	Develop sustainable funding models, diversify sources, and align projects with market needs to ensure financial stability and enhance the impact of R&I.

## CONCLUSION

The evidence in this report demonstrates that CSIRO is driving substantial triple bottom line benefits for the nation, with a notable 8.8-to-1 ROI. While these results are strong, opportunities still exist to further enhance CSIRO's impact. Maximising CSIRO's contributions to Australia's R&I landscape requires optimising its impact capacity. Although the R&I environment is inherently complex, with each sector facing unique challenges, the IMM offers a practical path to advancing impact maturity.

Looking ahead, expanding the analysis beyond impact case studies to a broader dataset will provide more comprehensive insights into CSIRO's impact capacity. Establishing systems for consistent data collection and analysis will further enable data-driven decisions and continuous improvement in impact management. While no single solution can guarantee success, applying this model significantly increases the likelihood of CSIRO improving the realisation of its impact potential and enhancing its overall impact maturity in a continually evolving landscape.

# 1 Introduction

CSIRO is an impact-oriented organisation dedicated to continuously enhancing its ability to address major challenges through innovative science and technology, thereby delivering significant benefits to all Australians. Every 2 years, CSIRO assesses the value it provides to the nation by analysing its impact.

The 2024 Value of CSIRO report presents the results of CSIRO's current impact assessment, drawing on an increasingly extensive portfolio of externally conducted or validated impact case studies. In addition to previous iterations of this assessment, the 2024 assessment also evaluates CSIRO's direct and indirect contributions within the national and international innovation systems through specifically exploring the internal and external factors that affect optimal impact realisation. This new assessment dimension acknowledges that the ability of all organisations to measure, manage, and enhance their impact capacity and its maturity is crucial for fostering sustainable and inclusive impact realisation.

The assessment provides a holistic analysis that depicts both the key components of CSIRO's internal operating environment, and the requirements for effective engagement in its external operating environment, that are necessary to optimise its contribution to triple bottom line (TBL) impacts (social, environmental, and economic). To achieve this, the analysis is based largely on an Impact Maturity Model (IMM) developed and updated by CSIRO since 2020. Although this model is currently still evolving, it is unique in the international innovation system and represents a conceptual advancement aimed at enabling CSIRO to achieve a higher level of impact maturity to support the effective realisation of impact within both the national and global innovation systems. It offers an integrated perspective on CSIRO's impact capacity, enabling a nuanced and targeted assessment designed to gauge and improve its performance. The adoption of this approach is anticipated to enhance the quantity, quality, and interoperability of the impact-relevant data required to support effective impact management. Harmonising data and improving its coherence, consistency, and comparability with strategic clarity, are essential steps towards overcoming barriers to impact realisation.

Sections 3 and 4 of this report explore the implications of this report for the future direction of CSIRO's impact processes, presenting a consolidated view of the 'lessons learnt' from this assessment, as well as a consideration

of the actions CSIRO can take to support the continuous improvement of its impact capacity maturity. As part of this 'lessons learnt' approach, Section 3.4 also explores the systemic weaknesses identified in the recent *Research Assessment in Australia: Evidence for Modernisation* (RAAEM) report by the Australian Council of Learned Academies (ACOLA), commissioned by Australia's Chief Scientist, Dr. Cathy Foley, discussing how CSIRO's processes, including the potential adoption of CSIRO's IMM, address some of these gaps.<sup>1</sup>

## 1.1 BACKGROUND

For over a century, CSIRO has served as Australia's national science agency, working across the national and international innovation systems to enhance the quality of life for all Australians. As an Australian Government statutory authority within the Industry, Science, and Resources portfolio, it operates under the *Science and Industry Research Act 1949*.

CSIRO's mission is to tackle the nation's most significant challenges through cutting-edge science and technology, with the ultimate vision of creating a better future for Australia. To achieve this mission, CSIRO focuses on four primary objectives:

- Impact translation
- Purpose-driven science and technology
- Engaging and empowering talent
- World-class infrastructure.

CSIRO deliberately targets **six key Challenge** areas that are crucial to Australians:

1. Health and wellbeing
2. Food security and quality
3. Secure Australia and region
4. Resilient and valuable environments
5. Sustainable energy and resources
6. Future industries.

By acting as a bridge for Australian innovation, CSIRO engages in best practice knowledge generation and translation processes in collaboration with other innovators in the public and private sectors to transform discoveries and ideas into technologies and services that benefit the nation.

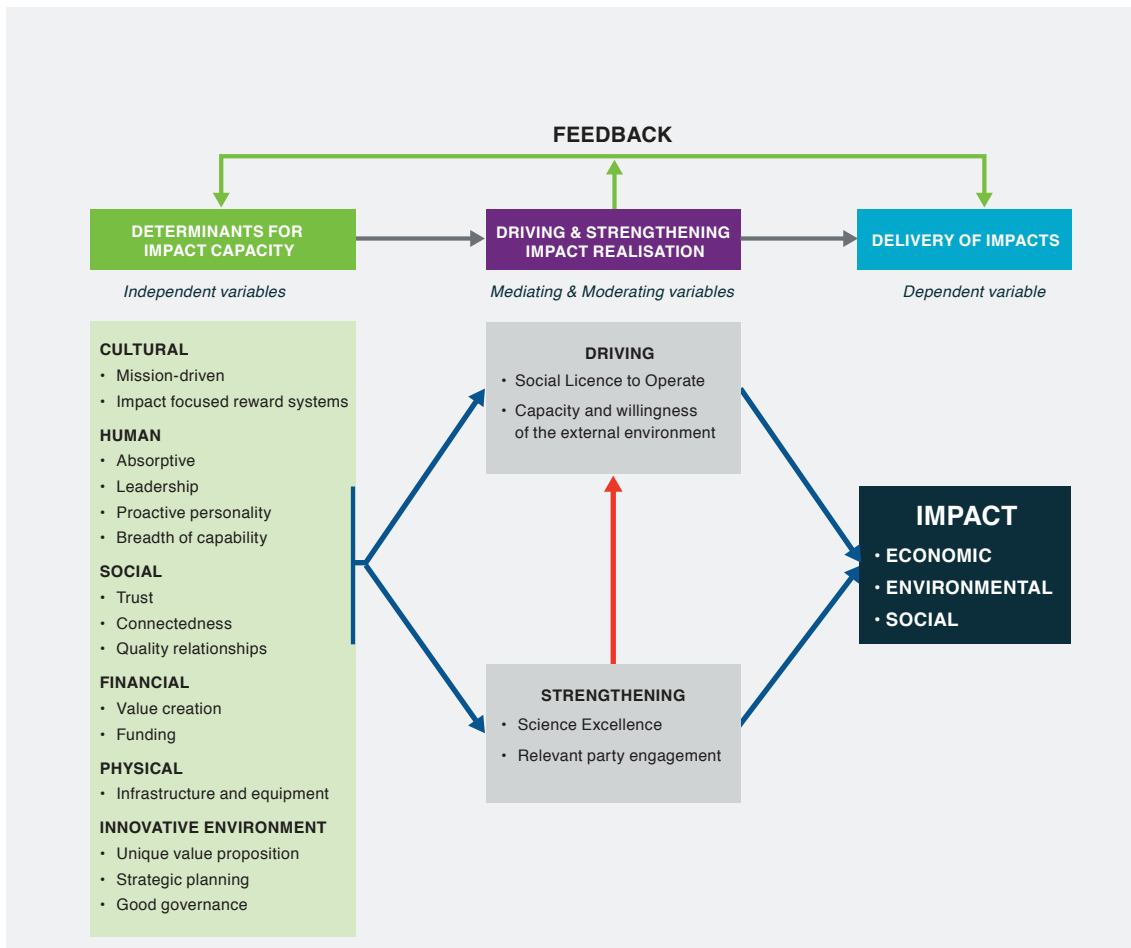
<sup>1</sup> ACOLA (Australian Council of Learned Academies). (2023). *Research Assessment in Australia: Evidence for Modernisation*. [https://acola.org/wp-content/uploads/2023/11/ACOLA\\_ResearchAssessment\\_FINAL.pdf](https://acola.org/wp-content/uploads/2023/11/ACOLA_ResearchAssessment_FINAL.pdf)

### 1.1.1 History of Value of CSIRO Reports

To date, CSIRO primarily assesses impact by completing case studies of the economic impact of research activities and programs. Each case study provides detailed insight into the impacts of specific CSIRO activities, and as the portfolio of case studies grows, it provides broader insight into the impact of CSIRO activities overall. The analysis presented in this report – as with previous iterations of the Value of CSIRO report – is grounded in these case studies of CSIRO’s science, meaning that the return on investment (ROI) figures calculated specifically represent returns to the nation associated with CSIRO’s core activity and fundamental purpose – science. As of 2024, the case study portfolio consists of 84 case studies with time series of benefits and costs covering research initiated within the last 25 years and capped at 10 years of projected values.

### 1.1.2 CSIRO’s Impact Maturity Model

The IMM is a comprehensive framework designed to articulate, evaluate, and enhance internal organisational performance across six key resource capitals: Cultural, Human, Social, Financial, Physical, and Innovation Environment (see Figure 1.1). These key resource capitals interact synergistically with the external environment to drive and strengthen impact realisation, culminating in TBL impacts.<sup>2</sup>



2 Dowd, A., Keenan, T., & Graham, K. (Eds). (Forthcoming). *Cornerstones of Impact Management: How to Plan, Implement, Assess and Understand Factors for Success*. CSIRO Publishing, Clayton, VIC.

**Determinants for Impact Capacity:** CSIRO's determinants for impact capacity encompass the six key resource capitals and their associated specific capacities (see Table 1.1). The capacities of cultural capital focus on a mission-driven ethos and impact-focused rewards that encourage employees to focus their efforts on contributing to impact realisation. Human capital is associated with impact-focused skills, knowledge, and leadership, emphasising the ability to absorb new knowledge and proactive engagement with key collaborators and other relevant parties. Social capital highlights the importance of networks and relationships, and fostering trust and connectedness, for effective collaboration. Financial capital relates to funding

mechanisms, such as external revenue and intellectual property income. Physical capital includes the necessary infrastructure, equipment, and associated resources – such as research facilities and digital assets – required to enable the organisation to contribute effectively to impact realisation. The innovation environment covers the internal and external factors that drive impactful outcomes through strategic planning and good governance, as well as the aspects of CSIRO that support its unique value proposition.

**Table 1.1: CSIRO's Impact Maturity Model – Six Capitals for Determining Impact Capacity**

CAPITAL TYPE	DEFINITION	CAPACITY FACTORS
<b>Cultural</b>	<i>In a culture of impact, employees feel that what they are working on is meaningful, significant, and purpose-based. Everyone concerned is highly inspired by the common purpose, which becomes the driving force behind everything that they do.</i>	Mission-driven Impact-focused reward systems
<b>Human</b>	<i>Knowledge and skills that are easily transferable and are required to realise and optimise impact.</i>	Absorptive Leadership Proactive personality Breadth of capability
<b>Social</b>	<i>The human networks, relationships, and channels of communication and engagement required to realise impact.</i>	Trust Connectedness Quality of relationships
<b>Financial</b>	<i>Mechanisms and finance required to support the realisation of impact.</i>	Value creation Funding
<b>Physical</b>	<i>Resources and infrastructure necessary to realise impact.</i>	Infrastructure and equipment
<b>Innovation environment</b>	<i>The knowledge creation and translation environment, internal systems and processes, as well as the external operating system that supports impact.</i>	Unique value proposition Strategic planning Good governance

**Driving and Strengthening Impact Realisation:** Driving factors include elements such as CSIRO’s social licence to operate (SLO) and the external environment’s capacity to adopt innovations, ensuring acceptance, as well as utilisation and scaling, of innovations. Strengthening factors focus on science excellence and effective engagement with external partners, enhancing impact by amplifying the reach and translation of outputs into meaningful outcomes.

**Delivery of Impacts:** The nature and interaction of these internal and external environment factors result in TBL impacts. Feedback from this process informs continuous improvements in impact capacity, creating a dynamic system which supports the sustained realisation of impact.

The IMM offers a robust, integrated approach to improving organisational impact realisation by recognising and addressing both internal capacities and external drivers and strengthening factors. These factors collectively assist in increasing the scale, reach, and translation of research and innovation (R&I) outputs by enabling and maximising desired outcomes.

It is important to note that while the aspects of the IMM reasonably represent CSIRO based on this early-stage assessment, the nature of resource capitals, and the driving and strengthening factors of success, are specific to each R&I organisation and their specific broader system of operation, and must be identified and defined accordingly.

## 1.2 REPORT OBJECTIVES

The primary objectives of this report are to:

1. Provide a quantitative estimate of the return on Australia’s investment in CSIRO (Section 2)
2. Provide a qualitative review of the direct and indirect impacts of CSIRO in the innovation system (Sections 2 & 3)
3. Analyse data drawn from CSIRO’s impact case study repository and other evaluations to assess the validity of CSIRO’s IMM as a framework to conceptualise the determinants of successful impact realisation (Section 3)
4. Demonstrate how the IMM could inform future data collection for, and assessment of, CSIRO’s impact capacity based on the assessment of the model’s validity (Section 3)
5. Explore ‘lessons learnt’ to improve CSIRO’s impact maturity based on this expanded review (Section 3).

## 1.3 METHODOLOGY

The methodology for this analysis of CSIRO’s value involved several key components, ensuring a robust and nuanced evaluation.

### Data Collection

Over 100 impact case studies – completed in accordance with the principles and processes articulated in CSIRO’s Impact Evaluation Guide – were reviewed for the quantitative assessment of CSIRO’s ROI and the qualitative assessment of impact realised. Impact case studies were either completed by CSIRO’s internal Impact Evaluation team or were commissioned by CSIRO and completed by external evaluators, including ACIL Allen, ACIL Tasman, the Centre for International Economics (CIE), Deloitte Access Economics (DAE), RTI International, or Tractuum.

These studies provided a rich dataset with opportunities to learn from detailed accounts of potential and/or realised impacts, leading to a deeper understanding of the mechanisms of systemic change, and facilitating the ability to assess CSIRO’s performance across multiple dimensions.

Additionally, other evaluations conducted within the CSIRO context, as well as other data (e.g., relevant external reports), were incorporated in the assessment, including (but not limited to):

- Benchmarking of Research and Technology Organisations’ Business Processes (BRTOBP) report<sup>3</sup>
- Tensions in the Commercialisation Process (TICP) report<sup>4</sup>
- CSIRO program evaluations (e.g., Future Science Platforms [FSPs] – Review of the ‘Lessons Learnt’ from the Initial Funding Round of the FSP Program)
- *Research Assessment in Australia: Evidence for Modernisation report*<sup>5</sup>
- Insights attained during recent interviews with relevant parties (including customers, investors, partners, CSIRO employees, etc.)
- Selected international and domestic reports containing best practice examples in this domain to contextualise CSIRO’s performance with respect to global best practices.

3 Social Research Centre. (2024). *Benchmarking of Research and Technology Organisations’ Business Processes*.

4 CSIRO. (2022). *Tensions in the Commercialisation Process*. Internal Report – Commercial in Confidence. This report is referenced as ‘TICP’ throughout the remainder of this report.

5 ACOLA (Australian Council of Learned Academies). (2023). *Research Assessment in Australia: Evidence for Modernisation*. [https://acola.org/wp-content/uploads/2023/11/ACOLA\\_ResearchAssessment\\_FINAL.pdf](https://acola.org/wp-content/uploads/2023/11/ACOLA_ResearchAssessment_FINAL.pdf)



## Data Analysis

<b>ROI methodology</b>	We estimated the impact of CSIRO activities by comparing the present value (PV) of benefits with the PV of costs for technologies and programs delivered. We compared a time series of benefits and costs across 84 individual impact case studies covering research initiated within the last 25 years and capped at 10 years of projected values.
<b>Framework</b>	As previously highlighted, the analysis was grounded in the evaluation of six resource capitals: Cultural, Human, Social, Financial, Physical, and Innovation Environment. These resource capitals were assessed using a comprehensive framework, the IMM, which integrates both internal capacities and external driving and strengthening factors to provide insights into organisational impact capacity.
<b>Evaluation metrics</b>	The data for this report has been retrospectively analysed to determine its alignment with the framework's evaluation criteria. A thorough analysis was conducted to adapt the data accordingly, evaluating capacities across various resource capitals.
<b>Mixed-methods review process</b>	Data analysis involved a detailed review of case studies, relevant party interviews, and internal reports (as highlighted above). Qualitative data were systematically coded, as per the IMM framework, to identify recurring themes and patterns. This qualitative approach was complemented by quantitative data where available, ensuring a balanced, triangulated, and comprehensive analysis.

## Limitations

<b>Purpose-specific data collection</b>	The data used for analysis and validation of the IMM were not originally collected for this specific purpose, which may limit the precision and applicability of the findings.
<b>Data gaps</b>	Gaps in the data could affect the comprehensiveness and accuracy of the analysis. Incomplete or missing information can lead to potential biases or missed insights.
<b>Selection bias</b>	This analysis is based primarily on impact case studies that focus on successful initiatives. As such, it may not fully capture the organisation's broader experience, including both its successes and less successful efforts. This limitation should be considered when interpreting the findings.
<b>Data interpretation issues</b>	Interpreting the available data posed challenges due to inconsistencies in the manner, and the varied contexts, in which the data were collected. This could impact the reliability of the conclusions drawn from the analysis.
<b>Statistical significance</b>	Since targeted questions specific to this exercise were not included during the review process, some analyses lack statistical significance. This limitation may affect the robustness of the findings and their generalisability.
<b>Comparability</b>	The BRTOBP report noted fundamental differences in size and revenue among the participating organisations, making comparisons challenging. For instance, total revenue and staff numbers varied by a factor of ten in some cases.

## 1.4 REPORT STRUCTURE

The report is organised as follows:

- **Section 2** establishes the monetised value of CSIRO as represented by the ROI across the increasing portfolio of Economic Impact Assessment Case Studies; and provides additional, non-monetised metrics of impact.
- **Section 3** analyses CSIRO's internal environment using the IMM framework, focusing on various resource capitals and their relevance to CSIRO. It provides an overall impact maturity analysis, highlighting strengths, areas for improvement, key lessons, and priority action items, and concludes with a summary of key takeaways.
- **Section 4** presents future directions, particularly in terms of adopting the IMM for assessing and enhancing CSIRO's impact capacity.

## 2 Establishing the Value of CSIRO

Economic Impact Assessment Case Studies provide robust evidence of strong, consistent returns to the Australian people from the work that CSIRO does.

### 2.1 QUANTIFYING THE VALUE OF CSIRO

To date, CSIRO primarily assesses its contribution to impact by completing case studies of the economic impact of research activities and programs.<sup>6</sup> Each case study provides detailed insight into the impacts of specific CSIRO activities, and as the portfolio of case studies grows, it provides broader insight into the impact of CSIRO activities overall. CSIRO maintains rigorous impact analysis standards that help ensure the results of individual assessments are comparable. As a result, the costs and monetised impacts can be aggregated across case studies to assess the aggregate ROI represented by the portfolio.

As in the 2020<sup>7</sup> and 2022<sup>8</sup> Value of CSIRO reports, we estimated the impact of CSIRO activities by comparing the PV<sup>9</sup> of benefits with the PV of costs for technologies and programs delivered by the organisation. We compared a time series of benefits and costs covering research initiated within the last 25 years and capped at 10 years of projected values. Continuing to shift this time series forward with each new Value of CSIRO report produces a moving average of the value CSIRO delivers. Our methods are detailed below and are consistent with the 2020 and 2022 versions of this report.

#### 2.1.1 Portfolio of CSIRO Impact Case Studies

CSIRO's primary impact evaluation approach is to prepare case studies of research outcomes. We reviewed 133 case studies published between 2010 and 2024. These case studies assessed the benefits and costs of research initiated between 1965 and 2023, with nearly all the studies covering research initiated after the year 2000. Each study was completed by one of seven institutions: ACIL Allen, ACIL Tasman, CIE, DAE, RTI, Tractuum, or CSIRO's internal Impact Evaluation team.

Of the 133 case studies, 112 were included in the 2022 Value of CSIRO report, and 21 were delivered to CSIRO since the publication of that report. Of the total 133 studies, 42 were either qualitative studies or had insufficient benefit or cost data to be incorporated into the analysis. We further filtered the studies to only those with benefits and costs beginning in 1999 or later, which removed seven additional studies. This meant there were 84 studies available to inform our analysis (see Table 2.1).

**Table 2.1: Number of CSIRO Impact Analysis Case Studies Reviewed and Included in the Analysis for Each Value of CSIRO Report Since 2020**

	2020 VALUE OF CSIRO REPORT	NEW TO 2022 VALUE OF CSIRO REPORT	NEW TO 2024 VALUE OF CSIRO REPORT	TOTAL
Total studies reviewed	63	49	21	133
Studies with sufficient benefit and cost data for inclusion in our analysis	41	31	18	90
Studies with data beginning within the last 25 years*	38	30	16	84

\*Note that the date range matching this criterion changes with each report, so studies from previous years may be removed.

Table A.1 in the Appendix provides a complete list of the case studies reviewed, including the title, author, date range covered, and whether each case study was included in the 2020, 2022, and/or 2024 Value of CSIRO reports.

6 Case studies are completed by the CSIRO Strategy team or by outside contractors, currently including CIE, RTI International, and Tractuum, and formerly including DAE, ACIL Allen, and ACIL Tasman.

7 RTI. (2021). *The Value of CSIRO: The Broader Impact of CSIRO's Portfolio of Activities 2020 Update*. Prepared for CSIRO.

8 RTI. (2023). *The Value of CSIRO: The Broader Impact of CSIRO's Portfolio of Activities 2022 Update*. Prepared for CSIRO.

9 The sum of values across time while taking inflation and social time preferences around spending into account. See the appendix for more calculation details.

## Analysis of Impact Case Studies

As in previous reports, we reviewed the available data and benefit-cost analysis (BCA) calculation methods for each case study completed since the 2022 Value of CSIRO report. We verified the accuracy of the data and methods for each, and standardised methods or made other corrections or adjustments as needed. We focused on the reported research costs funded directly by CSIRO and on the estimated benefits attributable to CSIRO. We did not review the underlying assumptions for each case study's valuation approach.

When sufficient time series data for benefits and costs were available for a study, we standardised the study's BCA methods by performing inflation and discounting adjustments for each year of data. We adjusted for inflation (i.e., converted from nominal to real values) using the Australian Consumer Price Index (CPI). We discounted benefit and cost time series to 2024 values using the benchmark 7% real social discount rate specified by the CSIRO Impact Evaluation Guide.<sup>10</sup> We used 2024 as the base year for both inflation and discounting adjustments, as recommended in the guide. We also updated the inflation and discounting of the previously audited and synthesised case study portfolio from 2022 to 2024 values using the same methods.

### 2.1.2 Aggregated Times Series of Benefits and Costs

After reviewing, standardising, and updating the case study data, we updated the dataset comprising the time series of benefits and costs for all case studies with time series data. Following previous methods, we identified which values from the new studies were realised versus projected at the time of publication for each study.

Next, we limited the set of case studies included to those covering research initiated within 25 years (i.e., between 1999 and 2024). We removed benefit and cost projections beyond 10 years for each case study to reduce the uncertainty inherent in estimating future benefits and costs. This shortened the benefit and/or cost projections for three newly completed case studies that included projected values for anywhere from 11 to 16 years into the future.

Figure A.1 in the Appendix shows the years and type (actual versus projected) of benefit and cost data for each case study in the portfolio. This figure shows that projected values of either benefits or costs are limited to no more than 10 years, while there is no limit to the number of years of actual (realised) benefit or cost data included.

We aggregated benefits across all case studies and years to generate the PV of benefits of CSIRO research. We used the same method to generate the PV of costs. We calculated the net present value (NPV) of CSIRO research activities and programs by subtracting the PV of costs from the PV of benefits, and calculated the benefit-cost ratio (BCR) by dividing the PV of benefits by the PV of costs.

### 2.1.3 Economic Impact Analysis Results and Trend Analysis

Table 2.2 summarises the portfolio result for this year's analysis, along with results from previous years. The current analysis relies on a sample of 84 case studies spanning selected CSIRO activities conducted beginning in 1999 and projecting forward in time through 2034. The case studies represent \$3.7 billion in funding (PV of costs) over that period. The results indicate that by 2034, the CSIRO activities covered in the case study portfolio will have accrued \$32.0 billion in benefits (PV of benefits). This indicates an NPV of \$28.4 billion in benefits generated beyond the dollars invested.<sup>11</sup>

**Table 2.2: Summary of Impact Case Study Portfolio Analysis Results for the 2020, 2022, and 2024 Value of CSIRO Reports**

	NUMBER OF CASE STUDIES	DATA YEAR RANGE	PV BENEFITS (\$M) a	PV COSTS (\$M)	NPV (\$M)	BCR
2020 Report	54	1995–2029 b	\$11,613.5	\$1,528.9	\$10,084.7	7.6:1
2022 Report	68	1998–2031 c	\$22,531.5	\$2,671.7	\$19,859.9	8.4:1
2024 Report	84	1999–2034	\$32,006.5	\$3,655.8	\$28,350.7	8.8:1

Notes:

a) m = million

b) The eligible range for case studies in this report was 1995 through 2030, but the case studies only covered 1995 through 2029.

c) The eligible range for case studies in this report was 1997 through 2032, but the case studies only covered 1998 through 2031.

<sup>10</sup> CSIRO. (2024). *Impact Evaluation Guide*. Canberra, Australia: CSIRO.

<sup>11</sup> Note that while the NPV of the case study portfolio has consistently and largely increased with each new Value of CSIRO report, this is at least partially because of the increasing size of the case study portfolio, rather than an increase in the value of CSIRO activities captured in the portfolio. It is more appropriate to compare the BCR over time, as this measure is not impacted by the scale of the total benefits and costs represented in the portfolio.

---

Further comparing the streams of benefits and costs represented in the portfolio, we find a BCR of 8.8-to-1. In other words, for every dollar invested in the CSIRO activities covered in the case studies, \$8.80 in benefits are accrued. The BCR has remained consistently strong and increasing over time as more impact case studies have been added to the portfolio, indicating robust evidence for the positive impact that CSIRO activities generate for the Australian people.

If these same returns can be expected across the rest of the portfolio of CSIRO activities (initiatives not yet covered in case studies), this implies that CSIRO's 2024 operating expenditure of \$1.7 billion will generate PV benefits of \$14.96 billion, for an NPV of \$13.26 billion. The estimated returns likely represent a conservative figure, as they do not capture the broader impacts that cannot be easily quantified, including CSIRO's contributions to expanding the national knowledge base, fostering human capital development, shaping policy, raising public awareness of science and innovation, advancing education, enhancing national reputation, and preserving Australia's conservation efforts and cultural heritage.

## 2.2 ADDITIONAL METRICS OF IMPACT

As mentioned previously, the economic impact estimates above do not fully capture the value CSIRO provides to Australia. They do not capture the broader impacts that cannot be easily quantified, including CSIRO's contributions to expanding the national knowledge base, fostering human capital development, shaping policy, raising public awareness of science and innovation, advancing education, enhancing national reputation, and preserving Australia's conservation efforts and cultural heritage. The additional metrics below provide more indicators of CSIRO's impact that are not easily monetisable.

### 2.2.1 Impact Translation

CSIRO aims to advance Australia's translation and commercialisation of science through collaborative networks. Research publications are one method for advancing translation and nurturing research collaborations. As of 2024, CSIRO had 3,412 publications with an average normalised citation impact of 1.5, indicating the strong contributions of CSIRO's trusted research results to the scientific knowledge base. CSIRO's extensive collaboration is displayed through its publication record, as about 91% of CSIRO's research publications are published jointly with external collaborators.

Importantly, CSIRO's research translation efforts extend beyond scientific knowledge dissemination. CSIRO works to ensure that its science and technology are adopted and create value for industry. As of 2024, CSIRO held over 690 families of patents and more than 600 active technology licences. Industry is also a direct customer of CSIRO's research services; and CSIRO's consumer surveys have indicated continuous high ratings in terms of awareness and positive sentiment.

CSIRO also invests directly in industry by supporting deep tech start-ups through the ON Program and the Innovation Fund managed by Main Sequence Ventures (MSV). The ON Program supports Australian scientists to create start-ups to commercialise their research with activities including business planning, development of presentation skills, raising of capital, and recruiting of a Board. Since its initiation in 2015, the ON Program has supported more than 70 companies and created over 700 jobs. The Innovation Fund invests in companies borne out of Australia's research sector and supports the transition to commercialisation. Since its inception in 2017, the Innovation Fund has supported over 60 ventures and created over 2,200 jobs.

### 2.2.2 Purpose-Driven Science and Technology

CSIRO aims to deliver impact at scale aligned with the challenges it is solving and the portfolios of research directed to them. CSIRO further aims to invest in the right future science and technology to solve tomorrow's challenges. The impact assessment results in Section 2.1 provides evidence of CSIRO's success in meeting this objective across multiple science investments, aimed at addressing national challenges.

### 2.2.3 Engage and Empower Talent

CSIRO aims to attract world-class talent and strengthen Australia's science, technology, engineering, and mathematics (STEM) pipeline. CSIRO further aims to build a culture that makes CSIRO be an employer of choice and operate in an adaptable, resilient, and responsive way. CSIRO directly supports the people of Australia by providing high-paying jobs and striving to ensure a vibrant, safe, and positive work culture to nurture and attract world-class talent. CSIRO employs over 6,600 people in Australia and globally, and operates sites in every state and territory of Australia (see Figure 2.2).

**Figure 2.1: CSIRO Staff per State and Territory**



CSIRO helps meet Australia’s growing demand for STEM skills by nurturing and developing the next generation of STEM researchers through its education and outreach programs. CSIRO engaged over 1,500 undergraduate and postgraduate students in the 2023–2024 FY.<sup>12</sup>

CSIRO’s undergraduate education programs include the Undergraduate Vacation Scholarship, which engages students in STEM workshops and career development opportunities, and the Undergraduate Research Opportunities Program, which facilitates traineeships for students in research laboratories. CSIRO supports postgraduate students through either sponsored studentships via a full or top-up stipend, supervised-only studentships, CSIRO’s Industry PhD Program, or postgraduate internships.

### 2.2.4 World-Class Infrastructure

As Australia’s national science agency, CSIRO maintains science infrastructure and collections for public use. These include the Australian Centre for Disease Preparedness (ACDP), Australian Telescope National Facility, National Research Collections Australia, and Atlas of Living Australia, among others. Impact case studies provide monetised estimates of the impacts of three such elements: the Marine National Facility (MNF), Pawsey Supercomputing Centre, and Australian Synchrotron. Each of these case studies is summarised below.

### 2.3.4.1 Marine National Facility

The MNF supports research and education about oceanography, seafloor geology, marine life, weather, and climate that further Australian science on a global scale. Launched in 2014, CSIRO’s new premier research vessel (RV), the RV *Investigator*, has overhauled Australian ocean observation capabilities. The RV *Investigator* is a 94-metre research vessel outfitted with world-class instrumentation and gear that is capable of spending up to 300 days per year at sea.

The RV *Investigator* generates value by collecting robust data about oceans, marine life, the seafloor, and the atmosphere. These data are made available at no cost for use by the public and play a critical role in evidence-based decision-making, resource and risk management strategies, and offshore activities. Users from all segments of Australian society leverage these data to deepen and expand their collective understanding of ocean ecosystems, climate and weather changes, and fisheries.

RTI’s economic impact analysis of the MNF<sup>13</sup> reviewed four of its main value streams: Seabed Mapping, Ecosystem Health, Weather Forecasting, and Shipwreck Discovery. Cumulatively, these impacts are projected to yield \$5.3 billion in 2024 dollars to Australia’s economy through 2031. These benefits greatly surpass the \$1.1 billion cost of MNF improvements and operations, yielding a BCR of 5.0-to-1.

### 2.3.4.2 Pawsey Supercomputing Centre

The Pawsey Supercomputing Centre (Pawsey) is a world-class petascale facility. It supports a range of cutting-edge research, including radio astronomy, engineering, physics, chemistry, earth sciences, and life sciences. Pawsey helps researchers interpret complex data and demonstrates how to adopt scalable computational approaches to advance the biggest scientific questions. In a single year, Pawsey has the capacity to support over 1,500 researchers and 194 projects and to upskill over 600 Australians in high-performance computing and data activities.

The benefits of Pawsey are far-reaching and include accelerating scientific progress and offering a proving ground for commercial ventures that require supercomputing access. There are also scientific discoveries that could not take place but for supercomputing capabilities, such as those relying on large genetic datasets. Pawsey also provides expertise and attracts talent in the fields of data engineering, warehousing, data mining, statistical analysis, cloud and system architecture, data management, machine learning, and visualisation. Finally, Pawsey yields social benefits by forging international relationships in supercomputing and large-scale data processing and analysis.

<sup>12</sup> CSIRO. (2021). *Annual Report 2020–21*. Canberra, Australia: CSIRO.

<sup>13</sup> RTI. (2020). *Impact Analysis of the Marine National Facility*. Prepared for CSIRO.



---

Pawsey presents a long-term investment in advanced infrastructure for public use. While positive returns are expected over the next 30 years, short-term returns over 10 years are negative.<sup>14</sup> This displays the important role of a national agency like CSIRO in maintaining science infrastructure, because private industry would not be able to make a long-term investment of this nature.

#### **2.3.4.3 Australia Telescope National Facility**

The CSIRO Australia Telescope National Facility (ATNF) is one of the world's most advanced radio astronomy facilities, and the only one of its kind in the Southern Hemisphere. The ATNF is used by astronomers from around the world, 24 hours a day, every day, to learn about our universe. One of the facilities within the ATNF, the Australia Square Kilometre Array Pathfinder (ASKAP), comprises 36 nearly identical parabolic antennas that collaborate as a single astronomical interferometer, offering a collective surface area of approximately 4,000 square metres. ASKAP's distinctive capabilities, encompassing its wide field of view, swift survey speed, and advanced data processing techniques, empower scientists to explore astronomical phenomena with unparalleled precision.

Furthermore, ASKAP serves as a technology demonstration for the Square Kilometre Array (SKA) project, an ambitious global initiative aiming to construct a radio telescope of even greater magnitude and sensitivity. Thanks largely to the success of ASKAP, Australia is hosting SKA-Low, one of two global SKA facilities, at the Murchison Radio-astronomy Observatory alongside ASKAP. Projections from the Prime Minister and the Hon Scott Morrison MP in 2021 indicated that SKA-Low would attract an estimated \$1.8 billion in foreign income flows into Australia in its first 30 years of operations.<sup>15</sup>

In addition, ASKAP has prioritised meaningful cooperation and consultation with the Wajarri Yamatji people, who hold the Traditional Ownership of the land. These efforts have included recognition and respect, cultural heritage preservation, and employment and capacity building. These commitments are formalised through an Indigenous Land Use Agreement, signifying a dedication to equitable and mutually advantageous terms for land use, as well as appropriate compensation arrangements.

#### **2.3.4.4 National Research Collections Australia**

The National Research Collections Australia (NRCA) is a state-operated biological collection under CSIRO, hosting Australia's biodiversity. It includes specimens of wildlife, insects, plants, tree seeds, and algae. NRCA supports bioprospecting, biodiversity management, and research that benefits Australian industries, government, and academia. RTI's 2024 impact analysis<sup>16</sup> highlighted NRCA's contribution across various sectors, such as environmental conservation, food security, biotechnology, and disease prevention.

The assessment found that NRCA plays a vital role in research, public health, and industry applications. Its collections help with disease tracking, biotechnology innovations, and environmental preservation by supporting biodiversity studies. NRCA's digitisation is expanding access to its resources, encouraging further global research collaboration. Investments in advanced facilities and trained staff ensure that these collections are preserved and accessible for research and industrial use. This provides Australia with economic, environmental, and social benefits, and supports NRCA's role as essential in maintaining Australia's rich ecological history while providing scientific knowledge.

<sup>14</sup> CIE. (2019). *Pawsey: Making Big Things Happen*. Prepared for CSIRO.

<sup>15</sup> The Hon Christian Porter MP. (2021). *Australia to Invest \$387 Million in the World's Largest Radio Telescope*. Joint media release with the Prime Minister the Hon Scott Morrison MP.

<sup>16</sup> RTI. (2024). *Impact Assessment of the National Research Collections Australia*. Prepared for CSIRO.

# 3 CSIRO's Impact Capacity: An Ecosystem Analysis

This section provides an analysis of CSIRO's impact capacity using the IMM. It delves into the internal impact capitals – Cultural, Human, Social, Financial, Physical, and Innovation Environment – and their related capacities (see Table 1.1) to examine how CSIRO engages with the external system through driving and strengthening factors. The discussion culminates with insights on continuous impact maturity growth, highlighting current performance, key lessons, priority actions, and key takeaways.

## 3.1 IMPACT MATURITY MODEL

The IMM offers a framework for standardising capacity review and building efforts. This initial analysis, based on a detailed review of a broad range of material (as outlined in Section 1.1.2 above), sets the stage for ongoing evaluation and improvement.

## 3.2 INTERNAL ENVIRONMENT – RESOURCE CAPITALS FRAMEWORK ANALYSIS

This section introduces the analysis of six key resource capitals (i.e., Cultural, Human, Social, Financial, Physical, and Innovation Environment), each with CSIRO-specific capacities which are crucial for the organisation to understand and strengthen in order to enhance its contribution to impact.

The analysis identifies both current successes and areas for growth within each capital, offering actionable insights to further advance impact maturity. Exemplar case studies are provided throughout to support and illustrate the analysis.

### 3.2.1 Cultural Capital

<p><b>CULTURAL CAPITAL:</b> <i>In a culture of impact, employees feel that their work is meaningful, significant, and purpose-based. Everyone concerned is highly inspired by the common purpose, which becomes the driving force behind everything that they do.</i></p>	
<p><b>Current Performance: What's working and should be sustained</b></p>	<p>CSIRO is increasingly demonstrating a strong alignment between its projects and its objectives, enhancing its strategic planning by incorporating impact considerations into investment decisions and conducting multiple impact planning workshops each year.</p> <p>The organisation has improved its oversight of its impact focus through annual evaluations and external validation of impact, showcasing global best practices in impact evaluations.</p> <p>CSIRO should continue reinforcing the strategic planning, governance, and oversight processes that are effectively aligning projects with its impact goals.</p> <p>Further, it should sustain its focus on mission-driven initiatives to ensure continued relevance and effectiveness in realising impactful outcomes for the nation.</p>
<p><i>Enhancing these areas will enable CSIRO to respond more swiftly to external needs and foster a more collaborative and agile environment.</i></p>	
<p><b>Impact Maturity: Opportunities for growth</b></p>	<ul style="list-style-type: none"> <li>✓ Increase risk appetite for commercialisation</li> <li>✓ Implement impact-focused reward systems</li> <li>✓ Celebrate failures; move beyond the era of cherry-picking successful initiatives for impact assessment to improve transparency, data sharing, and feedback loops from lessons learnt</li> <li>✓ Prioritise market pull initiatives, while balancing market signals with fundamental science to support future growth</li> <li>✓ Enhance internal cooperation to assist with shortening response time to external requests</li> </ul>

### Endua

#### Opportunity

Off-grid communities face growing energy demand, high costs, and significant environmental impacts from diesel generators, while renewable sources like wind and solar struggle with intermittency. As Australia aims to become 100% renewable energy-powered, the need for sustainable off-grid energy solutions is increasingly urgent. Globally, over 1 billion people still lack access to electricity.

#### Response

The Endua initiative, launched in 2021 under a 'Company Creation Model,' brings together key partners: CSIRO (technical expertise), Ampol (industry knowledge), MSV (investment), and Entrepreneur-in-Residence Paul Sernia. The collaboration is focused on developing hydrogen-powered energy storage systems to deliver scalable, clean energy solutions for off-grid communities.

#### Impact

The new hydrogen storage technology is envisioned to deliver triple bottom line impacts through producing economically, environmentally friendly, and societally feasible renewable energy solutions. The successful development and adoption of the proposed systems is expected to address energy security and decarbonisation, boost renewables penetration, build a new industry in Australia, and help realise the nation's vision to be 100% renewable energy powered whilst addressing the growing commercial and domestic power demand in off-grid areas. The 'Company Creation Model' fosters rapid development and commercialisation of this innovative technology.

#### Cultural Capital Exemplar

The Endua initiative exemplifies cultural capital through its strong mission-driven approach, focusing on decarbonisation and clean energy solutions for off-grid communities. Its structured collaboration between key partners reflects deliberate strategic planning and impact-focused execution. The initiative is designed with governance and oversight built into its model, ensuring each partner's contributions align with the overarching mission to address climate change and energy security in Australia.

### Q-Sera (RAPClot)

#### Opportunity

Emergency departments in hospitals require rapid, stable, and complete clotting of blood samples to enhance efficiency and accuracy during analysis, particularly for batch processing. This ensures that analysis can begin promptly, avoiding delays caused by waiting for samples to reach the laboratory.

#### Solution

Q-Sera engaged CSIRO to develop a suitable spray-coat and manufacture blood collection tubes. CSIRO collaborated with On Board Solutions for spray machines Greiner Bio-One and Terumo Engineering for blood collection tubes, and universities to develop patented RAPClot tubes for rapid, reliable, stable, and superior blood sample tubes, saving 12.5 minutes compared to other products on the market.

#### Impact

By engaging CSIRO, the development timeline was accelerated by 18 months, resulting in savings of over \$200,000. The estimated BCR is 6.82 to 1, with an NPV of \$2.78 million (between 2023–2032). The solution also reduced the need for re-centrifuging samples due to unstable clotting, lowered the incidence of incorrect analyte readings in blood samples, and accelerated revenue through faster research and development (R&D) outcomes.

#### Cultural Capital Exemplar

This partnership exemplifies CSIRO's commitment to addressing significant and meaningful challenges, supporting Australian start-ups with impactful innovation. Q-Sera also benefited from CSIRO's Kick-Start Program, which assists innovative Australian start-ups and small businesses by providing funding, research expertise, and capabilities to foster growth and development.

### 3.2.2 Human Capital

<b>HUMAN CAPITAL: Knowledge and skills that are easily transferable and are required to realise and optimise impact.</b>	
<b>Current Performance: What's working and should be sustained</b>	<p>CSIRO staff exhibit strong absorptive capacity by monitoring external environments and integrating research into practical applications.</p> <p>The organisation's diverse and multidisciplinary science teams excel in tackling complex challenges through advanced scientific research.</p> <p>CSIRO staff demonstrate proactivity, versatility, inventiveness, and adaptability, essential for impactful solutions.</p> <p>CSIRO should continue to improve its focus on strategic planning and market understanding.</p>
<b>By addressing these areas, CSIRO would be better positioned to tackle complex challenges, deliver impactful solutions, and maintain a competitive edge in the global market.</b>	
<b>Impact Maturity: Opportunities for growth</b>	<ul style="list-style-type: none"> <li>✓ Shift focus to translating scientific excellence into tangible end-user benefits</li> <li>✓ Improve support systems to strengthen pathways for delivering impactful solutions (e.g., improved staff involvement in commercialisation activities; well-resourced support teams; timely support availability; and streamlined internal processes)</li> <li>✓ Integrate scientific and entrepreneurial mindsets, use end-user-focused approaches through leveraging accelerator programs such as ON, and recalibrate funding programs to prioritise downstream impact</li> <li>✓ Support continuous training and development; maintain scientific excellence through continuous development of human capital to preserve CSIRO's competitive edge in the innovation system</li> <li>✓ Foster a talented, multidisciplinary, and collaborative workforce by embedding these principles in the design of various initiatives</li> <li>✓ Cultivate leadership that embodies CSIRO's core values and provides necessary support to drive focus on impact. R&amp;I teams should offer a clear and coherent articulation of support requirements to the organisation's leadership.</li> </ul>

### Maintaining Access to EU Markets for Australian Canola

#### Opportunity

Australia's non-GMO canola exports to the EU, the country's largest and most lucrative market, were at risk due to stricter GHG savings targets introduced by the European Commission's Renewable Energy Directive. Failure to meet these revised standards would have resulted in significant financial losses and disrupted access to the premium EU market.

#### Solution

CSIRO, working alongside Lifecycles and Meo Carbon, developed a detailed life cycle assessment (LCA) of GHG emissions from Australian canola production. This report was the first to be accepted by the EU, ensuring that Australian exports complied with the new regulations. Australian trade officials in Brussels, Belgium, in collaboration with CSIRO, worked swiftly to have the report implemented in time to protect the 2017 canola harvest.

#### Impact

Since the report's acceptance in 2017, over 4.4 million tonnes of Australian canola, valued at more than \$2.5 billion, have been exported to the EU, preserving access to this critical market (as reported in 2019). The timely acceptance of the report ensured that Australia retained its competitive edge, protecting the industry from potential market disruption. The BCR of this effort has been estimated in the range of 19.1–22.9. Additionally, the NPV of the initiative is estimated at between \$88.7 million and \$89.5 million, underscoring the substantial financial benefits of maintaining market access. Beyond economic gains, this success also established a framework for future environmental assessments in Australian agriculture, ensuring ongoing sustainability and competitiveness in global markets.

#### Human Capital Exemplar

CSIRO's quick response to the EU's regulatory changes was enabled by its expertise in LCAs, developed over years of research. The collaboration with Lifecycles and Meo Carbon combined diverse skills to produce a rigorous report that met the EU's standards. The team navigated tight deadlines and complex requirements, ensuring timely delivery. This project was not just about immediate needs; it established a framework for future agricultural assessments, supporting the long-term sustainability and competitiveness of Australian agriculture. Strong leadership and collaboration ensured that the project met its goals ahead of schedule, safeguarding Australia's trade relationships.

### FMD (Foot-and-Mouth Disease)

#### Opportunity

An outbreak of an emergency animal disease (EAD) such as FMD poses a serious economic and social threat to Australia's livestock production, trade, and tourism sectors. A 2022 estimate suggested that a large-scale FMD outbreak could result in direct economic losses of approximately \$80 billion. Although Australia has been FMD-free since 1872, concerns about increased risks and the nation's preparedness for an EAD remain high.

#### Solution

CSIRO partnered with government departments, universities, and industry stakeholders to address this challenge. The project delivered a comprehensive vaccine bank covering a range of viral strains, developed SPREAD models for producer-led surveillance systems, and created testing, sampling, and management protocols for FMD across all livestock groups, including beef, sheep, cattle, goats, and pigs.

#### Impact

The initiative generated new knowledge and technologies to enhance biosecurity risk management and reduce the economic impact of potential FMD outbreaks by enabling faster recovery to normal trade conditions. It also strengthened trust and reporting through improved collaboration between researchers, government, and industry. CSIRO's involvement in the FMD Ready Program is valued at \$53.54 million over 10 years, with a BCR of 2.5 to 1.

#### Human Capital Exemplar

This project showcases CSIRO's capability to leverage its diverse, transdisciplinary workforce – including expertise in science, modelling, and economics – to deliver solutions to complex problems. It demonstrates the importance of a collaborative approach between livestock industries, governments, and research organisations to tackle challenges that are beyond the reach of less-diverse teams.



### 3.2.3 Social Capital

<p><b>SOCIAL CAPITAL: <i>The human networks, relationships, and channels of communication and engagement required to realise impact.</i></b></p>	
<p><b>Current Performance: What's working and should be sustained</b></p>	<p>CSIRO's growing focus on understanding relevant party motivations has enhanced its ability to align projects with stakeholder needs, strengthening its overall impact capacity. Maintaining this focus is crucial.</p> <p>The organisation's trusted reputation as a leading scientific agency has been critical for the widespread adoption of its R&amp;I outputs both in Australia and internationally.</p> <p>Collaboration with the broader scientific community has expanded access to knowledge and resources, reinforcing CSIRO's capacity for impactful outcomes.</p> <p>High-quality relationships with external stakeholders have been crucial to driving the realisation of impacts from CSIRO's projects.</p> <p>Engagement with relevant parties and effective feedback mechanisms have facilitated the adoption of solutions, while ex-ante impact assessments have improved decision-making and impact realisation.</p>
<p><b><i>By addressing these issues, CSIRO would be better positioned to achieve its objectives and maximise its impact.</i></b></p>	
<p><b>Impact Maturity: Opportunities for growth</b></p>	<ul style="list-style-type: none"> <li>✓ Strengthen the understanding of strategic relevant parties within the organisation. Enhance the understanding of key relevant party groups and their roles in pathways to impact through a focus on 'So what?', 'Who cares?', and 'Who benefits?' questions.</li> <li>✓ Maintain and grow CSIRO's trusted reputation while fostering multisector cooperation to deliver effective solutions</li> <li>✓ Prioritise effective relevant party engagement and implement strong feedback mechanisms to address relevant party needs and concerns, improving the likelihood, efficiency, and efficacy of solution adoption</li> <li>✓ Foster quality relationships through improved communication and engagement, and long-term collaboration, to optimise impact. Ensure prompt engagement, quick responses, ongoing management, and dedicated relationship managers/project coordinators to enhance the engagement experience.</li> <li>✓ Implement regular revisits of ex-ante impact assessments at suitable intervals to enhance feedback loops, contribute to effective decision-making, and improve the implementation, monitoring, and evaluation of scientific interventions</li> <li>✓ Cultivate strong internal relationships between R&amp;I and non-R&amp;I teams, ensuring early and effective collaboration to align efforts and maximise downstream impact</li> <li>✓ Improve collaboration with SMEs to improve prospects for scale and depth of downstream TBL impacts</li> </ul>

### Total Wellbeing Diet (TWD) Online

#### Opportunity

Overweight and obesity are major contributors to chronic disease in Australia. In 2017–18, an estimated 67% of Australians aged 18 years and over were classified as overweight or obese. According to a report by the Dietitians Association of Australia (DAA), poor diet contributes to 10% of the total disease burden, with an additional 8.5% specifically linked to obesity. The combined health costs and productivity losses from obesity were estimated to exceed \$50 billion as of FY2020.

#### Solution

In 2015, CSIRO launched the TWD Online Program in partnership with Digital Wellness (formerly SP Health). This 12-week high-protein, low-Glycaemic Index, and low-carbohydrate diet offers a safe and effective approach to weight loss and diabetes management compared to other methods. The program also includes social media support and educational tools – such as diet scores, diet types, a weight loss calculator, and a mindset quiz – to engage users, gather valuable data, and refine the program for different population segments.

#### Impact

The TWD Online Program has improved health outcomes by boosting labour productivity, reducing medication use for chronic conditions linked to obesity (such as Type 2 diabetes, cardiovascular disease, and mental health issues), and increasing fruit and vegetable consumption. The program has delivered a BCR of 3.4-to-1, with an NPV of \$173.7 million as of FY2020.

#### Social Capital Exemplar

This initiative highlights CSIRO's ability to leverage its trusted reputation to form successful partnerships. The collaboration with Digital Wellness increased the program's reach and adoption. Even assuming just a 10% influence from CSIRO's branding, the BCR of CSIRO's involvement is estimated at 6.2-to-1—higher than the program's standalone impact.

### Cybersecurity Research

#### Opportunity

Global connectivity presents significant challenges to privacy and trust, with cybersecurity threats posing costly disruptions. Globally, US\$170 billion is spent annually to mitigate cybersecurity risks. In Australia, cybersecurity incidents are estimated to cost the economy up to \$1 billion per year. The Australian sectors most reliant on cyber connectivity generate more than \$500 trillion in annual gross revenue and employ nearly 670,000 people. A single week of cyber downtime in these sectors could result in an estimated gross domestic product (GDP) loss of \$5.6 trillion and 32,000 jobs.

#### Solution

CSIRO's work has enhanced research, commercialisation, and collaboration across Australia's cyber industry, driving the development of new cybersecurity architectures. The program encompasses over 47 activities across focused cyber themes, delivering new platform technologies and products that are being trialled and adopted by researchers, industries, and all levels of government, both in Australia and internationally. The initiative has also provided leadership, guidance, forums, and resources for cyber initiatives, along with new training and development opportunities to build capacity and capability for future demands.

#### Impact

CSIRO's efforts have strengthened resilience, shared awareness, and human capacity in Australia's innovation system and the broader national economy. CSIRO's widely disseminated publications have been globally embraced and frequently cited by the cybersecurity research community. The program achieved a cost recovery rate of 178% and has bolstered Australia's reputation, earning the trust of industry and government in the nation's cybersecurity excellence.

#### Social Capital Exemplar

This exemplifies CSIRO's strong relationships with national and international stakeholders, highlighting how collaboration and the spread of cybersecurity capacity building have achieved far greater outcomes than would have been possible in the absence of these relationships.

### 3.2.4 Financial Capital

<b>FINANCIAL CAPITAL: <i>Mechanisms and finance required to support the delivery of impact.</i></b>	
<b>Current Performance: What's working and should be sustained</b>	<p>CSIRO's SME Connect and ON Program have successfully supported entrepreneurship, enabling start-ups like CoviU and Emesent to thrive, contributing to Australia's economic growth and innovation ecosystem.</p> <p>CSIRO's funding structure includes contributions from government appropriations (60%), R&amp;D contracts (28%), and grants and other sources (13%), providing a broad funding base.</p> <p>CSIRO maintains a high patent output relative to its revenue, with increasing focus on improving IP quality and alignment with strategic and commercial goals.</p>
<b><i>Improving these areas would enhance CSIRO's impact and financial resilience, commercial viability, collaboration with SMEs, resource efficiency, and sustained assistance for commercialisation stages.</i></b>	
<b>Impact Maturity: Opportunities for growth</b>	<ul style="list-style-type: none"> <li>✓ Increase the focus on R&amp;D contracts to reduce reliance on government funding, enhance financial stability, and improve alignment with market needs. This would balance funding sources to strengthen strategic flexibility and capacity for impactful research.</li> <li>✓ Align with strategic intent, external partner vision, market awareness, and planning to improve resource utilisation efficiency. Impact planning workshops and ex-ante impact assessments can support this effort.</li> <li>✓ Tailor funding strategies to sector-specific needs, ensuring adequate periods for testing and development. Additionally, implement exit strategies for low-TRL technologies to bridge funding gaps and improve impact potential</li> <li>✓ Focus on filing high-quality patents that align with strategic goals and commercialisation potential, and implement robust tracking and governance mechanisms in IP decision-making to ensure effective use of resources</li> <li>✓ Develop sustainable funding models and improve the design of funding and grant programs to improve end-of-program support and enhance impact realisation potential</li> <li>✓ Identify opportunities to optimise pricing models, making CSIRO's services more accessible to SMEs in emerging sectors, thereby expanding collaboration opportunities</li> </ul>

### Coviu

#### Opportunity

Before COVID-19, accessing healthcare was already challenging for many Australians due to factors like remote locations, limited mobility, and transport issues. The pandemic intensified this, requiring rapid adoption of virtual healthcare to continue providing medical services safely.

#### Solution

Coviu, developed by CSIRO in 2015, was Australia's leading telehealth platform before the pandemic. When COVID-19 struck, Coviu rapidly scaled its operations, growing from 400 to 25,000 consultations per day within 2 weeks, supporting the healthcare system's urgent need for virtual consultations. Coviu's cloud-based, feature-rich platform enabled healthcare practitioners to offer secure, end-to-end encrypted video consultations while seamlessly integrating clinical tools and patient management systems.

#### Impact

Coviu's rapid adoption during the pandemic resulted in a significant economic impact, with an incremental revenue increase of \$59 million, delivering a BCR of 30-to-1 (low scenario) to 36-to-1 (high scenario) and an NPV of up to \$57.3 million. The platform created 42 direct jobs and empowered thousands of SMEs in the healthcare sector, enabling the sector to maintain critical services during COVID-19.

#### Financial Capital Exemplar

Coviu's success stemmed from early investments that positioned it as Australia's leading telehealth platform. It secured a range of financial support, from venture capital to early backing, which provided the necessary resources and guidance in its formative years. This targeted support was designed to meet specific needs in the healthcare sector, helping Coviu to rapidly scale and efficiently respond to the demands of the COVID-19 pandemic. Its growth trajectory demonstrates a clear alignment between strategic financial backing and the ability to deliver wide-reaching benefits for both the healthcare system and the broader economy.

### Earth Analytics Science and Innovation (EASI)

#### Opportunity

Australia relies on more than 160 government programs at the national, state, and territory levels that depend on Earth observation (EO) data across areas like meteorology, climate, agriculture, natural resources, infrastructure, and defence. EO is critical for research and decision-making in these fields. A 2021 Deloitte study found that EO contributed \$283 million directly to the Australian economy in 2020, supporting over \$2.5 billion in annual economic activity, which is equivalent to 0.2% of the GDP.

#### Solution

The Earth Analytics Science and Innovation (EASI) platform uses state-of-the-art cloud computing to produce EO products with speed, resolution, and scope far beyond what standard desktop tools can achieve. Developed in collaboration with Geoscience Australia and Digital Earth Australia, EASI builds on the Open Data Cube (ODC), integrating new capabilities in EO data distribution. It maximises the use of both national and international satellite data, providing a flexible tool for high-quality science that works with large datasets.

#### Impact

EASI offers greater scalability and customisation than other cloud-enabled EO platforms. It combines time-series EO data with high processing capacity, allowing for dynamic updates as new data are generated. CSIRO's centralised pre-processing of data ensures high quality, improving research standards across institutions. EASI's data-sharing, collaboration, and modelling capabilities also create opportunities for business expansion.

#### Financial Capital Exemplar

EASI faces funding challenges that restrict its ability to incorporate user feedback, train a broader range of researchers, acquire new data to sustain the platform, and market it to a wider audience. Additionally, the current costing model – where the Space and Astronomy research unit must seek reimbursement from users – creates a disadvantage compared to other CSIRO computing systems that are centrally funded. This highlights the need for ongoing and substantial investment to ensure the platform's long-term growth and sustainability.

### 3.2.5 Physical Capital

<b>PHYSICAL CAPITAL: Resources and infrastructure necessary to deliver impact.</b>	
<b>Current Performance: What's working and should be sustained</b>	<p>CSIRO's physical facilities bolster research activities in critical areas, contribute to economic development, and promote innovation by supporting pivotal projects and attracting investments.</p> <p>Centralised facilities and collaboration hubs at CSIRO reduce duplication, foster partnerships, and provide access to advanced infrastructure and multidisciplinary expertise to SMEs. Digital enhancements like data digitisation also improve data integration and global collaboration.</p> <p>Training programs, like those through infrastructure facilities, effectively build capacity in researchers and industry, enhancing internal and external skills critical to innovation.</p>
<b>Addressing the infrastructure challenges would strengthen CSIRO's research activities, support high-precision research, reduce duplication of efforts, foster partnerships, provide access to state-of-the-art infrastructure, and augment the capabilities of students, researchers, and industry experts across the broader national innovation system.</b>	
<b>Impact Maturity: Opportunities for growth</b>	<ul style="list-style-type: none"> <li>✓ Implement comprehensive data collection mechanisms to capture detailed information on infrastructure usage and outcomes</li> <li>✓ Develop enhanced reporting frameworks to document and link infrastructure use to specific impacts, providing evidence-based data for impact assessments</li> <li>✓ Foster system-wide collaborations, secure infrastructure funding, and create shared facilities to support project execution and timely delivery</li> <li>✓ Advocate for long-term funding solutions and diversify sources to ensure sustained investment in infrastructure development and maintenance</li> <li>✓ Implement regular infrastructure impact assessments and establish M&amp;E programs to continuously track, assess, and demonstrate the value of CSIRO's physical and e-infrastructures, incorporating customer feedback to enable periodic adjustments and improvements to enhance impact realisation</li> </ul>



### Marine National Facility

#### Opportunity

Australia's vast marine environment is critical to the nation's climate, economy, and security. However, comprehensive research on marine ecosystems, climate change, and oceanographic data is limited by the need for advanced facilities and resources to explore and study these environments.

#### Solution

The Marine National Facility (MNF), operated by CSIRO, addresses this challenge with the RV Investigator, a state-of-the-art research vessel. Since its commissioning in 2014, the RV Investigator has provided researchers with cutting-edge technology and specialised equipment to conduct multidisciplinary research in the oceanographic, geoscience, biological, and atmospheric fields.

#### Impact

The RV Investigator has delivered over \$3 billion in benefits (median scenario, as reported in FY2020), contributing to significant advances in marine research, ecosystem management, and weather forecasting. It supports critical national and international projects, enabling better resource management and environmental stewardship, and enhanced scientific understanding of marine ecosystems.

#### Physical Capital Exemplar

The RV Investigator and the MNF are vital to Australia's marine research, providing advanced technology and infrastructure that enable groundbreaking discoveries in climate science, oceanography, and ecosystem management. By facilitating collaboration between government, industry, and academia, the MNF accelerates scientific progress. Its hands-on training programs equip the next generation of marine scientists, while offering SMEs access to state-of-the-art resources, reducing risks and driving innovation in marine research.

### Pawsey

#### Opportunity

Supercomputers enable and support groundbreaking science, driving innovation by helping researchers interpret complex data, test and explore new theories, and adopt scalable computational approaches to address the biggest scientific challenges across all disciplines.

#### Solution

The Pawsey facility provides access to one of the largest supercomputers in the Southern Hemisphere for Australian researchers in government, academia, and industry. This infrastructure accelerates scientific research and delivers efficient outcomes across multiple disciplines, including radio astronomy, engineering, physics, chemistry, earth sciences, and life sciences. It facilitates research that would be impossible without supercomputing and promotes expertise in data science, large-scale data processing, and analysis.

#### Impact

Pawsey serves over 80 organisations, fostering international relationships in supercomputing, large-scale data processing, and analysis. It has achieved unprecedented results across scientific domains and advanced global scientific knowledge. The facility has helped retain and attract world-class research in Australia, particularly in data engineering, warehousing, data mining, statistical analysis, cloud and system architecture, data management, machine learning, and visualisation.

#### Physical Capital Exemplar

Pawsey represents a long-term investment in advanced infrastructure for public use. While positive returns are expected over the next 30 years, short-term returns over 10 years are negative. This highlights the vital role of a national agency like CSIRO in maintaining such scientific infrastructure, as private industry would struggle to make a long-term investment of this nature which carries longer-term significance.

### 3.2.6 Innovation Environment Capital

<p><b>INNOVATION ENVIRONMENT CAPITAL: CSIRO’s research environment and internal systems and processes, as well as the external operating system that supports impact.</b></p>	
<p><b>Current Performance: What’s working and should be sustained</b></p>	<p>CSIRO leverages its competitive advantage, such as research infrastructure and multidisciplinary expertise, to enhance the national ROI by supporting science priorities and driving growth through strategic investments.</p> <p>CSIRO’s focus on non-R&amp;D innovations, such as adopting new business models and organisational methods, has demonstrated enhanced efficiency and fast-tracked market entry, as seen in initiatives like v2food and Endua. Continuing this focus will be crucial for sustaining and amplifying impact realisation.</p> <p>CSIRO fosters innovation and entrepreneurship through a holistic approach that combines supportive policies, financial backing, and collaborative programs like ON and MSV.</p> <p>The organisation demonstrates its dedication to environmental sustainability by adopting green technologies and minimising waste.</p>
<p><b>Addressing these areas would enhance supporting science priorities and driving growth through strategic investment decisions, further cultivate a broader innovation system conducive to innovation, improve the chances of successful technology commercialisation, and boost visibility.</b></p>	
<p><b>Impact Maturity: Opportunities for growth</b></p>	<ul style="list-style-type: none"> <li>✓ Implement thorough evaluations of CSIRO’s competitive advantages during investment decision-making to ensure growth, contribution to impact, and maintenance of a competitive advantage</li> <li>✓ Standardise TRL assessments, incorporate independent evaluations, and establish longer-term collaboration agreements, including ongoing retainer contracts, to improve the transition from research to commercial application. This approach will strengthen relationships with relevant parties, support commercialisation partners through regulatory processes, streamline the process, and enhance the partnership experience, maximising the prospects of impact realisation.</li> <li>✓ Expand coverage of policy and infrastructure assessments to enhance impact tracking, establish feedback loops for improvement, and ensure effective resource allocation for high-impact initiatives</li> <li>✓ Leverage robust communication channels to enhance the visibility of CSIRO initiatives and their impact potential</li> </ul>

### v2food

#### Opportunity

With global demand for sustainable protein alternatives on the rise, CSIRO was tasked with developing a plant-based protein that replicates the taste and texture of meat. This challenge was driven by increasing concerns around food security, environmental sustainability, and evolving consumer preferences for healthier, sustainable diets.

#### Solution

In collaboration with Competitive Foods and Main Sequence Ventures, CSIRO established v2food in 2019. Leveraging its multidisciplinary expertise, CSIRO rapidly developed a plant-based burger patty that replicated meat-like qualities, launching the Rebel Whopper® in less than 10 months across over 400 Hungry Jack's stores. The initiative combined technical innovation with strong industry partnerships, supported by CSIRO's science-business approach.

#### Impact

v2food has made a significant economic and environmental impact by offering plant-based protein alternatives, generating jobs, and reducing reliance on traditional meat products. The company created 61 jobs (as reported in 2021) and expanded its product range to major supermarkets and international markets. Additionally, the initiative is contributing to sustainability goals by providing consumers with lower-emission food options, supporting Australia's leadership in the plant-based protein market.

#### Innovation Environment Capital Exemplar

CSIRO's unique value in the v2food initiative lies in its ability to combine foundational scientific knowledge with the infrastructure necessary to test and scale innovations. Through its interdisciplinary expertise and collaborative networks, CSIRO enabled the rapid translation of R&D into market-ready products. By integrating scientific research with business strategy in a venture science model, CSIRO accelerated the journey from lab to market, supporting the quick launch of v2food products. This approach demonstrates how CSIRO's innovation ecosystem drives industry transformation, delivering impactful results both domestically and globally.

### Synthetic Biomedical Polymers

#### Opportunity

There is growing demand from the medical device industry for biodegradable synthetic polymers to be used as short-term measures in therapies and devices to support tissue regeneration, rather than relying on permanent implants.

#### Solution

CSIRO developed the patented NovoSorb family of biostable synthetic polyurethane for use in therapies and devices to promote tissue regeneration. A spin-off company, PolyNovo, was established to lead R&D, manufacturing, commercialisation, and medical device development. PolyNovo also partnered with the U.S. Biomedical Advanced Research and Development Authority to help translate research outputs into scalable new products and practices.

#### Impact

The NovoSorb family of biostable polymers has made healthcare more affordable by reducing patient infections, minimising rejection of medical interventions, and decreasing wound contraction and scarring compared to alternative products. NovoSorb also seals wounds before secondary treatments, such as permanent skin grafts, allowing more time to source donor skin and promoting overall healing. Additionally, it has enhanced PolyNovo's research productivity and capabilities. A positive net benefit and a BCR greater than 1 is achieved when 3% of the health benefits and export revenue are attributed to CSIRO, accounting for human capital gains, increased research productivity, and investment costs.

#### Innovation Environment Capital Exemplar

This exemplifies CSIRO's research environment, which fosters innovation, commercialisation, entrepreneurship, and collaboration. The success of CSIRO's research into biodegradable synthetic medical polymers aligns with its strategic objectives to provide scientific and technological solutions to national challenges. It also supports the 'National Innovation and Science Agenda,' which emphasises science, research, and innovation as long-term drivers of economic prosperity, job creation, and growth.

### 3.3 IMPACT TRANSLATION – ENGAGING WITH THE EXTERNAL SYSTEM

This section reflects on how critical external factors drive and strengthen the realisation of impacts. Key elements, such as an organisation’s SLO and science excellence, are essential examples. Without considering these factors, even the most robust internal management and capacity building efforts may fall short of realising their impact potential.

As the external context is dynamic, it is crucial to regularly review and adapt to potential challenges and opportunities in relation to these factors for impact success. Recognising and leveraging these external factors is vital for achieving sustained and meaningful outcomes.

#### 3.3.1 Driving Factors

<b>DRIVING FACTORS: <i>Mediating variables that influence how initiatives realise impact.</i></b>	
<b>Drivers of Impact Realisation for CSIRO</b>	<p>SLO is crucial for the acceptance of CSIRO’s research outputs.</p> <p>Market demand is key to impactful innovations, requiring alignment with industry needs and strategic focus on competitive advantage.</p> <p>The risk appetite of partners affects innovation funding, while regulatory alignment can enhance or hinder progress.</p> <p>CSIRO’s commitment to aligning innovations with regulatory frameworks is crucial for successful impact realisation. This focus ensures scalability and market readiness, while misaligned policies can hinder progress and limit potential.</p> <p>High adoption costs and the need for convenience are significant factors, and early engagement with commercial partners can help overcome barriers.</p> <p>Supportive policy and funding environments, along with sector-based accelerators, further influence impact capacity.</p>
<b><i>Addressing these areas would enhance acceptance and adoption of CSIRO’s R&amp;I outputs, better align projects with market needs, address the risk appetite of partners, and contribute to a supportive policy and funding environment.</i></b>	
<b>Impact Maturity: Opportunities for growth</b>	<ul style="list-style-type: none"> <li>✓ Maintain a keen focus on SLO assessment during initiatives by building trust and collaboration with relevant parties from the outset. Depending on the use case, leveraging tools such as those offered by Voconiq might be an effective option for achieving these objectives.</li> <li>✓ Align projects with market needs to boost innovation relevance and adoption, leveraging programs like ON to refine value propositions and enhance clarity on commercialisation pathways</li> <li>✓ Engage commercialisation partners early in the R&amp;I process, especially for high-investment and conservative market deployments, to improve prospects of uptake and market penetration</li> <li>✓ Employ strategies to mitigate early-stage investment risks and attract venture capital to ensure sustained support through the innovation development phase to enhance impact capacity</li> <li>✓ Advocate for supportive government policies and stable funding sources (e.g., deployment grants) for improved impact capacity. Promote and leverage sector-based specialised accelerators in fields like healthcare and energy to enhance impact capacity.</li> </ul>

### 3.3.2 Strengthening Factors

<p><b>STRENGTHENING FACTORS: <i>Moderating variables that affect the strength, scale, and direction of the impact capacity achieved by initiatives.</i></b></p>	
<p><b>Current Performance: What's working and should be sustained</b></p>	<p>CSIRO's strong reputation for science excellence drives credibility, partnerships, funding, and policy influence, ensuring R&amp;I in areas of strategic importance for realisation of TBL impacts.</p> <p>CSIRO is also working to improve engagement with Traditional Owners to ensure culturally appropriate projects.</p>
<p><b><i>Addressing the areas mentioned would enhance CSIRO's already positive reputation for scientific excellence, improve its credibility, facilitate strategic alliances, and expand funding sources by selecting the right partners and enriching engagement with Traditional Owners.</i></b></p>	
<p><b>Impact Maturity: Opportunities for growth</b></p>	<ul style="list-style-type: none"> <li>✓ Select commercialisation partners based on TRL and required expertise to ensure effective technology implementation and adoption</li> <li>✓ Ensure clear communication and expectation management with partners to avoid misalignments and contractual misunderstandings</li> <li>✓ Foster mutual trust, commitment to collaboration outcomes, and effective communication to enhance RTO-SME partnerships</li> <li>✓ Address barriers such as insufficient funding support, lack of SME awareness of RTO capabilities, and IP ownership concerns through strategic goal alignment and partner training programs</li> <li>✓ Improve engagement with Traditional Owners and consider how initiatives benefit Indigenous groups, while fostering capabilities, inclusivity, and job creation opportunities</li> <li>✓ Incorporate Traditional Owners' perspectives and knowledge to ensure culturally appropriate and respectful projects, fostering trust and collaboration</li> </ul>

### 3.4 STRIVING FOR CONTINUOUS IMPACT MATURITY GROWTH

This section provides a concluding reflection on CSIRO’s impact maturity within the R&I landscape. As depicted in Figure 3.1, it is structured to first identify key strengths and areas for development. It ties together the findings from this review and examines them in the context of the recent ACOLA report, which highlights systemic weaknesses within the Australian research environment. This is followed by presenting learnings from critical lessons that guide future improvements; outlining targeted priority action items essential for continuous improvement; and highlighting the importance of continuous improvement, offering insights into how CSIRO can further strengthen its impact maturity and contribute more effectively to the national innovation system.

#### 3.4.1 CSIRO’s Impact Maturity – Current Performance

CSIRO’s impact maturity has a significant effect on the organisation’s ability to realise its impact potential. The alignment of initiatives with strategic objectives and the incorporation of impact considerations into investment decisions have enhanced CSIRO’s strategic planning. Annual performance evaluations and external impact case study validations have improved oversight of the organisation’s impact focus, showcasing global best practices. However, challenges with research translation (especially commercialisation of CSIRO science and technology) due to misaligned KPIs, low risk appetite, and reward systems that discourage translation efforts hinder the organisation’s ability to realise impactful solutions.

CSIRO staff’s strong absorptive capacity, proactivity, versatility, and adaptability are essential for delivering impactful solutions. Effective collaboration with external parties and internal teams is crucial for impactful outcomes. However, the lack of fit-for-purpose infrastructure and difficulties in obtaining sustained financial support for infrastructure growth and maintenance pose challenges for the organisation.

**Figure 3.1: CSIRO’s Impact Maturity Analysis Based on the IMM: From Identification to Progress**



Overall, while CSIRO has made significant strides in aligning its projects with strategic objectives and enhancing its strategic planning, there are areas for improvement in research translation (particularly commercialisation pathways), infrastructure, internal collaboration, and other processes that affect the realisation of impacts. Table 3.1 provides a summary of the key strengths and areas requiring further investigation and development.



**Table 3.1: Areas of Strength and Development for CSIRO's Impact Maturity**

STRENGTHS	AREAS FOR DEVELOPMENT
<p><b>Strategic planning and impact considerations:</b> CSIRO has enhanced its strategic planning by incorporating impact considerations into investment decisions and conducting impact planning workshops.</p> <p><b>Employee capabilities:</b> CSIRO employees exhibit strong absorptive capacity, proactivity, versatility, and adaptability, which are essential for impactful solutions.</p> <p><b>Multidisciplinary expertise:</b> The organisation's diverse and multidisciplinary team strengthens its capacity to tackle multifaceted challenges both effectively and efficiently.</p> <p><b>Innovation and entrepreneurship:</b> Initiatives such as SME Connect and the ON Program support entrepreneurship and start-ups, contributing to Australia's economic growth.</p> <p><b>Reputation and credibility:</b> CSIRO's strong reputation for scientific excellence supports its strategic alliances and funding opportunities.</p>	<p><b>Commercialisation:</b> Misaligned KPIs, a low-risk appetite, and inadequate reward systems affect CSIRO's ability to commercialise research effectively.</p> <p><b>Collaboration:</b> Effective collaboration with both external parties and internal teams needs improvement to better enable impactful outcomes.</p> <p><b>Infrastructure:</b> Fit-for-purpose infrastructure and sustained financial support for key infrastructure require further consideration.</p> <p><b>Market understanding:</b> Despite progress, further refinement is needed to strengthen commercialisation and expand staff expertise in relation to market-driven commercial impact pathways.</p> <p><b>Cost of services:</b> CSIRO's services are considered expensive for SMEs, limiting collaboration opportunities.</p> <p><b>Funding and financial resilience:</b> Better alignment with market demands is required to improve realisation of impact and financial sustainability.</p>

## Analysis of CSIRO's R&I Environment Compared to Systemic Weaknesses

This section explores the key systemic weaknesses outlined in the RAAEM report prepared by ACOLA in 2023. As highlighted in Section 1 of this report, it further examines how CSIRO's processes, including the potential use of the IMM, respond to some of these challenges while enhancing the organisation's impact capacity and adaptability within Australia's evolving R&I landscape.

**CHALLENGE 1: Overreliance on quantitative metrics** – The RAAEM report stresses issues relating to an overreliance on quantitative metrics like publication counts and citation numbers, overshadowing research quality and broader impact.

<p><b>RESPONSE</b></p>	<p>The Value of CSIRO report highlights a shift from these misaligned KPIs to fit-for-purpose metrics that measure real-world TBL impacts.</p> <p>CSIRO's IMM emphasises impact-focused reward systems as an important capacity associated with the organisation's Cultural Capital, ensuring comprehensive performance evaluations that recognise and value what truly matters.</p>
------------------------	--

**CHALLENGE 2: Recognition of diverse contributions** – ACOLA notes a lack of recognition for diverse contributions such as mentorship, outreach, team science, and innovations.

<p><b>RESPONSE</b></p>	<p>The IMM captures these elements through its consideration of 'Human Capital,' supporting a more inclusive approach to impact assessment.</p>
------------------------	---

---

**CHALLENGE 3: Industry engagement and career progression** – The RAAEM report criticises inadequate recognition of industry-focused work, hindering career progression for researchers and fostering an overly competitive environment.

**RESPONSE**

CSIRO emphasises engagement for realising impacts, with impact planning workshops and case studies focusing on relevant party engagement through joint projects, commercialisation and outreach activities, training, development, secondments, co-publications, etc. These aspects are accounted for as aspects of the Social and Cultural Capitals in the IMM.

---

**CHALLENGE 4: Diversity and inclusion** – The RAAEM report identifies biases and inequities in current evaluation practices, disadvantaging certain groups and limiting diversity within the research workforce.

**RESPONSE**

CSIRO promotes diversity and inclusion, integrating these metrics into performance assessments (e.g., BRTOBP report) and the IMM, and recognises these as significant elements that underpin the organisation's impact maturity.

---

**CHALLENGE 5: Frameworks for research assessment** - The Pillars of Modern Research Assessment framework presented in the RAAEM report and developed through extensive consultation with relevant parties focuses on diverse contributions, equity, integrity, and transparency to address the limitations of traditional evaluation methods and metrics (e.g., publication counts). The model emphasises broad principles such as collaboration, collegiality, transparency, integrity, and equity, providing a strong ethical and inclusive foundation for assessing research.

**RESPONSE**

The IMM complements and extends the 'Pillars' model's foundational principles, by providing a detailed, actionable implementation approach for systems-thinking assessment practice.

The IMM offers a detailed, structured, and practical approach for impact capacity assessment, emphasising cultural, human, social, financial, and innovative capitals as the key resource elements to consider as the basis for effect impact capacity in R&I organisations. It offers a step towards advancing the standardisation of the impact capacity review process and building data-driven impact maturity, while also addressing the complexities and dynamic nature of modern research environments.

**CONCLUSION:** CSIRO's assessment processes based on the IMM address many of the systemic weaknesses highlighted in the RAAEM report. By adopting the IMM, conducting impact planning workshops, and commissioning impact case studies, CSIRO ensures a robust framework for tracking and bolstering key aspects of research impact.

### 3.4.2 CSIRO's Impact Maturity – Key Lessons

Table 3.2 presents the key lessons identified based on this review, offering insights that can help CSIRO further enhance its impact maturity in future. These lessons span diverse areas, providing a comprehensive roadmap for consideration.

**Table 3.2: Five Key Lessons to Inform the Continued Growth of CSIRO's Impact Maturity**

THEME	LESSONS LEARNT
<b>Strategic planning &amp; impact focus</b>	<p>CSIRO has made significant strides in strategic planning by integrating impact-focused thinking and data into its investment decisions. Regular planning workshops have been instrumental in aligning projects with both strategic objectives and societal needs, ensuring the organisation remains adaptable to regulatory changes, global trends, and funding challenges.</p> <p>To truly embed an impact-oriented approach across the organisation, it is essential to extend this focus equally across all research areas and programs, ensuring consistent alignment in planning, decision-making, and performance management.</p>
<b>Commercialisation &amp; risk appetite</b>	<p>CSIRO's capacity to deliver impact can be improved by increasing its risk appetite for commercialisation, aligning performance metrics with societal and market benefits, and learning from failures through initiatives like the Missions Program's 'Lessons Learnt' database.</p> <p>Raising and embedding these areas into processes such as the Board Strategy Day, CSIRO's Risk Framework, as well as the Annual Planning and Performance Cycle, will establish a more transparent, objective, and longer-term impact evaluation schedule to ensure all investments are set to be assessed.</p>
<b>Human capital &amp; absorptive capacity</b>	<p>CSIRO employees demonstrate strong absorptive capacity, translating fundamental research into practical applications through their proactive, versatile, and adaptable approach, essential for providing impactful solutions.</p> <p>However, CSIRO staff need to play a stronger role in raising the awareness and absorptive capacity of the end users for their solutions (from both industry and government). This not only benefits the end users but also contributes to impact realisation by accelerating innovation and technological transfer and mobilisation.</p>
<b>Financial structure &amp; funding challenges</b>	<p>CSIRO's funding is diverse, with 60% from direct appropriation, 28% from R&amp;D contracts, and 13% from grants and other sources. However, securing financial investment during the final stages of significant funding periods remains challenging, particularly for commercial testing or deployment.</p> <p>Investors frequently hesitate to commit additional funds without clear evidence of an ROI or proven market demand. Additionally, the costs involved in these final phases can be substantial, further complicating the decision-making process for both investors and CSIRO. Expanding the use of ex-ante impact assessments at earlier phases of a research program's value chain (e.g., as demonstrated by FSP case studies) can provide credible and rigorous data and analyses to attract investment partners and support decision-making.</p>
<b>Importance of research infrastructure</b>	<p>CSIRO's advanced infrastructure supports high-precision research in critical areas, enhancing research quality and efficiency. However, the lack of fit-for-purpose infrastructure in emerging fields increases costs and causes delays, affecting project viability and impact capacity.</p> <p>Expanding the success of centralising facilities and the effectiveness of collaboration hubs at CSIRO can further reduce resource duplication, foster partnerships, and enable improved access to advanced infrastructure and multidisciplinary expertise. Growing the digital enhancements driven by the Digital Steering Committee has potential to improve data integration and global collaboration, streamlining processes and increasing research efficiency for greater impact.</p>

### 3.4.3 CSIRO's Impact Maturity – Priority Growth Actions

Overall, this report has provided approximately 45 actions CSIRO could undertake to improve its impact maturity, across the six capitals and associated capacities, and the impact realisation driving and strengthening factors articulated in the IMM. These actions focus on advancing commercialisation, improving internal collaboration, strengthening strategic planning, and deepening stakeholder engagement. Table 3.3 highlights the highest-priority actions for driving growth in CSIRO's impact capacity.

**Table 3.3: High-Priority Action Items to Improve CSIRO's Impact Maturity**

AREAS	HIGH-PRIORITY ACTION ITEMS
<b>Enhancing commercialisation &amp; impact</b>	Increase CSIRO's and partners' risk appetite for commercialisation, implement impact-focused reward systems, and ensure the translation of scientific excellence into tangible end-user benefits to enhance CSIRO's overall impact.
<b>Strengthening internal cooperation &amp; governance</b>	Strengthen strategic planning, governance, and internal cooperation to improve response times to external requests and ensure alignment of efforts to maximise impact.
<b>Fostering stakeholder engagement</b>	Prioritise effective engagement with stakeholders, including SMEs and Traditional Owners, and implement robust feedback mechanisms to improve the adoption and relevance of solutions.
<b>Developing sustainable funding models</b>	Develop sustainable funding models, diversify sources, and align projects with market needs to ensure financial stability and enhance the impact of R&I.

### 3.4.4 Key Takeaways

Optimising CSIRO's impact capacity is crucial for maximising its contribution to Australia's R&I landscape. The IMM offers a structured framework to guide this optimisation, ensuring that all capitals – Cultural, Human, Social, Financial, Physical, and Innovation Environment – work together effectively for optimal impact performance. While the R&I environment is inherently complex, with each case and sector presenting its own unique challenges, the IMM provides a pathway to enhance impact maturity. Although there is no 'one-size-fits-all' solution that guarantees impact, applying this model greatly improves the chances of success, positioning CSIRO to better realise its impact potential in an ever-evolving landscape.

---

## 4 Future Direction

The analysis conducted to test the validity of the IMM within the context of assessing CSIRO's impact capacity demonstrates that it is a valuable tool for providing an integrated view of CSIRO's capabilities and identifying areas for optimisation. As the organisation's maturity evolves, the critical capacities under each capital will also shift, requiring continuous adaptation.

To ensure meaningful use of this tool in measuring and enhancing CSIRO's impact capacity, targeted data collection must become an integral part of the organisation's impact management operations. Expanding the analysis beyond impact case studies and applying it to a statistically significant dataset will offer a more

comprehensive and reliable understanding of CSIRO's impact capacity. This broader approach will address the limitations, such as selection bias, data gaps, and statistical uncertainties, associated with this analysis, ensuring more representative insights.

Establishing coherent systems and databases for consistent data collection is essential for driving data-driven insights into the factors influencing CSIRO's impact capacity. This will support more strategic and informed decision-making. By harmonising data and enhancing its clarity, CSIRO can align its decisions with its long-term goals of optimising its impact potential.

# APPENDIX

## A.1 IMPACT CASE STUDY PORTFOLIO DETAILS

**Table A.1: High-Level Summary of CSIRO Impact Case Studies**

STUDY NAME	STUDY CODE	PUBLICATION YEAR	AUTHOR	USED FOR 2024 ESTIMATES	USED FOR 2022 ESTIMATES	USED FOR 2020 ESTIMATES
Agricultural Flagship: Cotton Varieties	A3	2014	ACIL Allen	✓	✓	✓
Longwall Automation Steering Committee: Longwall Automation	A8	2014	ACIL Allen	✓	✓	✓
Aquaculture Feed (Novacq) & Prawn Breeding	A10	2016	ACIL Allen	✓	✓	✓
Atlantic Salmon Breeding	C4	2016	CSIRO	✓	✓	✓
Bluelink	A4	2016	ACIL Allen	✓	✓	✓
Botanical Resources Australia	A5	2016	ACIL Allen	✓	✓	✓
BuildingIQ: Opticool	A6	2016	ACIL Allen	✓	✓	✓
Distal Footprints*	A15	2016	ACIL Allen	✓	✓	✓
Early Nutrition*	A12	2016	ACIL Allen	✓	✓	✓
Energy Waste*	A11	2016	ACIL Allen	✓	✓	✓
eReefs	A7	2016	ACIL Allen	✓	✓	✓
Medical Developments International: Pentrox	A9	2016	ACIL Allen	✓	✓	✓
Plant Yield*	A13	2016	ACIL Allen	✓	✓	✓
RAFT for Medical Applications*	A14	2016	ACIL Allen	✓	✓	✓
Synchrotron*	A16	2016	ACIL Allen	✓	✓	✓
Biomarkers for Detection of Colorectal Cancer	C20	2017	CSIRO	✓	✓	✓
Biosensors for Health & Food: CYBERTONGUE®/CYBERNOSE®	C22	2017	CSIRO	✓	✓	✓
Care Assessment Platform/ MoTER Cardiac Rehabilitation Program	E7	2017	CIE	✓	✓	✓
Future Grid Forum & Electricity Network Transformation Roadmap	C11	2017	CSIRO	✓	✓	✓
Rabbit Biocontrol	C8	2017	CSIRO	✓	✓	✓
Reservoir Rejuvenation Technology	C7	2017	CSIRO	✓	✓	✓
Total Wellbeing Diet Online	E2	2017	CIE	✓	✓	✓
Vaximiser	E4	2017	CIE	✓	✓	✓
Dry Slag Granulation	C12	2018	CSIRO	✓	✓	✓
Improving Iron Ore Sintering Process Performance	C14	2018	CSIRO	✓	✓	✓



STUDY NAME	STUDY CODE	PUBLICATION YEAR	AUTHOR	USED FOR 2024 ESTIMATES	USED FOR 2022 ESTIMATES	USED FOR 2020 ESTIMATES
Magnetic Resonance Ore Sorter	C13	2018	CSIRO	✓	✓	✓
Medical Image Communication Exchange (MICE)	C17	2018	CSIRO	✓	✓	✓
Remote-I Digital Eye Health System	E8	2018	CIE	✓	✓	✓
CSIRO's CAMP – Oventus	E9.2	2019	CIE	✓	✓	✓
Kick-Start Program	E10	2019	CIE	✓	✓	✓
Maintaining Access to EU Markets for Australian Canola	C18	2019	CSIRO	✓	✓	✓
Natural Hazards & Infrastructure Initiative	C5	2019	CSIRO	✓	✓	✓
Pawsey Supercomputing & CETO	E3.3	2019	CIE	✓	✓	✓
Pawsey Supercomputing & Efficient Gas Turbines	E3.1	2019	CIE	✓	✓	✓
Pawsey Supercomputing & the Murchison Widefield Array	E3.2	2019	CIE	✓	✓	✓
STEM+Business: Aquarius	E11.2	2019	CIE	✓	✓	✓
STEM+Business: Optotech	E11.1	2019	CIE	✓	✓	✓
TerriaJS	E1	2019	CIE	✓	✓	✓
3D Situational Awareness research	E14	2020	CIE	✓	✓	X
CSIRO Cybersecurity Research (Data61)*	E15	2020	CIE	✓	✓	X
CSIRO's Collaboration with CBG Systems	E18	2020	CIE	✓	✓	X
CSIRO's Development of Synthetic Biomedical Polymers	E19	2020	CIE	✓	✓	X
Diffuse Energy	A23	2020	ACIL Allen	✓	✓	X
Early and Dry Sowing of Wheat	C30	2020	CSIRO	✓	✓	X
Early Sowing of Canola in Eastern Australia	C32	2020	CSIRO	✓	✓	X
From Boat to Plate*	C24	2020	CSIRO	✓	✓	X
Genics	A20	2020	ACIL Allen	✓	✓	X
Graincast	F2	2020	RTI	✓	✓	X
Grover Scientific (E-DNA Sampler)	A24	2020	ACIL Allen	✓	✓	X
Marine National Facility	F1	2020	RTI	✓	✓	X
Microencapsulation Technology	E25	2020	CIE	✓	✓	X
MS3	G5	2020	Tractuum	✓	✓	X
PainChek LTD	A19	2020	ACIL Allen	✓	✓	X

STUDY NAME	STUDY CODE	PUBLICATION YEAR	AUTHOR	USED FOR 2024 ESTIMATES	USED FOR 2022 ESTIMATES	USED FOR 2020 ESTIMATES
RapidAIM – RapidFLY Smart Traps	E24	2020	CIE	✓	✓	X
Voconiq	A21	2020	ACIL Allen	✓	✓	X
Wildcat SLAM	E17	2020	CIE	✓	✓	X
1622 Water Quality Apps	F7	2021	RTI	✓	✓	X
Coral Reef Monitoring and Response Technologies	F8	2021	RTI	✓	✓	X
Coviu Refresh V3	G3	2021	Tractuum	✓	✓	X
Crown-of-Thorns Starfish Integrated Pest Management	C25	2021	CSIRO	✓	✓	X
CSIRO Eveleigh AI Centre of Excellence	F4	2021	RTI	✓	✓	X
DNA Ageing Technology Emerging	F5	2021	RTI	✓	✓	X
LOOC-C Carbon App	F9	2021	RTI	✓	✓	X
Megasonics Olive Oil Recovery*	C31	2021	CSIRO	✓	✓	X
Saltbush Forage Improvement (Anameka™)	C28	2021	CSIRO	✓	✓	X
WaterWise	F10	2021	RTI	✓	✓	X
Westmead Lab of the Future	F3	2021	RTI	✓	✓	X
Argo Program	F11	2022	RTI	✓	X	X
SEA Data Cube	E28	2022	CIE	✓	X	X
SynBio FSP Novelty by Design Project	F13	2022	RTI	✓	X	X
SynBio FSP Platform Zed	F12	2022	RTI	✓	X	X
Adaptive Experimental Design	E30	2023	CIE	✓	X	X
GraphAir	G8	2023	Tractuum	✓	X	X
Northern and Southern Farming Systems (N&SFS)	G9	2023	Tractuum	✓	X	X
National Biodiversity DNA Library (NBDL)	G10	2023	Tractuum	✓	X	X
Q-Sera RAPClot™ Serum Tubes	E31	2023	CIE	✓	X	X
Sandy Soils	E32	2023	CIE	✓	X	X
Ultrafine+®	G7	2023	Tractuum	✓	X	X
Rock Physics Machine Learning Tool	F21	2024	RTI	✓	X	X
Executive Gamification (Data61 Cybersecurity Portfolio)	F23a	2024	RTI	✓	X	X
Infratech's Fire Safety, Testing, and Certification Services for Tunnels	F18	2024	RTI	✓	X	X

STUDY NAME	STUDY CODE	PUBLICATION YEAR	AUTHOR	USED FOR 2024 ESTIMATES	USED FOR 2022 ESTIMATES	USED FOR 2020 ESTIMATES
FMD Ready	E33	2024	CIE	✓	X	X
OptimShare (Data61 Cybersecurity Portfolio)	F23b	2024	RTI	✓	X	X
Pathling	E34	2024	CIE	✓	X	X
High Pressure Processing	C16	2018	CSIRO	X	✓	✓
Cereal Rust	C1	2016	CSIRO	X	X	✓
Yield Prophet	C3	2016	CSIRO	X	X	✓
Coviu	A22	2020	ACIL Allen	X	X	✓
Cement Substitutes & Novel Products	B3	2010	ACIL Tasman	X	X	X
Climate Adaptation Flagship: Climate Ready Crops	B2	2010	ACIL Tasman	X	X	X
Climate Adaptation Flagship: Coastal Communities	B1	2010	ACIL Tasman	X	X	X
Radio-Astronomy: Square Kilometre Array	B5	2010	ACIL Tasman	X	X	X
The UltraBattery	B4	2011	ACIL Tasman	X	X	X
Australian Animal Health Laboratory: Foot-and-Mouth Disease	A1	2014	ACIL Allen	X	X	X
BARLEYmax™	D1	2014	DAE	X	X	X
Integrated Water Resource Assessments	A2	2014	ACIL Allen	X	X	X
Sustainable Commercial Fisheries	D2	2014	DAE	X	X	X
The Scientists and Mathematicians in Schools Program	C19	2015	CSIRO	X	X	X
Grapevine Breeding	C2	2016	CSIRO	X	X	X
Clinical Terminology Tools	C21	2017	CSIRO	X	X	X
Clinical Terminology Tools	D3	2017	DAE	X	X	X
Direct Injection Carbon Engine (DICE)	C15	2017	CSIRO	X	X	X
Impromy	E5	2017	CIE	X	X	X
Patient Administration Prediction Tool	C6	2017	CSIRO	X	X	X
RapidAIM Smart Traps	E6	2017	CIE	X	X	X
Weed Biocontrol	C9	2017	CSIRO	X	X	X
Silentium Defence	A18	2018	ACIL Allen	X	X	X
CSIRO's Clayton Advanced Manufacturing Precinct (CAMP)	E9.1	2019	CIE	X	X	X

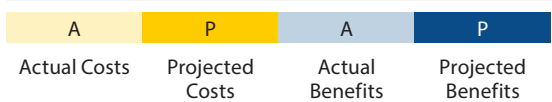
STUDY NAME	STUDY CODE	PUBLICATION YEAR	AUTHOR	USED FOR 2024 ESTIMATES	USED FOR 2022 ESTIMATES	USED FOR 2020 ESTIMATES
IA Quantified Risk Assessment of Complex Systems	E12	2019	CIE	X	X	X
Trustworthy Systems Group's Research & Technology	C10	2019	CSIRO	X	X	X
Applied Research and Innovation System in Agriculture (ARISA) Program	E20	2020	CIE	X	X	X
Centre for Australian National Biodiversity Research	E21	2020	CIE	X	X	X
CSIRO's Collaboration with the Five-Hundred-Metre Aperture Spherical Telescope (FAST)	E23	2020	CIE	X	X	X
CSIRO's RNAi Investments	E16	2020	CIE	X	X	X
CSIRO-Viet Uc Shrimp Breeding Program	E27	2020	CIE	X	X	X
Hydrogen Generator for Refuelling Fuel-Cell Electric Vehicles (FCEV)*	C33	2020	CSIRO	X	X	X
TAGV NeWheel	E13	2020	CIE	X	X	X
Air Quality Forecasting System (AQFx)	E26	2021	CIE	X	X	X
Automated Farm Provenance: Animal Welfare Compliance*	C23	2021	CSIRO	X	X	X
CSIRO Futures: A Case Study of the National Hydrogen Roadmap	F6	2021	RTI	X	X	X
CSIRO Investment in Proficiency Testing	E22	2021	CIE	X	X	X
Dual Purpose Canola	C26	2021	CSIRO	X	X	X
M♥ Ther: Gestational Diabetes e-Health Platform	C27	2021	CSIRO	X	X	X
Phalaris Breeding Program	C29	2021	CSIRO	X	X	X
RV Investigator SE Ecosystem Survey	G2	2021	Tractuum	X	X	X
SPARK	G4	2021	Tractuum	X	X	X
Virtual Power Station	G1	2021	Tractuum	X	X	X
Australian Biological Control Laboratory (ABCL)	E29	2023	CIE	X	X	X
Geological and Bioregional Assessment Program	E36	2022	CIE	X	X	X
Exploratory Regional Economy	F14	2022	RTI	X	X	X
Smarter Safer Homes	E35	2022	CIE	X	X	X

STUDY NAME	STUDY CODE	PUBLICATION YEAR	AUTHOR	USED FOR 2024 ESTIMATES	USED FOR 2022 ESTIMATES	USED FOR 2020 ESTIMATES
National Research Collections Australia (NRCA)	F22	2023	RTI	X	X	X
Earth Analytics Science and Innovation (EASI) Platform	F24	2023	RTI	X	X	X
Valuing Sustainability FSP	F15	2023	RTI	X	X	X
Education and Outreach Virtual Work Experience	F16	2023	RTI	X	X	X
Return on Australian Investment in ASKAP	F19	2024	RTI	X	X	X
CSIRO Early Research Career (CERC)	F17	2024	RTI	X	X	X
CSIRO-NSF Memorandum of Understanding	F20	2024	RTI	X	X	X
AuScope	D4	ND	DAE	X	X	X
v2food	G6	ND	Tractuum	X	X	X

\* The Science of Industry and Endowment Fund (SIEF) Projects

**Figure A.1: Benefit and Cost Data for Each Study by Year and Type (Actual vs. Projected)**

STUDY CODE	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036		
C14	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	P	P	P	P	P	P	P	P	P	P											
C13	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	P	P																			
E25		A	A	A	A	A	A	A	A	A	A	A	A	A																										
A8			A	A	A	A	A	A	A	A	A	A	A	A	P	P	P	P	P	P	P	P	P	P																
F11		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P		
A4				A	A	A	A	A	A	A	A	A	A	A	A																									
A5																																								
E19				A	A	A	A	A	A																															
A10				A	A	A	A	A	A	A	A	A	A	A	A																									
C4																																								
C22																																								
A3																																								
C20																																								
A6																																								
C12																																								
E4																																								
E7																																								
C8																																								
C7																																								





STUDY CODE	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036							
E3.3											A	A	A	A	A	A	A	A	A	A	P	P	P	P	P	P	P	P	P	P															
E24												A	A	A	A	A	A	A			A	P	P	P	P	P	P	P	P	P	P														
A13												A	A	A	A									P	P	P																			
A11												A	A	A	A	A	A				P	P	P	P	P	P	P	P	P																
F1												A	A	A	A	A	A	A	A	A	A	A	A	A	P	P	P	P	P	P	P	P	P	P											
C18												A	A	A	A	A	A	A			A	P	P	P	P																				
A12												A	A	A	A	A									P	P	P	P	P	P															
A14												A	A	A	A	A	A																												
E9.2													A																																
A7													A	A	A	A	P				P	P	P	P	P	P	P	P	P																
C11													A	A	A	A				P	P	P	P	P	P	P	P	P	P																
A16													A	A	A	A					P	P	P	P	P	P	P	P	P																
A15													A	A	A	A	A	A								P	P	P	P	P	P														
E8													A	A	A	A	A	A					P	P	P	P	P	P	P	P	P														
C30													A	A	A	A	A						P	P	P	P	P																		
E3.2													A	A	A	A	A	A					P	P	P	P	P	P	P	P	P														
E2													A	A	A	A	A				P	P	P	P	P	P	P	P	P																
G9													A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
G7														A	A	A	A	A	A								P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

A	P	A	P
Actual Costs	Projected Costs	Actual Benefits	Projected Benefits



STUDY CODE*	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036							
G5																		A	A	A																									
E32																		A	A	A	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P							
G3																			A	A	A	A																							
F10																			A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P								
A23																			A	A	A	A																							
E18																			A	A	A																								
A20																			A	A	A																								
E14																			A	A	A	A	P																						
E11.2																			A	A	A																								
E11.1																			A	A	A																								
F9																			A	A	A	A	A																						
F12																			A	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P					
F13																			A	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P					
E31																			A	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P					
F21																			A	A	A	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P					
F8																			A	A	A	A	P																						
E15																			A	A	A																								
A24																			A	A																									

A	P	A	P
Actual Costs	Projected Costs	Actual Benefits	Projected Benefits

STUDY CODE*	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036		
E30																				A	A	A	P	P	P	P	P	P	P	P	P	P	P							
E17																						P	P	P	P	P	P	P	P	P	P									
F5																					A	A	A	P																
G8																					A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
E34																						A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P			
F23b																						A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P			
F23a																						A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P			
E28																							P	P	P	P	P	P	P	P	P	P	P	P	P	P	P			
G10																						A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P		
F4																							P	P	P	P	P	P	P	P	P	P	P	P	P	P				
F3																							P	P	P	P	P	P	P	P	P	P	P	P	P					

A	P	A	P
Actual Costs	Projected Costs	Actual Benefits	Projected Benefits

---

# The Value of CSIRO

## The Broader Impact of CSIRO's Portfolio of Activities

2024 Update



**RTI International**  
3040 E. Cornwallis Road  
Research Triangle Park,  
NC 27709



**Tractuum**  
Ridgewood Drive  
Brookwater QLD  
4300 Australia

© 2024 RTI International and Tractuum Pty Ltd.

RTI International is a registered trademark and a trade name of Research Triangle Institute  
The RTI logo is a registered trademark of Research Triangle Institute