

The Auditor-General
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Performance Audit

The Development and Administration of National Research Flagships

**Commonwealth Scientific and Industrial Research
Organisation**

Australian National Audit Office

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of Australia 2011

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Canberra ACT
8 June 2011

Dear Mr President
Dear Mr Speaker

The Australian National Audit Office has undertaken an independent performance audit in the Commonwealth Scientific and Industrial Research Organisation with the authority contained in the *Auditor-General Act 1997*. Pursuant to Senate *Standing Order 166* relating to the presentation of documents when the Senate is not sitting, I present the report of this audit and the accompanying brochure to the Parliament. The report is titled *The Development and Administration of National Research Flagships*.

Following its presentation and receipt, the report will be placed on the Australian National Audit Office's Homepage—<http://www.anao.gov.au>.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Ian McPhee', written over a horizontal line.

Ian McPhee
Auditor-General

The Honourable the President of the Senate
The Honourable the Speaker of the House of Representatives
Parliament House
Canberra ACT

AUDITING FOR AUSTRALIA

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Contents

Abbreviations.....	7
Glossary	8
Summary and Recommendations	11
Summary	13
Introduction	13
Audit objective, criteria and scope	16
Overall conclusion.....	17
Key findings.....	21
Summary of agency response	27
Recommendations	28
Audit Findings and Conclusions	29
1. Introduction	31
Background.....	31
Evolution of the National Research Flagships	32
External priority setting.....	37
Strategic change program.....	40
Audit approach.....	43
Structure of the report	44
2. Organisational Realignment.....	45
Background	45
Implementation of the Portfolio Performance Framework	45
Science Investment Process.....	47
The operating model	54
3. Evolution of the Selected Flagships.....	59
Background	59
Changes to the original Flagships.....	60
The development of the new Flagships	68
4. Funding and Expenditure	73
Sources of funding	73
Budget and expenditure for the Flagship Program	77
Funding and expenditure of the Flagship Collaboration Fund.....	83
5. Performance Reporting	87
Background	87
CSIRO Annual Report.....	87
Assessing impact	89
Portfolio Performance Framework performance reporting arrangements	95
6. Internal and External Reviews	104
Background.....	104

Divisional Science Reviews	104
Flagship Reviews	106
Lapsing Program Reviews	108
Consolidating the findings of reviews.....	113
Appendices	117
Appendix 1: Detailed Agency Response	119
Appendix 2: Case studies on impact included in the <i>CSIRO Annual Report 2009–10</i>	120
Appendix 3: Funding and expenditure of the selected Flagships.....	124
Index.....	128
Series Titles.....	129
Current Better Practice Guides	134

Abbreviations

ANAO	Australian National Audit Office
APG	Annual Performance Goal
BHAG	Big Hairy Audacious Goal
COAG	Council of Australian Governments
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
KPI	Key Performance Indicator
PBS	Portfolio Budget Statement
RDC	Research and Development Corporation

Glossary

Cluster	Three-year collaborative research program funded by CSIRO through the Flagship Collaboration Fund.
Flagship Collaboration Fund	Funding pool designed to further strengthen collaboration between the Flagships, universities and other publicly funded research institutions.
Flagship roadmap	Visual summary and representation of a Flagship and theme's key steps or actions for delivering impact.
Impact	Proven benefit to Australia that has been achieved through the application or utilisation of the results of CSIRO research.
Matrix-based management model	A structure that creates dual lines of authority. In the case of CSIRO, functional authority for research staff rests with the Division Heads whereas product development responsibility rests primarily with the Flagship Directors. This arrangement is intended to facilitate multi-disciplinary by allowing Flagships to draw on the research skills of individuals from across the organisation. Individual research staff may contribute to a number of research projects.
Portfolio Performance Framework	Framework that aims to provide a mechanism for tracking and reporting progress against the strategic goals of the Flagship Program to ensure they have a national impact.
Route/Path to Impact	Development pathway(s) through which a research output is delivered to the end-user, including product or process development, positioning and commercial considerations or activities necessary to achieve maximum impact in a timely manner.

Science Investment Process	CSIRO planning process that is intended to provide CSIRO with a systematic approach to support science and investment decisions and to allow the CSIRO Executive Team to make critical decisions in a clear, consistent and transparent manner.
Stream	Collection of related projects that address a particular aspect of a theme goal.
Theme	Major area of research that is directed towards the Flagship goal.

Summary and Recommendations

Summary

Introduction

1. The Commonwealth Scientific and Industrial Research Organisation¹ (CSIRO) is Australia's largest research and development organisation. CSIRO has an annual budget of over \$1.3 billion and employs 6680 staff, located across 56 sites within Australia and overseas. CSIRO's primary functions are to:

- carry out scientific research to assist Australian industry and to further the interests of the Australian community;
- contribute to the national and international objectives and responsibilities of the Australian Government; and
- encourage or facilitate the application and use of the results of its own or any other scientific research.

2. CSIRO established the Flagship Program to address major national challenges and opportunities through large-scale multi-disciplinary research partnerships. The Flagship Program comprises 10 individual National Research Flagships (Flagships). Each Flagship has an overarching goal which is framed around addressing the National Research Priorities which apply to all Australian Government science agencies such as CSIRO, and Australian Government competitive grant schemes for public sector research.

3. The genesis of the Flagship Program came from internal concerns surrounding the future of the organisation. A factor contributing to these concerns were reductions in funding to CSIRO, combined with a lack of new funding for the organisation under the Australian Government's *Backing Australia's Ability* initiative.² CSIRO concluded that its competitive advantage lay in its capacity to assemble large multi-disciplinary research teams to

¹ CSIRO is constituted and operates under the provisions of the *Science and Industry Research Act 1949*. CSIRO is a statutory authority, so it is also subject to the *Commonwealth Authorities and Companies Act 1997*. The CSIRO Board is responsible to the Australian Government for the overall strategy, governance and performance of CSIRO. The CSIRO Chief Executive is responsible for conducting the affairs of CSIRO in accordance with the strategy, plans and policies approved by the CSIRO Board.

² Under the 2001 *Backing Australia's Ability* initiative, the Australian Government provided \$3 billion in new funding over five years to a range of research programs to address issues in Australia's science and innovation system, including programs directed to: public sector and business research and development; adoption of technology; and commercialisation of research. None of the programs funded under this initiative specifically provided funding to CSIRO.

undertake research associated with major national goals. Consequently, in 2002, CSIRO commenced developing the Flagship Program, with its launch by the then Prime Minister taking place in 2003. The Flagship Program now represents a significant proportion of the research activities undertaken by CSIRO.

4. Since the Program was established CSIRO has invested over \$2 billion in research projects under the umbrella of the Flagship Program. This funding has come through a range of sources including direct Budget measures, an ongoing process of redirecting CSIRO research activities and associated funding to the Flagship Program, and external revenue derived through specific research projects.

5. The Flagship Program started with six Flagships and since 2003 the number of Flagships has increased to 10. The 10 Flagships and their goals are set out in Table S 1. The Flagships that were the focus of this audit (the ‘selected Flagships’) are highlighted in the table.

Table S 1

The current goals and launch dates of the Flagships

Flagship	Current Goal	Launch Date [^]
Light Metals	To lead a global revolution in light metals, doubling export income and generating significant new industries for Australia by the 2020s, while reducing environmental impact.	June 2003
Preventative Health	To improve the health and wellbeing of Australians and seeking to save \$2 billion in annual direct health costs by 2020 through the prevention and early detection of disease.	September 2003
Energy Transformed	To halve greenhouse gas emissions and double the efficiency of the nation's new energy generation, supply and end use.	October 2003
Food Futures	To transform the international competitiveness of the Australian agrifood sector, adding \$3 billion annually, by applying frontier technologies to high-potential industries.	March 2004
Water for a Healthy Country	Aims to provide Australia with solutions for water resources management, creating economic gains of \$3 billion a year by 2030, while protecting or restoring the country's major water ecosystems.	May 2004
Wealth from Oceans	To position Australia by 2020 as an international benchmark in the delivery of economic, social and environmental wealth based on leadership in understanding ocean systems and processes.	August 2004

Flagship	Current Goal	Launch Date [^]
Minerals Down Under	To assist the Australian minerals industry to exploit new resources with an in-situ value of \$1 trillion by the year 2030 and to more than double the size of the associated services and technology sector to \$10 billion a year by 2015.	May 2008
Climate Adaptation	To equip Australia with practical and effective adaptation options to climate change and variability and in doing so create \$3 billion per annum in net benefits by 2030.	July 2008
Future Manufacturing	To provide transformational innovation for the Australian manufacturing industry, enabling outcomes that will ensure global competitiveness, enhance the manufacturing value chain and deliver high-value export-oriented environmentally sustainable products and services.	September 2009
Sustainable Agriculture	To secure Australian agriculture and forest industries by increasing productivity by 50 per cent and reducing net carbon emissions by at least 50 per cent by 2030.	February 2010

Note [^]: These dates are the official launch dates. The planning, development and establishment of these Flagships occurred prior to these dates.

Source: CSIRO documentation.

6. CSIRO regards Flagships as vehicles for government interaction on key policy areas. In line with this interaction, research undertaken by Flagships has been influenced by a number of Commonwealth, state and territory government policy initiatives such as: the National Water Initiative (2004); the Department of Agriculture, Fisheries and Forestry's Rural Research and Development Priorities (2007), the Council of Australian Government's National Climate Change Adaptation Framework (2007), the Department of Climate Change and Energy Efficiency's National Framework for Climate Change Science (2009) and the Department of Climate Change and Energy Efficiency's 2010 Position Paper on Adapting to Climate Change in Australia. A number of these policy initiatives have provided research grants to CSIRO.

7. In addition to the Flagships, a key component of the Flagship Program is the Flagship Collaboration Fund, which was established in 2004. The Flagship Collaboration Fund is designed to further strengthen collaboration between the Flagships, universities and other publicly funded research institutions by building partnerships with these organisations in support of delivering Flagship goals. Since its inception, the Flagship Collaboration Fund has received Budget funding of \$114.3 million.

Organisational change program

8. Through a succession of strategic plans since 2000, CSIRO has undertaken a significant organisational change program. This program has encompassed structural, planning, reporting and administrative processes across the organisation. Key structural changes have included:

- the introduction of a standardised planning and reporting framework across research activities, known as the Portfolio Performance Framework;³
- the transition to a matrix-based management model⁴ to facilitate multi-disciplinary research by allowing Flagship projects to draw on the capabilities from across the various research divisions within CSIRO; and
- the development of an organisation-wide annual investment process, known as the Science Investment Process, to allocate resources across research activities.

9. To a large degree the development and implementation of the Flagship Program has acted as a driver for this change process as the Flagships rely on the effective operation of the matrix-based management model, adopted by CSIRO, to undertake multi-disciplinary research. The Science Investment Process uses the Portfolio Performance Framework as the basis for decision-making and to direct research activities across the matrix.

Audit objective, criteria and scope

10. The objective of the audit was to assess the effectiveness of CSIRO's development and administration of selected National Research Flagships. In assessing CSIRO's performance, the ANAO examined whether:

- mechanisms were in place to develop and implement the Flagships, within the context of the broader CSIRO change program;

³ The Portfolio Performance Framework structure comprises:

- **Themes** — major areas of research contributing to a Flagship goal;
- **Streams** — a collection of related projects that address a particular aspect of a theme; and
- **Projects** — core units of research undertaken.

⁴ See Glossary.

- governance arrangements for Flagships incorporated sound oversight, planning and reporting arrangements; and
- periodic review activities were used to assess and improve the operation of the Flagships.

11. In addition to examining overarching governance arrangements, the ANAO focused on four selected Flagships where there was potential for interrelated issues (see Table S 1). These Flagships are undertaking research in the fields of energy, water, agriculture and climate adaptation. Within this context there is increasing acknowledgement in the scientific community that the areas of energy security, water security, food security, climate change mitigation and climate adaptation interact, and that there is a need to understand this interaction.⁵

12. The audit does not provide an opinion on the scientific merits of Flagship research, with the examination of individual research projects underpinning Flagships only being used to gain an understanding of the operation of the program.

Overall conclusion

13. The Flagship Program was launched in 2003, and since that time has become a core component of the framework within which CSIRO undertakes research activities. In 2011–12, CSIRO will allocate some \$566.18 million⁶ (or 43 per cent of budgeted revenue) towards funding the 10 Flagships within the program.⁷ The Flagship Program provides a model for undertaking multi-disciplinary research to address the Australian Government's National Research Priorities. Flagship research is directed at long-term goals and focuses on applied research in contemporary fields. The issues within these fields of research are often complex, to some extent interrelated, and are areas where advances in knowledge may have significant benefit for Australia.

⁵ Examples include Office of the Chief Scientist, *Securing Australia's future: PMSEIC reports on food security and energy-water-carbon intersections* [Internet]; 2010, available from <<http://www.chiefscientist.gov.au/2010/12/securing-australia%e2%80%99s-future-pmseic-releases-expert-reports-on-food-security-and-energy-water-carbon-intersections>> [accessed 18 February 2011] and R Garnaut, *Climate Change Update 2011 – Transforming Rural Land Use* [Internet]; 2011, available from <<http://www.garnautreview.org.au/update-2011/update-papers/up4-transforming-rural-land-use.html>> [accessed 17 March 2011].

⁶ Comprises \$339.5 million from Government funding and \$226.7 million from external revenue.

⁷ Department of Innovation, Industry, Science and Research, *Portfolio Budget Statements 2011–12*, DIISR, 2011, pp. 211-215.

14. The Flagship Program has provided the basis for a significant realignment of the research activities in CSIRO over several years. This realignment has been supported by a series of initiatives implemented through a large-scale organisational change program. Consequently, the Flagship Program has developed in an environment of ongoing changes to business processes while also acting as a key driver for the organisational change program. This approach contributed to the effective development of the Flagship Program within CSIRO.

15. CSIRO's approach to administering the Flagship Program has evolved as the program has matured. As part of this, CSIRO has used the experiences from the progressive rollout of individual Flagships to inform the development and implementation of subsequent Flagships. CSIRO has also used the organisational change process as a base to support the administration of the program. In that regard, the transition to a matrix-based management model has been a particularly challenging exercise. CSIRO has adopted a continuous improvement approach to administering the Flagship Program and has actively refined and modified change initiatives related to the Flagship Program to enhance organisational outcomes. This approach has provided a sound structural framework for administering Flagship research.

16. Given the nature of the Flagship Program in terms of its long-term goals, partnership arrangements and research paths, which are subject to external drivers that change over time, the evolution of the program and the individual Flagships will necessarily be a continuous process. This process requires not only effective external engagement but also an ongoing focus on refining internal arrangements for managing complex multi-disciplinary research activities in a matrix management environment. Within this context there are opportunities to improve the administration of the program, particularly around performance management arrangements and reporting on budget performance. More broadly, there are opportunities to improve the overarching governance, direction-setting and internal coordination of the program.

17. A key intended outcome of establishing the Flagship Program was to undertake research focused on delivering economic, social and environmental impact. This focus on impact continues to be the case, as reflected in the Flagship goals. The evaluation of impact is a complex exercise confronting

many research organisations, as the impact of research may be somewhat removed from the production of the research output.⁸ While there is evidence that the research of the selected Flagships has contributed to policy and investment decisions by government, CSIRO does not have a systematic process for measuring the impact of Flagship research. Instead, CSIRO has relied on external consultants to estimate the impact of research through a series of individual studies that have been based on a range of assumptions in areas of ongoing uncertainty. The 2010 Lapsing Program Review⁹ recommended that CSIRO improve its measurement of the social, environmental and economic value of its research. In response, CSIRO established a project in late 2010 (Impact 2020 Project), which is designed to improve the way impact is measured.

18. The change program has provided a defined structure for planning which incorporates performance management and reporting arrangements. CSIRO has developed an internal reporting framework at the research stream level based around Annual Performance Goals (APGs). The implementation of these arrangements for the Flagship Program is yet to provide a stable reporting regime which demonstrates the performance of individual Flagships over time. APGs are variable in format and content, making the comparison of performance across research streams within the Flagship Program difficult. Reporting processes for APGs are not metrics-based, making them a subjective indicator of long-term performance. This reflects the nature of the planning structure introduced by the change program which aggregates projects into research streams. As this aggregation occurs, the ability to develop objective measurable performance indicators decreases.

19. External reporting for the Flagship Program is based on Key Performance Indicators (KPIs) which have been modified as CSIRO has transitioned to reporting within an outcome/program framework. This

⁸ In 2009 the Organisation for Economic Co-operation and Development (OECD) released a report titled *Measuring Government Activity* which stated with respect to measuring the outcomes of government programs:

Commonly one cannot hold particular organisations – or even governments – fully responsible for outcomes in the same way that one can hold them responsible for outputs. On the other hand, they are not entirely without responsibility either: very frequently they make a contribution to the final outcome but cannot wholly determine it.

⁹ Government guidelines require that a review of CSIRO be conducted at the end of each funding agreement, known as a Lapsing Program Review. The review is undertaken by an Inter-Departmental Committee and examines whether CSIRO is operating appropriately, effectively and efficiently and may recommend the continuation of funding.

ongoing modification of KPIs limits the capacity to analyse the performance of the Flagship Program over time. The current KPIs focus on indicating performance against a mixture of outcomes and outputs. In the absence of systematic mechanisms for measuring the impact of Flagship research, the statement against the outcome-focused KPI is subjective. For a number of the KPIs the data presented in support of KPI achievement is not specific to the Flagship Program, thereby providing limited insight into the performance of the program, relative to other research activities undertaken by CSIRO.

20. A comparison of Flagship financial data from key external documents including the Portfolio Budget Statements, CSIRO Operational Plans and Annual Reports, revealed that these documents contained different financial information for the same financial year. Further, there was also a high degree of variability in the way this data was presented. These factors diminish the transparency and accuracy of the Flagship financial performance information available to external stakeholders.

21. Achieving an appropriate balance in the level of executive oversight of the Flagship Program has presented some challenges to CSIRO. Initially, a Flagship Oversight Committee was the primary governance body with direct responsibility for managing the Flagship Program, including direction-setting and governance. However, the role of this committee was subsumed by another committee in 2008, and this resulted in a dilution in the direct oversight of the Flagship Program, particularly in the area of overarching governance of the program. In late 2010, the Flagship Oversight Committee was re-established to provide a stronger focus on the governance and coordination of the Flagship Program, consistent with its significance to CSIRO.

22. Since the Flagship Program commenced, there have been a number of internal and external reviews and audits of CSIRO activities. CSIRO has also sought external input through a range of advisory committees. These activities have been wide ranging and both directly and indirectly assessed the Flagship Program, individual Flagships and the broader CSIRO administrative arrangements encompassing the Flagship Program. It is evident that these activities have influenced the way CSIRO administers the Flagship Program and the direction of its research. As the Flagship Program relies on the effective management of research activities across CSIRO and the ongoing interaction and support of stakeholders, improving mechanisms for capturing and consolidating the findings of reviews, internal audits and stakeholder input

would assist CSIRO in identifying areas where improvements can be made to organisational performance and responsiveness.

23. To help improve the effectiveness of CSIRO's administration of the Flagship Program, the ANAO has made two recommendations aimed at enhancing both the financial reporting arrangements and the use of the insights captured through review activities.

Key findings

Organisational realignment (Chapter 2)

24. Since 2000, CSIRO has undertaken a significant program of organisational change. Structural change initiatives have included implementing a common planning framework (Portfolio Performance Framework) across CSIRO which is underpinned by a Science Investment Process, the consolidation of corporate functions, and the progressive implementation of an operating model based around a matrix-based management model. To a large degree, these initiatives have now transitioned to business-as-usual within CSIRO.

25. The Portfolio Performance Framework is a standardised planning framework that was piloted in two Flagships in 2002 before being applied across the organisation. In 2004, CSIRO undertook a review of the implementation of the Portfolio Performance Framework. The review of the framework made generally positive findings with respect to the implementation of the strategic elements of the framework for the Flagship Program.

26. Investment decisions surrounding Flagships made through the Science Investment Process were based on recommendations to CSIRO's Science Sub Committee by the Flagship Oversight Committee up until 2008. Within CSIRO, the Flagship Oversight Committee was also regarded as a positive influence in terms of governance, although there was some tension surrounding the extent of oversight that it provided. In 2008, the Flagship Oversight Committee was dissolved through a change to the committee structure in CSIRO. This resulted in the newly established CSIRO Appraisal and Investment Committee assuming responsibility for input to investment decisions relating to the Flagship Program. In late 2010, the Flagship Oversight Committee was re-established.

27. The Flagship Program has been in place for over eight years and today represents an organisation-wide initiative. A key area where this is evident is the Flagships' reliance on research capabilities from across CSIRO to undertake multi-disciplinary research. CSIRO has transitioned to a matrix-based management model to facilitate this multi-disciplinary research. Over several years, CSIRO has attempted to improve the operation of the matrix-based management model, although several recurrent issues have been encountered. These issues include uncertainty surrounding roles and responsibilities, and the complexity of undertaking and administering research in a matrix environment. CSIRO continues to work on optimising the operation of the matrix-based management model.

28. There are linkages between the research areas of the selected Flagships. Through the Science Investment Process there is some evidence of consideration of this relationship. Also, the nature of multi-disciplinary research in a matrix-based management model can provide some cross-fertilisation of ideas and knowledge across the Flagships. However, there was no apparent structure around this interaction within CSIRO at the time of audit fieldwork. Given recent statements by the Office of the Chief Scientist about the intersection of issues that are the focus of these Flagships, and the intent that Flagships undertake multi-disciplinary research, this is an area of the program that could be strengthened. The recently re-established Flagship Oversight Committee should provide a vehicle to influence and develop strategies to promote interaction where Flagship research interrelates.

Evolution of the selected Flagships (Chapter 3)

29. To assess the key characteristics underpinning the development and ongoing operation of the Flagship Program, the ANAO examined four Flagships (the 'selected Flagships'). This included a comparison of the factors that have influenced the development of two of the original Flagships—the Water for a Healthy Country Flagship and the Energy Transformed Flagship; and two new Flagships—the Climate Adaptation Flagship and the Sustainable Agriculture Flagship.

30. In many areas, CSIRO had a history of undertaking research prior to the introduction of the Flagship Program. As such, while some Flagships received new funding at their outset, the research undertaken, to an extent, often represents a consolidation and redirection of existing research. Further, the introduction of the Flagships has occurred in an environment where

Australia has been facing many challenges, such as water scarcity, and this is reflected in Flagship goals, themes, streams and research projects.

31. The drivers and demand for research vary between Flagships and/or can change over time. This can result in difficulties in defining goals and the focus of research. The Energy Transformed Flagship is an example of this, and the Flagship underwent a significant restructure in 2009 following CSIRO-commissioned review activities.

Funding and expenditure (Chapter 4)

32. Through the Flagship Program, CSIRO has received additional funding from government and progressively increased the proportion of the remainder of its budget that it directs to the Flagships. In 2009–10, CSIRO allocated \$534.9 million to the Flagship Program. This comprised \$363.2 million from government funding and \$171.7 million of external revenue. External revenue is derived from a number of sources including: Australian, state, territory and local government agencies; the Australian private sector; and overseas entities.

33. The 2002 report on the implementation of the Portfolio Performance Framework commented that the framework must fit within the current organisation-wide planning, budgeting and reporting processes. The process was intended to provide a direct relationship between Portfolio Performance Framework and budgeting processes including the Portfolio Budget Statements (PBS), the operational plan and the annual report. A comparison of the budget information contained in the Quadrennium Funding Agreement¹⁰, PBS, operational plans and annual reports shows inconsistencies in the figures contained in the documents and instances where information has not been included. It is also apparent that the budget figures contained in external documents contain some inaccuracies, primarily due to weaknesses in the way CSIRO prepared budget data for inclusion in the PBS. This is an issue which CSIRO is seeking to address. The inaccuracies in the PBS combined with the lack of continuity in the financial data included in key external documents

¹⁰ A four-year agreement between the Australian Government and CSIRO that sets out funding principles for CSIRO. The current Quadrennium Funding Agreement 2007–08 to 2010–11 is in its final year of operation. As part of the 2011–12 Budget, the Australian Government announced a continuation of funding for CSIRO. The funding will form the basis of a new Quadrennium Funding Agreement expected to operate over four years from 2011–12. At the conclusion of the audit, the Quadrennium Funding Agreement 2011–12 to 2014–15 was yet to be finalised.

have reduced the transparency of the Flagship financial performance information available to external stakeholders.

34. The nature of the research partnership arrangements means that the capacity of a Flagship to attract and retain external revenue, from a diverse range of stakeholders, is an important factor in setting the research direction of a Flagship and determining the potential impact of Flagship research. CSIRO was unable to provide the ANAO with consistent client contract financial information for all of the selected Flagships, which limited the capacity to compare Flagship performance on this basis. However, based on the client contract financial information provided, it was apparent that the selected Flagships received a large proportion of their external revenue from Australian Government agencies that are responsible for developing and implementing policy initiatives, or for administering ongoing research programs such as Cooperative Research Centres and Research and Development Corporations.

35. While each Flagship has a number of research projects, many rely on a small number of high-value contracts. This highlights the importance of CSIRO's ability to identify and establish partnerships for the Flagships. As research under these projects is completed, CSIRO is conscious that it will need to identify new research opportunities that are consistent with the external drivers for research in the respective fields.

Performance reporting (Chapter 5)

36. Through the Portfolio Performance Framework, CSIRO introduced a framework for internal performance reporting. At the pinnacle of this framework are the Flagship goals. For the selected Flagships, these goals are very broad in scope and their achievement will be subject to a range of external factors. As such, they are more aspirational than a baseline for the measurement of progress and performance.

37. Consistent with the intent of the Flagship Program, the Flagship goals are impact-focused. The evaluation of research impact is a complex exercise, particularly as users of research may take into account a range of other factors in making decisions and, potentially, there can be a significant time lag between when research output is produced and when the impact of that research is realised.

38. While there is evidence that the research of the selected Flagships has influenced policy and investment decisions by government, CSIRO does not have in place systematic processes for measuring the impact of Flagship

research. Since the program commenced, economic consultants have been engaged on a number of occasions to assist in estimating the impact of research, although even in cases where Flagship research has been prepared specifically to inform decision making, a range of assumptions are necessarily required to estimate the economic impact of a specific research output. This includes the impact of factors beyond CSIRO's control. Where research is less mature or the external environment less certain, an increasing range of assumptions need to be applied. Further, Flagship research may also have social and environmental impacts not directly measurable in an economic sense.

39. CSIRO has introduced Flagship roadmaps, which are intended to demonstrate progress towards achieving Flagship goals by indicating the progress of research themes within a Flagship. These roadmaps appear in both internal and external reports. While this is a positive initiative, the measurement of progress against these roadmaps is limited by the lack of a systematic process for monitoring and assessing the impact of research.

40. At the research stream level, CSIRO has implemented Annual Performance Goals (APGs) to report performance. APGs are not metrics or milestone-based and do not indicate the quality of underlying science. Over time, CSIRO has attempted to improve the consistency in defining and reporting against APGs. The APGs for the selected Flagships indicate variability in terms of timeframe, definition and measurability. These factors combine to limit the capacity to use APGs to compare performance across the Flagship Program and the performance of individual Flagships over time.

41. External reporting for the Flagship Program is based around a series of Key Performance Indicators (KPIs). Within the *2009–10 CSIRO Annual Report*, the Flagship Program reported against five KPIs. This was the first year that these KPIs had been included in the Annual Report, meaning that a direct analysis of performance over time was not possible. The ANAO reviewed the KPIs and found that in some instances they were not a direct indicator of performance. In other cases the data presented in support of KPI achievement was either not Flagship-specific, or was presented in such a way that it risked being misleading.

42. Through the Lapsing Program Review, CSIRO has recognised that there is an opportunity to enhance its overall performance reporting arrangements. The review also identified a need to improve monitoring and measurement of economic, social and environmental impact. In late 2010,

CSIRO commenced the Impact 2020 Project. The goal of this project is to increase the visibility of CSIRO's future impact pipeline for the next 10-20 years. The project charter outlines that to achieve this goal it is likely that modifications will be required to the Science Investment Process, project planning and management arrangements within CSIRO. Achieving such an outcome will be particularly challenging and until such arrangements are established, CSIRO should consider how to best present the impact of Flagship research through external reporting.

Internal and external reviews (Chapter 6)

43. Since establishing the Flagship Program, CSIRO has commissioned a number of reviews that have either been Flagship-specific or have touched on aspects of the program, individual Flagships or the broader CSIRO operational environment. Periodic review and acting on resulting recommendations can contribute to a continuous improvement approach to management. Consistent with this outcome, CSIRO has used reviews and stakeholder feedback to assist in defining the future research direction for individual Flagships. For example, a review of the Energy Group, which incorporated two Flagships, resulted in a significant change to the research focus of the Energy Transformed Flagship.

44. Reviews that have focused specifically on the Flagships have been generally positive in their findings. Flagship-specific and broader reviews have also identified a range of cultural, resourcing and structural issues surrounding the Flagships and the broader change program undertaken within CSIRO. It is important that the outcomes of reviews are not considered in isolation as to do so may limit the capacity to draw strategic insights, identify systemic issues and recognise points of leverage where organisational outcomes can be improved. This is particularly the case in situations where organisations undertake an extensive volume of reviews and seek input from a range of stakeholders, as has been in the case in CSIRO. Accordingly, CSIRO should investigate options to improve the mechanisms for capturing and consolidating the findings of reviews to improve overall organisational performance.

Summary of agency response

45. CSIRO welcomes the ANAO report and accepts its key findings and recommendations. CSIRO is committed to the further development of the administration, governance and performance management of the Flagship program and the findings of this review will assist their evolution.

46. In relation to the report's recommendations, both are accepted.

Recommendations

Recommendation No.1
Paragraph 4.19

To improve the consistency and accuracy of financial reporting, the ANAO recommends that CSIRO review and amend, as required, internal and external budget preparation and reporting arrangements for the Flagship Program.

Agency Response: Agreed

Recommendation No.2
Paragraph 6.36

To inform the ongoing management and administration of the Flagship Program, the ANAO recommends that CSIRO implement arrangements to better capture and consolidate the findings of internal and external reviews, internal audits and stakeholder input.

Agency Response: Agreed

Audit Findings and Conclusions

1. Introduction

This chapter describes the inception of the Flagship Program, key concepts surrounding the National Research Flagships (Flagships) and linkages to the external policy-setting environment. The chapter also outlines the audit approach.

Background

1.1 CSIRO is Australia's largest research and development organisation and employs 6680 staff, located across 56 sites within Australia and overseas. CSIRO is a statutory authority under the *Commonwealth Authorities and Companies Act 1997* that is within the Australian Government's Innovation, Industry, Science and Research Portfolio. The total proposed budget for CSIRO for 2011–12 was \$1.3 billion, comprising \$725 million from government and \$574 million in other revenue.

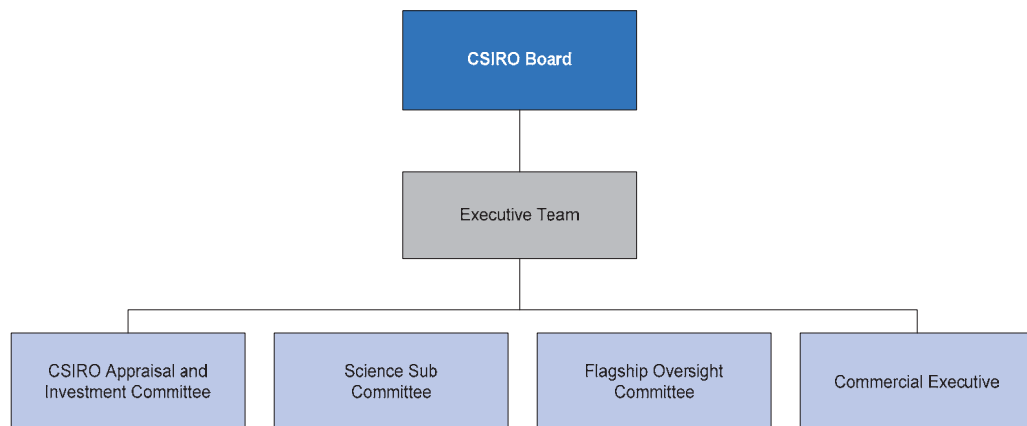
1.2 CSIRO is constituted and operates under the provisions of the *Science and Industry Research Act 1949* (the Act). The Act provides that CSIRO shall, as far as possible, co-operate with other organisations and authorities in the coordination of scientific research, with a view to preventing unnecessary overlap. CSIRO's primary functions are to:

- carry out scientific research to assist Australian industry and to further the interests of the Australian community;
- contribute to the national and international objectives and responsibilities of the Australian Government; and
- encourage or facilitate the application and use of the results of its own or any other scientific research.

1.3 Figure 1.1 sets out CSIRO's governance structure including key management committees. The CSIRO Board is responsible to the Australian Government for the overall strategy, governance and performance of CSIRO. The CSIRO Chief Executive is responsible for conducting the affairs of CSIRO in accordance with the strategy, plans and policies approved by the CSIRO Board. The Chief Executive is supported by other members of the CSIRO Executive Team through their involvement in a number of management and advisory committees, including the Science Sub Committee, the CSIRO Appraisal and Investment Committee and the Flagship Oversight Committee.

Figure 1.1

Key CSIRO committees



Source: Adapted by ANAO from CSIRO documentation.

1.4 The principles agreed to by the Australian Government surrounding CSIRO’s funding are set out in the Quadrennium Funding Agreement 2007–08 to 2010–11, which is in its final year of operation. Similar funding arrangements have been in place since 1988–89. Government guidelines require a Lapsing Program Review of CSIRO to be conducted at the end of each funding agreement. The review examines whether CSIRO is operating appropriately, effectively and efficiently and may recommend the continuation of funding. A Lapsing Program Review was conducted by an Inter-Departmental Committee in late 2010 as input to the 2011–12 Budget process.

1.5 As part of the 2011–12 Budget, the Australian Government announced a continuation of funding for CSIRO.¹¹ The funding will form the basis of a new Quadrennium Funding Agreement expected to operate over four years from 2011–12. At the conclusion of the audit, the Quadrennium Funding Agreement 2011–12 to 2014–15 was yet to be finalised.

Evolution of the National Research Flagships

1.6 In 2001, CSIRO was concerned about the future direction of the entity. One of the factors contributing to this concern were reductions in funding,

¹¹ Media release Senator the Hon Kim Carr, Minister for Innovation, Industry, Science and Research, ‘Australian Government’s Record \$3 Billion Support for the CSIRO’ 10 May 2011.

combined with a lack of new funding being provided to CSIRO through the Government's *Backing Australia's Ability* initiative.¹² This led CSIRO to review its role and the relevance of its research activities. CSIRO concluded that its competitive advantage lay in its capacity to assemble large multi-disciplinary research teams to undertake research associated with major national goals. CSIRO recognised that leveraging this competitive advantage would require its component Divisions to work together in a much more coordinated and constructive way, and created the 'One-CSIRO' concept.

1.7 CSIRO developed six 'Big Hairy Audacious Goals' (BHAGs)¹³ through which CSIRO intended to frame new responses to national scientific challenges, and on which it would focus its research. In 2002, CSIRO commenced developing the Flagship Program with the BHAGs forming the original goals for the Flagships.

1.8 The *2002–03 CSIRO Annual Report* described the intent of the Flagships as follows:

Flagships are Australia-wide multi-disciplinary partnerships established to tackle ambitious goals in nationally important areas such as the environment, energy, agrifood and preventative health. The Flagship partnerships will make a sustained contribution to Australia's economic and social growth and sustainability over a 25-year period.¹⁴

1.9 Through the *2003–07 CSIRO Strategic Plan*, CSIRO identified that it had been spreading its science investment too thinly. To address this, CSIRO recognised that it would need to continue to focus on maximising impact and

¹² Under the 2001 *Backing Australia's Ability* initiative, the Australian Government provided \$3 billion worth of new funding over five years to a range of research programs to address issues in Australia's science and innovation system, including programs directed to public sector and business research and development; adoption of technology; and commercialisation of research. None of the programs funded under this initiative specifically provided funding to CSIRO.

¹³ A 1996 article in the *Harvard Business Review* by James C. Collins and Jerry I. Porras outlined the concept of BHAGs as follows:

A company must have a BHAG (pronounced Bee-hag), a "big, hairy audacious goal" — a clear and compelling unifying focal point of effort and a catalyst for team spirit. It has a finish line, so the organization can know when it has achieved the goal. A BHAG should not be a sure bet — it will have perhaps only a 50% to 70% probability of success — but the organization must believe that it can reach the goal anyway.

Collins, JC and Porras, JI, *Building Your Company's Vision* [Internet]; *Harvard Business Review*, 1996, available from <<http://www.tecker.com/downloads/buildingvision.pdf>> [accessed 19 November 2010].

¹⁴ Commonwealth Scientific and Industrial Research Organisation, *Annual Report 2002–2003*, CSIRO, Australia, 2003, p. 19.

maintaining competitive standing for quality and scale. The Flagships were a fundamental element of this strategy.

1.10 The Flagship Program was officially launched by the then Prime Minister in April 2003. CSIRO then successively launched:

- (a) the six original Flagships between June 2003 and August 2004;
- (b) three additional Flagships between May 2008 and September 2009; and
- (c) a tenth Flagship in February 2010.

1.11 The Minister for Innovation, Industry, Science and Research provided CSIRO with a Statement of Expectations in February 2010. That Statement outlined the Government's expectations on CSIRO's research and innovation priorities, strategic direction, governance and communication. With regard to Flagships, the Minister stated:

I also expect CSIRO to invest in leading edge research and application projects at a scale necessary to achieve results, including through the National Research Flagships program.¹⁵

1.12 Table 1.1 lists the 10 Flagships, their current goals, and their official launch dates. This audit focused on four Flagships (the 'selected Flagships'), which are highlighted in Table 1.1. These Flagships included two of the original Flagships; one of the Flagships established in 2007–08; and the newest Flagship that was established in 2009–10.

¹⁵ Senator the Hon Kim Carr, Minister for Innovation, Industry, Science and Research, *Statement of Expectations for the CSIRO*, 25 February 2010.

Table 1.1**The current goals and launch dates of the Flagships**

Flagship	Current Goal	Launch Date [^]
Light Metals	To lead a global revolution in light metals, doubling export income and generating significant new industries for Australia by the 2020s, while reducing environmental impact.	June 2003
Preventative Health	To improve the health and wellbeing of Australians and seeking to save \$2 billion in annual direct health costs by 2020 through the prevention and early detection of disease.	Sept 2003
Energy Transformed	To halve greenhouse gas emissions and double the efficiency of the nation's new energy generation, supply and end use.	Oct 2003
Food Futures	To transform the international competitiveness of the Australian of the Australian agrifood sector, adding \$3 billion annually, by applying frontier technologies to high-potential industries.	Mar 2004
Water for a Healthy Country	Aims to provide Australia with solutions for water resources management, creating economic gains of \$3 billion a year by 2030, while protecting or restoring the country's major water ecosystems.	May 2004
Wealth from Oceans	To position Australia by 2020 as an international benchmark in the delivery of economic, social and environmental wealth based on leadership in understanding ocean systems and processes.	Aug 2004
Minerals Down Under	To assist the Australian minerals industry to exploit new resources with an in-situ value of \$1 trillion by the year 2030 and to more than double the size of the associated services and technology sector to \$10 billion a year by 2015.	May 2008
Climate Adaptation	To equip Australia with practical and effective adaptation options to climate change and variability and in doing so create \$3 billion per annum in net benefits by 2030.	July 2008
Future Manufacturing	To provide transformational innovation for the Australian manufacturing industry, enabling outcomes that will ensure global competitiveness, enhance the manufacturing value chain and deliver high-value export-oriented environmentally sustainable products and services.	Sept 2009
Sustainable Agriculture	To secure Australian agriculture and forest industries by increasing productivity by 50 per cent and reducing net carbon emissions by at least 50 per cent by 2030.	Feb 2010

Note [^]: These dates are the official launch dates. The planning, development and establishment of these Flagships occurred prior to these dates.

Source: CSIRO documentation.

Funding

1.13 The Government agreed to provide additional funding to the CSIRO to support the Flagship Program on three occasions:

- \$20 million through the 2003–04 Budget to establish the first six Flagships;

- \$305 million over seven years under the Australian Government's 2004 *Backing Australia's Ability – Building Our Future Through Science and Innovation* initiative¹⁶ to support the development of the Flagships; and
- \$174 million over four years through the 2007–08 Budget, for the creation of three new Flagships and the extension of the Energy Transformed Flagship.

1.14 To support the Flagship Program, CSIRO has also undertaken an ongoing process of redirecting existing research activities and associated funding to the Program. Flagships have also derived external revenue through specific research projects. External revenue is funding not sourced directly from the Australian Government through a Budget appropriation to CSIRO. External revenue is derived from a number of sources including Commonwealth, state, territory and local government programs.

1.15 The total investment made in the Flagship Program from its inception in 2002–03 to mid-2010–11 amounts to \$2.03 billion.

The Flagship Collaboration Fund

1.16 CSIRO established the Flagship Collaboration Fund in 2004 using a portion of the funding provided under *Backing Australia's Ability – Building Our Future Through Science and Innovation* initiative. The Flagship Collaboration Fund is designed to further strengthen collaboration between the Flagships, universities and other publicly funded research institutions by building partnerships with these organisations in support of delivering Flagship goals. The Flagship Collaboration Fund allows CSIRO to be a research funder rather than a research provider, and recognises that CSIRO alone cannot deliver on the full scope of the Flagship goals.

1.17 Since its inception, the Flagship Collaboration Fund has received Budget funding of \$114.3 million. The CSIRO Annual Report for 2009–10 indicated that almost \$56 million had been disbursed from the Flagship Collaboration Fund. CSIRO advised that as at the end of 2009–10, \$96 million of the fund had been committed, with the full allocation to be disbursed by the end of 2013–14.

¹⁶ This initiative, which aimed to encourage and support science and innovation, is the extension of the initial *Backing Australia's Ability* initiative which commenced in 2001. Commonwealth Government, *Backing Australia's Ability – Building Our Future Through Science and Innovation*, Canberra, 2004, p. 9.

1.18 The ANAO did not specifically audit the operation of the Flagship Collaboration Fund but it did examine its overall funding and expenditure (refer Chapter 4) and also considered a 2010 review of the fund (refer Chapter 6).

External priority setting

1.19 In December 2002, the Australian Government introduced four National Research Priorities as part of the *Backing Australia's Ability* initiative. The National Research Priorities apply to Australian Government science agencies such as CSIRO and Australian Government competitive grant schemes for public-sector research. Each National Research Priority is underpinned by a number of priority goals. These goals are focused on areas where research may make a significant contribution. The National Research Priorities and the priority goals are not ranked in importance or quantified, nor is funding earmarked for particular priorities. Table 1.2 outlines the National Research Priorities and their associated priority goals.

Table 1.2

National Research Priorities and their associated priority goals

National Research Priority	Priority goal
<p><u><i>An Environmentally Sustainable Australia</i></u> Transforming the way we utilise our land, water, mineral and energy resources through a better understanding of human and environmental systems and the use of new technologies.</p>	1. Water—a critical resource
	2. Transforming existing industries
	3. Overcoming soil loss, salinity and acidity
	4. Reducing and capturing emissions in transport and energy generation
	5. Sustainable use of Australia's biodiversity
	6. Developing deep earth resources
	7. Responding to climate change and variability
<p><u><i>Promoting and Maintaining Good Health</i></u> Promoting good health and well being for all Australians.</p>	1. A healthy start to life
	2. Ageing well, ageing productively
	3. Preventive healthcare
	4. Strengthening Australia's social and economic fabric
<p><u><i>Frontier Technologies for Building and Transforming Australian Industries</i></u> Stimulating the growth of world-class Australian industries using innovative technologies developed from cutting-edge research.</p>	1. Breakthrough science
	2. Frontier technologies
	3. Advanced materials
	4. Smart information use
	5. Promoting an innovation culture and economy

National Research Priority	Priority goal
<u>Safeguarding Australia</u> Safeguarding Australia from terrorism, crime, invasive diseases and pests, strengthening our understanding of Australia's place in the region and the world, and securing our infrastructure, particularly with respect to our digital systems.	1. Critical infrastructure
	2. Understanding our region and the world
	3. Protecting Australia from invasive diseases and pests
	4. Protecting Australia from terrorism and crime
	5. Transformational defence technologies

Source: Department of Innovation, Industry, Science and Research, *National Research Priorities Fact Sheet*, DIISR, Australia, 2010.

1.20 The funding provided to CSIRO under the *Backing Australia's Ability - Building Our Future Through Science and Innovation* initiative was to enable the development of Flagships that reflect the National Research Priorities. In line with this expectation, CSIRO designed and developed the six initial Flagships to be the organisation's key response to the National Research Priorities.

Linkages to other policies

1.21 CSIRO's operational plan for 2004–05 stated as follows:

CSIRO helps to shape government policy settings through the outcomes of its research projects in areas such as sustainability, broadband connectivity, and biotechnology. Increasingly, Flagships are vehicles for government interaction around key challenges such as water, energy, and preventative health policy. Engagement with the Federal Government has focussed around responses to government reviews and the triennium funding agreement, championship of Flagships and budget process, and membership of high level Committees (including PMSEIC [Prime Minister's Science, Engineering and Innovation Council], CCST [Coordination Committee on Science and Technology], COAG [Council of Australian Government] working groups, Interdepartmental Committees).¹⁷

1.22 In line with this interaction, research undertaken by selected Flagships has been influenced by policy initiatives of the Commonwealth, state and territory governments. A number of these policy initiatives have provided research grants to CSIRO. Some examples of these policy initiatives include:

¹⁷ Commonwealth Scientific and Industrial Research Organisation, *CSIRO Operational Plan 2004–05*, CSIRO, Australia, 2004, p. 238.

- **The National Water Initiative (2004)**—The overall objective of the National Water Initiative is to achieve a nationally compatible market, regulatory and planning based system of managing surface and groundwater resources for rural and urban use that optimises economic, social and environmental outcomes.
- **The Department of Agriculture, Fisheries and Forestry’s Rural Research and Development Priorities (2007)**—These Priorities are intended to complement the National Research Priorities and aim to foster innovation and guide the research and development effort in the face of continuing economic, environmental and social change.
- **COAG’s National Climate Change Adaptation Framework (2007)**—This Framework outlines the future agenda of collaboration between governments to address key demands from business and the community for targeted information on climate change impacts, and to fill critical knowledge gaps that currently inhibit effective adaptation.
- **The Department of Climate Change and Energy Efficiency’s National Framework for Climate Change Science (2009)**—This Framework identifies national climate change science priorities for the coming decades and sets out ways to harness Australia’s full science to address them.
- **The Department of Climate Change and Energy Efficiency’s 2010 Position Paper on *Adapting to Climate Change in Australia***—The Position Paper sets out the Australian Government’s vision for adapting to the impacts of climate change and proposes steps to realise this vision.

1.23 More recently, in December 2010, the Prime Minister’s Science, Engineering and Innovation Council released two impact statements for reports on food security and energy-water-carbon intersections. In releasing these reports, the website for the Office of the Chief Scientist stated as follows with respect to *Challenges at Energy-Water-Carbon Intersections*:

The interplay between energy, water and carbon in human activities has been made more complex and more pressing by the need to mitigate climate change

risk through reducing carbon emissions, whilst continuing to supply energy, water and nutritious and affordable food to a growing population.¹⁸

1.24 In regard to *Australia and Food Security in a Changing World*, the website also stated:

Australia is currently a net exporter of food, with considerable expertise in food production under resource constraints and in the face of climate variability. However the PMSEIC report suggests increased challenges to this important Australian industry including: land degradation, population growth, long-term climate change, competition for arable land, scarcity of water, and nutrient and energy availability.¹⁹

1.25 In releasing these reports, the then Chief Scientist commented:

We charged the cross-disciplinary, expert groups that authored these reports to take a holistic approach, to look at the big picture, and not just a single piece of the science-society interface.

The independent, scientific reports they produced are ground-breaking and vital to the future of the nation. I am delighted that they have been released today so that they can inform not only government decision-making, but also public discourse.²⁰

1.26 The 2011 Garnaut Review update on the Land Sector also indicates that climate change and mitigation will greatly affect the land sector and that agriculture may have a role in addressing carbon emissions.

Strategic change program

1.27 The Act sets out the strategic and operational planning requirements for CSIRO. These arrangements require that CSIRO develop a strategic plan²¹ for approval by the Board which sets out:

- the broad objectives of the organisation in performing its functions during the planning period; and

¹⁸ Office of the Chief Scientist, *Securing Australia's future: PMSEIC releases expert reports on food security and energy-water-carbon intersections* [Internet]; 2010, available from <<http://www.chiefscientist.gov.au/2010/12/securing-australia%e2%80%99s-future-pmseic-releases-expert-reports-on-food-security-and-energy-water-carbon-intersections>> [accessed 18 February 2011].

¹⁹ *ibid.*

²⁰ *ibid.*

²¹ Under the Act, strategic plans are limited to periods not exceeding five years.

- a broad outline of the policies and strategies to be pursued by the organisation to achieve those objectives.²²

1.28 The current CSIRO strategic planning framework is based around a strategic roadmap covering the period 2000 to 2015. Within this framework, a sequence of four strategic plans was envisaged as set out below:

- **2000–2003** was focused on making CSIRO more relevant in order to deliver greater value to stakeholders and clients;
- **2003–2007** concentrated on refocusing on delivery and execution, building scale, flexibility and adopting multi-disciplinary approaches;
- **2007–2011** is focused on building momentum as the most successful paths for increasing CSIRO's impact become clearer; and
- **2011–2015** was planned to focus on increasing impact and accelerating the delivery of national benefits.

1.29 As the roadmap for the strategic plans suggests, the period from 2000 to 2011 was intended to be a period of ongoing change within CSIRO. The first strategic plan to refer to the Flagships was the *CSIRO Strategic Plan 2003–07*, which stated as follows:

Flagships have great potential to impact the lives of Australians and key Australian industries. They represent a new way for CSIRO to organise our activities.

We must execute effectively on the Flagships in order to make internal and external arrangements effective. Monitoring and managing their performance along the way is critical. We will provide milestone-based funding for Flagships, seeking to ensure that Flagships achieve maximum impact.²³

1.30 The subsequent *CSIRO Strategic Plan 2007–11* indicated that CSIRO's strategy through to 2011 consisted of the three elements as set out in Table 1.3.

²² Section 36 of the Act requires that when a strategic plan or an annual operational plan is in effect CSIRO shall not perform its functions otherwise than in accordance with those plans. However, that section also provides that nothing done by CSIRO is invalid on the grounds that CSIRO has failed to comply with this requirement. Additionally Section 36 is subject to the application of a sub section of the Act that was repealed in 1997.

²³ Commonwealth Scientific and Industrial Research Organisation, *CSIRO Strategic Plan 2003–07*, 2003, p. 104.

Table 1.3**Strategic elements of the *CSIRO Strategic Plan 2007–11***

Strategic element	Initiative/objective
National Challenges	Addressing national challenges and opportunities faster and better by: <ul style="list-style-type: none"> • accelerating and expanding Flagships; and • focusing on partnerships nationally and internationally to find new solutions to big problems in water, energy, climate, health, industry, and the environment.
Discovery and Delivery	Focusing and strengthening core science capability by improving delivery of science by implementing better business practices, accelerated adoption processes and enhancing communication.
One-CSIRO Foundations	Strengthening the CSIRO enterprise and enhancing operational arrangements to: <ul style="list-style-type: none"> • foster an innovative, collaborative, and performance-based environment; and • develop and adopt common systems, structures and processes that support a matrix enterprise.

Source: *CSIRO Strategic Plan 2007–11*, pp. 20–23.

Operational planning

1.31 The Act also requires the Chief Executive of CSIRO to prepare an annual operational plan each financial year for approval by the CSIRO Board. The annual operational plan is required to give effect to the strategic plan by setting out the strategies that CSIRO intends to pursue; the activities CSIRO plans to carry out; and the resources CSIRO proposes to allocate to these activities.

1.32 The first operational plan to refer to Flagships was the 2002–03 plan. This plan was prepared prior to the Government decision to provide \$20 million in funding to CSIRO for the Flagships through the 2003–04 Budget.²⁴ The operational plan for 2003–04 focused on the initial establishment of the Flagships within CSIRO. Through the 2004–05 Budget, the Government allocated \$305 million to establish the initial six Flagships. Consequently, the Flagships were a much more prominent feature of the operational plans for 2004–05 onwards.

²⁴ In May 2003 CSIRO wrote to the then Minister for Science outlining its approach to implementing the National Research Priorities. That report indicated that, while the concept of the Flagship predates the National Research Priorities, CSIRO had reviewed the planned rollout of the Program to ensure optimal alignment with the National Research Priorities.

Audit approach

1.33 The objective of the audit was to assess the effectiveness of CSIRO's development and administration of selected National Research Flagships. In assessing CSIRO's performance, the ANAO examined whether:

- mechanisms were in place to develop and implement the Flagships, within the context of the broader CSIRO change program;
- governance arrangements for Flagships incorporated sound oversight, planning and reporting arrangements; and
- periodic review activities were used to assess and improve the operation of the Flagships.

1.34 The audit scope included overarching governance arrangements and focused on elements of selected Flagships where there was potential for inter-related issues. In line with this approach, the selected Flagships were:

- Energy Transformed;
- Water for a Healthy Country;
- Climate Adaptation; and
- Sustainable Agriculture.

1.35 The audit does not provide an opinion on the scientific merits of Flagship research, with the examination of individual research projects underpinning Flagships only being used to gain an understanding of the operation of the program.

1.36 The audit was conducted in accordance with the ANAO Auditing Standards at a cost of \$320 000. The methodology included an examination of relevant CSIRO documentation, including reports, committee meeting minutes, performance data and financial information. The CSIRO documentation review focused on, but was not limited to, documentation relating to the selected Flagships. The ANAO also interviewed a number of CSIRO staff both within and external to the selected Flagships.

1.37 A range of other documentation external to CSIRO was also used as input to the audit report. In addition, the ANAO held discussions with personnel from the Department of Finance and Deregulation; Department of Innovation, Industry, Science and Research; Department of Climate Change and Energy Efficiency; Department of Agriculture, Fisheries and Forestry; Department of Resources, Energy and Tourism; the Bureau of Meteorology;

and Flagship Collaboration Fund cluster leaders from a limited number of universities.

Structure of the report

1.38 The remaining chapters in the report are as follows:

- **Chapter 2—Organisational Realignment.** This chapter examines changes to the governance arrangements within CSIRO since the establishment of the Flagship Program, from a planning and operating model perspective.
- **Chapter 3—Evolution of Selected Flagships.** This chapter compares and contrasts the factors that have influenced the development of the four selected Flagships from a planning perspective.
- **Chapter 4—Funding and Expenditure.** This chapter examines the sources of Flagship funding and associated expenditure.
- **Chapter 5—Performance Reporting.** This chapter outlines the performance reporting arrangements and assesses their effectiveness in demonstrating Flagship performance.
- **Chapter 6—Internal and External Reporting.** This chapter discusses internal and external reviews which have either focused on elements of the Flagship Program or commented on the operation of the Flagship Program within CSIRO.

2. Organisational Realignment

This chapter examines changes to the governance arrangements within CSIRO since the establishment of the Flagship Program, from a planning and operating model perspective.

Background

2.1 The implementation of the Flagship Program has acted as a driver for significant changes within CSIRO. These changes have modified CSIRO's planning and business processes, and organisational arrangements.²⁵ Significant among these changes have been the implementation of a:

- Portfolio Performance Framework;
- Science Investment Process; and
- matrix-based management model.

2.2 Combined, these elements have provided the structure around which many of the other change initiatives have been built.

Implementation of the Portfolio Performance Framework

2.3 The strategic plan for 2003–07 commented that CSIRO's ability to manage internal governance and performance management properly had been made more difficult by non-uniform systems and processes across Divisions. The plan further stated that a lack of standards across Divisions increased administrative transaction costs and reduced the capacity to make well-informed decisions. To address these issues, an external consultant was engaged to work with key CSIRO stakeholders to develop and implement a Performance Measurement Framework.²⁶ The Framework was to provide a mechanism for tracking and reporting progress against the strategic goals of the Flagship Program to ensure they were having a national impact. The design principle for the Portfolio Performance Framework required it to:

²⁵ A number of the change programs are organisation-wide, therefore the full extent of these changes are beyond the scope of this audit. This chapter focuses on the impact from the Flagship Program perspective.

²⁶ At the time the Portfolio Performance Framework was referred to as the Performance Measurement Framework.

- track progress against the Flagship strategy;
- align measures of success from projects up to the CSIRO Board;
- provide a framework that linked annual performance measurement to long-term goals; and
- encourage optimal resource allocation.

2.4 The implementation of these planning and reporting arrangements resulted in research activities within CSIRO, including Flagships, being organised into the structure set out in Table 2.1.

Table 2.1

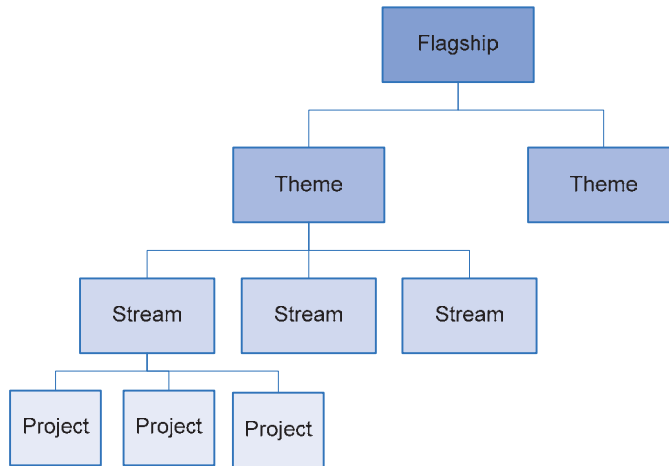
Portfolio Performance Framework planning and reporting hierarchy

Portfolio Performance Framework element	Description
Program	A program focuses significant CSIRO effort and resources on a clearly defined mission, for example, the Energy Transformed Flagship.
Theme	A theme refers to a major area of research that is directed towards a clear and measurable strategic goal, which is a key part of the program's goal.
Stream	A stream represents a collection of related projects that address a particular aspect of the theme goal. Each stream has an explicit medium-term stream objective supported by specific annual performance goals (APGs).
Project	A project is the core unit of research activity and budgetary control.

Source: CSIRO Annual Report 2005–06, p. 18.

2.5 Each Flagship contains a number of research themes. Figure 2.1 outlines how these elements are aligned within a Flagship.

Figure 2.1
Structure of Flagships



Source: CSIRO documentation.

2.6 The Portfolio Performance Framework was piloted in the Preventative Health and Light Metals Flagships. In late 2002, an external consultant made a series of recommendations to assist the two pilot Flagships with the implementation of the Portfolio Performance Framework. These recommendations covered a range of areas including the use of roadmaps to describe the phased nature of Flagships and the medium-term milestones and outputs for themes (see Chapter 5).

2.7 A March 2004 post-implementation review of the Portfolio Performance Framework made positive findings in terms of the strategic elements of the Portfolio Performance Framework including themes, streams and roadmaps, noting that it would take six years to implement the Portfolio Performance Framework. By the time of the 2004 review, the Portfolio Performance Framework had been applied more broadly across CSIRO. The review found that the CSIRO Divisions had lagged behind the Flagships in implementing the Portfolio Performance Framework, partly due to divisional activities not easily being reflected in the impact-oriented structure of the Portfolio Performance Framework.

Science Investment Process

2.8 The Science Investment Process was introduced in 2005 and was a key component of CSIRO's 2003–2007 strategic plan. The development and expansion of common planning arrangements through Portfolio Performance

Framework research themes across CSIRO was a key measure underpinning the Science Investment Process. The *CSIRO Operational Plan 2005–06* stated as follows in this respect:

The clarification of themes, including an increasing emphasis on outcome orientation, has continued in this Operational Plan. It will be furthered by the implementation of the new Science Investment Process (SIP). Effective implementation of the SIP requires clearly articulated themes with outcomes that align as closely as possible with the roles of the organisation...²⁷

2.9 The Science Investment Process is intended to allow the CSIRO Executive Team to make critical decisions in a clear, consistent and transparent manner. The principal goals for the Science Investment Process are to:

- increase linkages across the organisation;
- tap into CSIRO’s strengths in cross-disciplinary initiatives;
- encourage longer-term perspectives in science planning;
- increase transparency and rigour of decision-making throughout the organisation;
- increase the transparency of purpose to foster greater complementarity with the broader national innovation system;
- promote a trust-based approach through which the right people are making the appropriate decisions; and
- make evolutionary rather than revolutionary changes to CSIRO’s portfolio.

2.10 The key steps involved in the Science Investment Process include the Broad Direction Setting process; theme-based reviews; and an iterative cycle to smooth out the impact of any unintended consequences. A report on the first Science Investment Process in 2006–07 described the process surrounding the Broad Direction Setting and theme review stages as set out in Table 2.2.

²⁷ Commonwealth Scientific and Industrial Research Organisation, *CSIRO Operation Plan 2005–06, CSIRO, Australia, 2005*, p. 20.

Table 2.2**Key Science Investment Process elements (2006–07)**

Key Science Investment Process element	Description
Broad Direction Setting	The senior executives of the organisation, taking into consideration a large array of internal and external factors such as global science trends, advice from industry, government research priorities, economic data and assessments of comparative research strengths, set broad directions for research investments next year and beyond, translating CSIRO's strategy into medium term investment priorities.
Theme review	Divisions, Groups and Flagships iterate to give effect to required directional shifts over appropriate timeframes. Senior scientists and research leaders across the organisation evaluate research activities against criteria from the perspective of relevance and impact.

Source: Science Investment Process Outcomes 2006–07, p. 21.

2.11 At the time of audit fieldwork, CSIRO had completed the Science Investment Process on four occasions.

The Broad Direction Setting document

2.12 The Broad Direction Setting document is a key input to the annual Science Investment Process. The first Broad Direction Setting Document was issued in September 2005, which was half way through the CSIRO Strategic Planning period 2003–2007. The September 2005 Broad Direction Setting document indicated:

The Executive Team's Broad Direction Setting process has adopted a "precautionary principle" in 2005, recognising that we are working with a new process, but at the same time has provided an indicative set of priorities and challenges with which Group Executives, Flagship Directors and Chiefs can shape a Theme-based response to these longer term priorities.²⁸

2.13 The 2005 Broad Direction Setting indicated the intent to increase the Flagships' share of CSIRO's government funding from 30 to 40 per cent and using the Flagship Collaboration Fund build collaborative linkages. Subsequent Broad Direction Setting documents have reinforced CSIRO's ongoing commitment to increasing the level of investment in the Flagships.

²⁸ Science Investment Process, Broad Direction Setting, 12 September 2005, p. 1.

2.14 The 2007 Broad Direction Setting was published following the issue of the *CSIRO Strategic Plan 2007–11*, and the Government’s decision to fund three additional Flagships, including the Climate Adaptation Flagship, through the 2007–08 Budget. The 2008 Broad Direction Setting document was an update to the 2007 version. The Broad Direction Setting document was not updated in 2009. In November 2010, CSIRO advised the ANAO that:

...we are currently in the process of updating the BDS [Broad Direction Setting] (which has essentially been unchanged since the 2007 version) and will use the updated BDS as part of implementation of the 2011–15 Strategy and consequential investment decisions. It is a WIP [work in progress], at present, but is being done in a more extensive manner than previously in relation to input from external stakeholders.²⁹

Theme reviews

2.15 Theme reviews are based on theme proposals or statements submitted to the Science Sub Committee. The Science Sub Committee provides high-level oversight and advice on science investment priorities, portfolio balance and broad direction setting to the CSIRO Executive Team as part of the Science Investment Process. Theme proposals include:

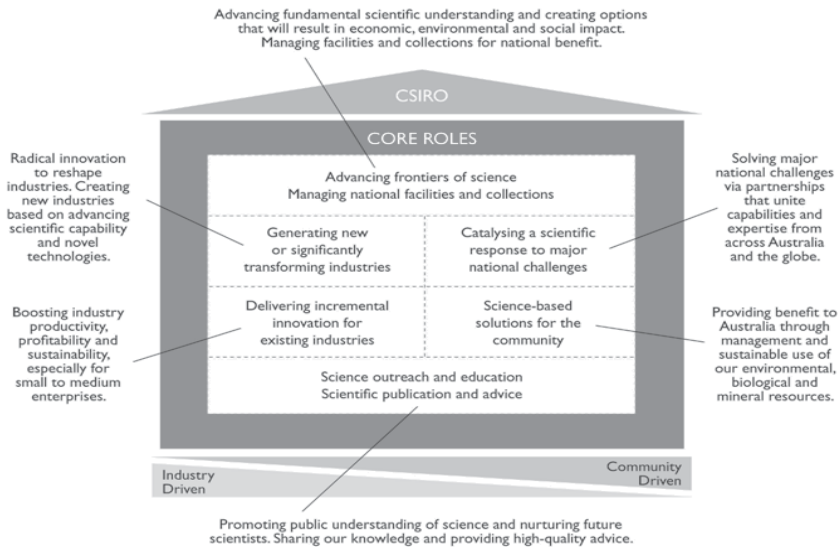
- an overview of the theme including the divisional/Flagship alignment, proposed investment and related themes;
- a theme purpose;
- a strategy response including alignment to the Broad Direction Setting; and
- a rationale for investment including relevance and impact.

2.16 A key element of the theme proposal is the contribution that each theme makes to the various research roles that CSIRO fulfils. CSIRO depicts these roles diagrammatically through CSIRO’s role house (see Figure 2.2).

²⁹ E-mail RE: ANAO Performance Audit of National Research Flagships [SEC=UNCLASSIFIED], 4 November 2010.

Figure 2.2

CSIRO's role house



Source: *CSIRO Operational Plan 2010–11*, p. 9.

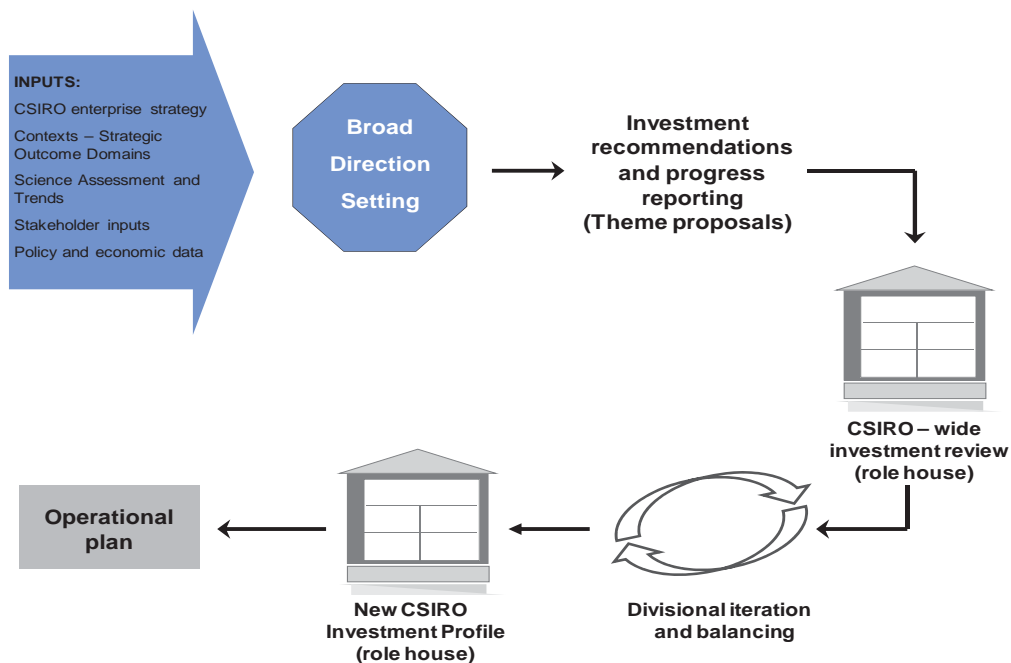
2.17 Theme proposals indicate, based on a proportional basis, how each theme contributes to the core roles in the role house. For example, the 2005–06 theme proposal for the Urban Waterscapes Theme, which was part of the Water for Healthy Country Flagship, allocated its contribution to CSIRO roles as follows:

- Generating new or significantly transforming industries— 10 per cent;
- Catalysing a scientific response to a major national challenge— 75 per cent; and
- Science-based solutions for the community— 15 per cent.

2.18 The relationship between the Broad Direction Setting, theme proposals and CSIRO's role house within the Science Investment Process is depicted in Figure 2.3.

Figure 2.3

The Science Investment Process



Source: Adapted from CSIRO documentation.

2.19 A common costing framework underpins the investment decisions made through the Science Investment Process and logging of research staff time to specific projects is a key cost driver in this framework. The common costing framework is used to inform the budgeting process.

Committee input and oversight of Flagships in the Science Investment Process

2.20 The direction for the Flagship Program at the time of the first Science Investment Process was based on recommendations by the Flagship Oversight Committee to the Science Sub Committee. The Flagship Oversight Committee was responsible for governance of the Flagship Program including:

- ensuring an appropriate alignment between research portfolios and long-term Flagship goals;
- ensuring that the Flagships’ research portfolios were appropriately balanced and aligned with CSIRO’s strategic research initiatives;
- ensuring that research in the Flagships continued to be of the highest quality; and

- reviewing the performance of the Flagships against their annual performance plans.

2.21 The 2004 external review of the Portfolio Performance Framework commented that the Flagship Oversight Committee provided strong governance. In 2005 and 2008, internal audits reaffirmed this view.

2.22 While these documents commented favourably on the governance arrangements provided by the Flagship Oversight Committee, the 2004 external review commented that some regarded the Flagship Oversight Committee processes as being too intrusive. A November 2005 presentation indicated a tension between the recommendations of the Flagship Oversight Committee and divisional decision-making within CSIRO. CSIRO advised the ANAO that:

At the time, it was necessary for the FOC [Flagship Oversight Committee] to exercise strong discipline and accountability to ensure that Divisions did align with the enterprise objectives and deliver on Flagship commitments.³⁰

2.23 The May 2008 internal audit of Flagship governance recommended that the roles of the Flagship Oversight Committee and Science Sub Committee be clarified to address areas of overlap.

2.24 In 2009, CSIRO established the CSIRO Appraisal and Investment Committee, which subsumed the previous investment activities of the Flagship Oversight Committee. The CSIRO Appraisal and Investment Committee was responsible for investment decisions across CSIRO and did not have the governance role of the Flagship Oversight Committee. Therefore the change diminished the specific focus on Flagships provided by the Flagship Oversight Committee arrangements. The first CSIRO Appraisal and Investment Committee process occurred late in 2009. In 2010, the CSIRO Appraisal and Investment Committee did not meet and instead, was replaced by a Chief Executive Officer Group review process that was designed to deliver the key aspects of the CSIRO Appraisal and Investment Committee process but in a manner that emphasised engagement between the Chief Executive Officer, Executive Team members and their direct reports.

2.25 In November 2010, the Flagship Oversight Committee was re-established under a revised charter. The re-constituted committee should

³⁰ CSIRO Response to ANAO Issues Papers, February 2011.

provide a renewed focus on the direction across the Flagship Program. Further, the Flagship Oversight Committee will be responsible for ensuring that Flagship business plans, which sit at the pinnacle of the Portfolio Performance Framework planning hierarchy and have had a reduced focus since 2008, are updated on an annual basis. One area where the committee's terms of reference could be improved relates to providing explicit references to performance management and identifying and assessing paths to impact (refer Chapter 5).

The operating model

2.26 One of the strategic elements of the *CSIRO Strategic Plan 2007–11* was the One-CSIRO Foundation, which was outlined as follows:

To address major national challenges and global opportunities more effectively, CSIRO must leverage its scale and scope, through effective multidisciplinary and boundary-crossing team work, harnessing the full and integrated power of a unified CSIRO.³¹

2.27 The 2004–05 operational plan outlined the relationship between Flagships and the One-CSIRO initiative:

The Flagship Programs and Major Cross Divisional Programs³² described in this Plan are prime examples of this “One-CSIRO” approach. They represent the concentrated application of resources to major programs of research which are designed to address problems and opportunities of national significance with a high degree of alignment to the government's National Research Priorities.³³

2.28 Since 2004–05, the organisational structure of CSIRO has changed. Figure 2.4 outlines the July 2010 structure of the Research Groups in CSIRO.

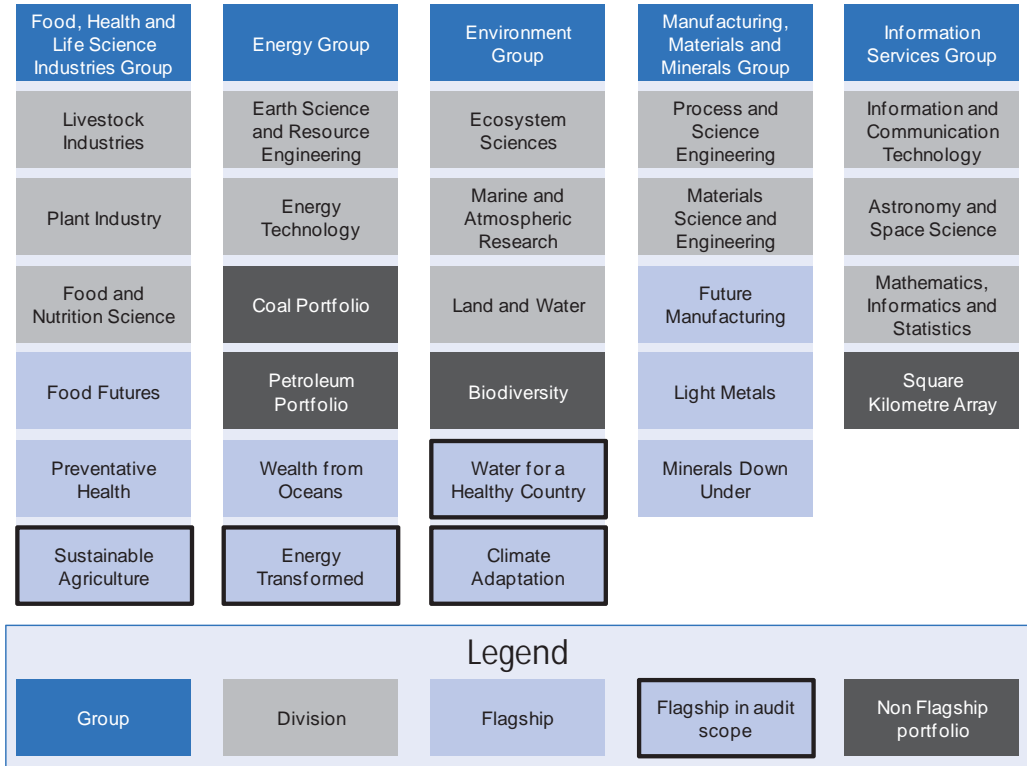
³¹ Commonwealth Scientific and Industrial Research Organisation, *CSIRO Strategic Plan 2003–07*, CSIRO, 2003, p. 18.

³² One of the cross-divisional programs related to climate as set out in paragraph 3.21.

³³ Commonwealth Scientific and Industrial Research Organisation, *CSIRO Operational Plan 2004–05*, CSIRO, 2004, p. 23.

Figure 2.4

CSIRO Research Groups



Note: Figure 2.4 includes three non-Flagship Portfolios. The origin of the two non-Flagship Portfolios located in the Energy Group is discussed in Chapter 3.

Source: CSIRO documentation.³⁴

2.29 In a practical sense, the One-CSIRO initiative is operationalised by Flagships drawing researchers from across a number of Divisions within the various Research Groups. This made transitioning to a matrix-based management model for CSIRO research activities a key underpinning feature of the Flagship Program.

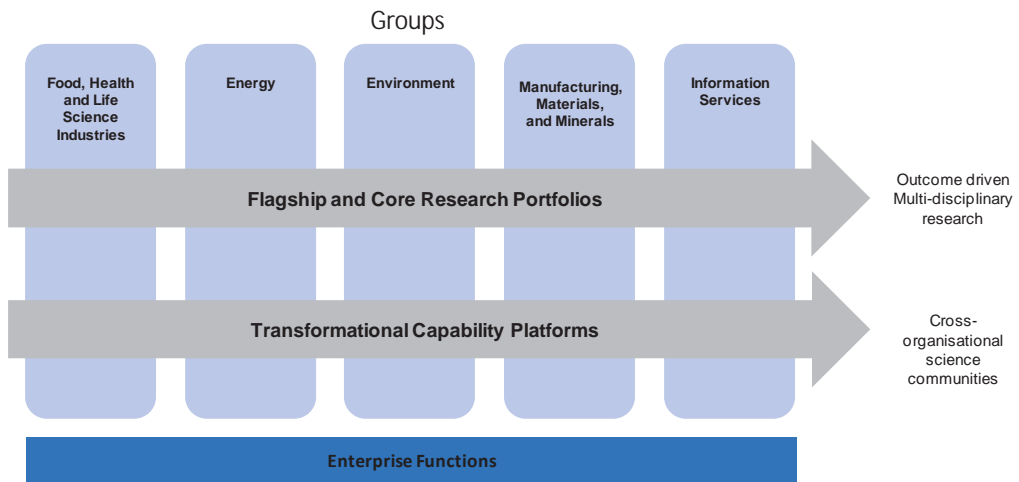
2.30 A matrix-based management model creates dual lines of authority. In the case of CSIRO functional authority for research staff rests with the Division Heads whereas product development responsibility rests primarily with the Flagship Directors. This arrangement is intended to facilitate multi-disciplinary

³⁴ Figure 2.4 does not depict the complete CSIRO organisational structure including four Enterprise Services Groups. Enterprise Services Groups include Operations, Science Strategy and People, Chief Finance Officer and Development.

research by allowing Flagships to draw on the research skills of individuals from across the organisation. Individual research staff may contribute to a number of research projects. Figure 2.5 depicts the way the matrix-based management model is intended to operate.

Figure 2.5

Matrix-based management arrangements in CSIRO



Source: CSIRO documentation.

Note: The enterprise functions in Figure 2.5 are separate to the Research Groups and provide a range of policy and support services across CSIRO.

2.31 Implementing a matrix-based management model can be complex and CSIRO advised the ANAO that:

The matrix is a difficult organisational form to implement and that there were very few precedents for CSIRO’s approach to Flagships, therefore a period of evolution and fine tuning was inevitable.³⁵

2.32 To support the implementation, CSIRO commissioned a series of reviews, internal audits and staff surveys. These processes have identified a range of issues surrounding the operation of the matrix-based management model within CSIRO. Among these was a 2006 external review of the Flagship Program which found that progress towards implementing the matrix-based management model in CSIRO was not yet complete and suggested that full implementation was essential to the successful delivery of Flagships.

³⁵ CSIRO Response to ANAO Issues Papers, February 2011.

2.33 In response to issues identified surrounding the operation of the matrix-based management model, CSIRO has undertaken a series of activities over several years to improve the operation of the matrix. A significant focus of these activities has been to clarify roles, responsibilities and accountabilities across the matrix.

2.34 The impact of the matrix-based management model on the operation of the Flagships has varied. For example, in April 2009, two reviews focusing on Fossil Energy and Alternative Energy were conducted. Unlike a number of other reviews undertaken by CSIRO, these reviews encompassed the Flagships and Divisions within the Energy Group.

2.35 In terms of the operation of the matrix-based management model the reviews came to different conclusions. The review of research activities surrounding fossil fuels found that the matrix-based management model had been very successful in building cross-discipline teams, thereby establishing a positive differentiator for CSIRO. The review also found that external stakeholders were satisfied with the efficacy of the matrix approach. In contrast, the Alternative Energy review found that one of the consequences of the newly adopted matrix-based management model was that it was quite difficult for outsiders to understand the management and leadership of the Renewable Energy activities. The Panel perceived that there was also some lack of clarity within the research (Flagships) and capability (Divisions) groups and that any simplifications to clarify these relationships would be an improvement.

2.36 In April 2009, the CSIRO Executive Team was provided with a project charter for the Simplification Strategy Implementation Goal.³⁶ That charter indicated that while there was evidence that the strategic reform had been successful, there was also a need to simplify the way CSIRO operated. The document identified a number of underlying issues including an incomplete transition to an operating model that supported the current strategy; a lack of clarity about the operating model; and some changes had not been adequately embedded or were in need of revision. The project identified two streams of work, one concerned with aligning the operating model to the strategy, and the other focusing on processes and services.

³⁶ In each CSIRO operational plan, members of the CSIRO Executive Team set out specific Strategy Implementation Goals for the planning year. Strategy Implementation Goals describe actions and/or targets that will be of enterprise-wide significance in meeting strategic plan goals and objectives.

2.37 In February 2010, an internal audit of the design, implementation and operation of the CSIRO operating model sought to consider the extent to which the operating model supported the achievement of CSIRO's strategic objectives. It also assessed the effectiveness of changes to the model proposed by the Simplification Strategy Implementation Goal to address identified issues. While the report found the operating model, in its fundamental design, to be an effective mechanism through which the organisation can achieve its objectives, it identified areas where improvements could be made. These included: optimising business processes; more effectively allocating resources; clarifying funding arrangements surrounding capability development; and improving role clarity.

2.38 The final report on the Simplification Project was issued in February 2011. The changes proposed in this report are significant in nature and are likely to take several years to implement. This is consistent with the process of continuous improvement CSIRO has adopted in implementing a matrix-based management model. Given the reliance that the Flagships have on the effective operation of the matrix, it is apparent that the Flagship Oversight Committee will need to actively monitor the implementation of the measures proposed by the Simplification Project from a Flagship perspective to ensure that desired outcomes are achieved.

2.39 The Flagship Program has been a central driver of the key organisation reforms undertaken by CSIRO. It is evident from the nature of the changes that the organisational realignment will take a number of years and continue to evolve as the new frameworks and practices have become part of business-as-usual operations. The transition to a matrix-based management model is one of the more significant changes and has been a particularly challenging exercise, partly due to the inherent management effort required for its implementation. In this context, CSIRO has adopted a continuous improvement approach to administering the Flagship Program and has actively refined and modified change initiatives related to the Flagship Program to enhance organisational outcomes. This approach has provided a sound structural framework for administering Flagship research.

3. Evolution of the Selected Flagships

This chapter compares and contrasts the factors that have influenced the development of the four selected Flagships from a planning perspective.

Background

3.1 The original Flagships were established during a period of significant organisational change in CSIRO, and prior to current planning arrangements being put in place. The newer Flagships were established in a more stable organisational and planning environment. This chapter examines the factors that have influenced the development of two original Flagship—being Water for a Healthy Country and Energy Transformed; and two more recent Flagships—Climate Adaptation and Sustainable Agriculture.

3.2 Since 2005, the Broad Direction Setting documents, which form part of the Science Investment Process, have provided the executive level direction to the Flagship Program. Table 3.1 outlines the direction provided to the selected Flagships through the 2007 Broad Direction Setting document.

Table 3.1

Investment directions (Broad Direction Setting 2007)

Flagship	Direction over 3–5 years
Water for a Healthy Country	Grow investment. Continue to develop strategic partnerships to ensure adoption and the focus on the Water for a Healthy Country Flagship.
Energy Transformed	Grow investment. Expand Energy Transformed Flagship in line with the Quadrennium Funding Agreement investment. Substantially increase level of external partner support.
Climate Adaptation	Grow investment. Focus government funding investment in Climate Adaptation Flagship. Increase level of external support. Adjust balance of effort in climate predication and adaptation over time to optimise impact as Australia's climate future unfolds.

Note: The Sustainable Agriculture Flagship did not exist at the time the document was produced.

Source: Science Investment Process - Broad Direction Setting Update - Version 4.0 - 18 December 2007.

3.3 A minor update to the 2007 Broad Direction Setting was issued in 2008. Changes relating to the selected Flagships in the update included:

- responding to challenges in increasing agricultural productivity in a natural resource, land and carbon-constrained world through the Agricultural Sustainability Initiative (which later became the

Sustainable Agriculture Flagship), and within certain activities of the Climate Adaptation Flagship; and

- highlighting the importance of effective CSIRO engagement with government and industry initiatives in the Energy Group including the National Low Emissions Coal Council, the Global Carbon Capture and Storage Institute, and the Australian Solar Institute.

Changes to the original Flagships

3.4 Each Flagship has an overarching goal against which planning is undertaken.³⁷ A key focus of these goals is scientific impact.³⁸ The goals are pitched at a high level and over a relatively long time. Table 3.2 sets out the evolution of the Flagship goals for the Water for a Healthy Country and Energy Transformed Flagships since 2003.

Table 3.2

Evolution of Flagship goals for the Energy Transformed and Water for a Healthy Country Flagships[^]

Flagship	Flagship goal		
	2003 2003–07 Strategic Plan	2007 2007–11 Strategic Plan	2010 2010–11 Operational Plan
Water for a Healthy Country	To achieve a tenfold increase in the social, economic and environmental benefits from water by 2025.	To achieve a tenfold increase in the economic, social and environmental benefits from water by 2025.	To provide Australia with solutions for water resources management, creating economic gains of \$3 billion a year by 2030, while protecting or restoring the country's major water ecosystems.

³⁷ The utility of the current Flagship goals as a basis for performance management and reporting is discussed in Chapter 5.

³⁸ The arrangements that CSIRO has in place to measure impact are also discussed in Chapter 5.

Flagship	Flagship goal		
	2003 2003–07 Strategic Plan	2007 2007–11 Strategic Plan	2010 2010–11 Operational Plan
Energy Transformed	To double the efficiency of the nation's new energy production, to halve energy losses and make Australia a world leader in cutting greenhouse emissions.	To halve greenhouse emissions and double the efficiency of the nation's new energy generation, supply and end use and to position Australia for a future hydrogen economy.	To halve greenhouse gas emissions and double the efficiency of the nation's new energy generation, supply and end use.*

Note ^: CSIRO advised that of the original six Flagships only the Energy Transformed and Water for a Healthy Country Flagships have modified their goals, although consideration was being given to modifying the goal of the Wealth from Oceans Flagship following an external review of that Flagship.

Note *: At the time of audit fieldwork CSIRO was reconsidering the goal for the Energy Transformed Flagship.

Source: CSIRO documentation.

3.5 The drivers and demand for research vary between Flagships and/or can change over time. The Water for a Healthy Country and Energy Transformed Flagships demonstrate the importance of understanding this demand and positioning research activities to meet research needs. A significant demand and high priority for research surrounding water security, combined with CSIRO's capacity to fulfil this need, created an environment where the direction of research for the Water for a Healthy Country Flagship was well defined. While there was also demand for energy security research, a range of issues contributed to a level of uncertainty surrounding the direction of research for the Energy Transformed Flagship.

Evolution of the Water for a Healthy Country Flagship

3.6 Themes are a key component of the Portfolio Performance Framework and are a focus for CSIRO in the Science Investment Process. Each Flagship comprises a number of themes. The themes within the Water for a Healthy Country have changed over time. Table 3.3 outlines the changes to research themes within this Flagship from 2004 to 2010.

Table 3.3

Changes to the research themes within the Water for a Healthy Country

Flagship	Themes		
	2004	2008	2010
Water for a Healthy Country	Urban Waterscapes	Urban Water	Urban Water
	River Murray Region	Better Basin Futures	Regional Water
	Southwest Western Australia	Healthy Water Ecosystems	Healthy Water Ecosystems
	Great Barrier Reef Catchments		
		Water Resources Observation Network	Integrated Water Information Systems

Source: CSIRO documentation.

3.7 The changes to the themes within the Water for a Healthy Country Flagship represent an evolution in this Flagship, rather than a change in direction. A September 2006 submission to the Science Investment Process outlined Australia’s water challenge to be addressed by the Water for a Healthy Country Flagship as follows:

Climate change and natural variability as well as increased demand are placing significant strain on the quality and availability of our water resources.

Security of supply is under serious threat, exemplified by the current water shortage crises in Perth, Brisbane and the Murray-Darling basin. Demand for water will soon exceed supply in most capital cities by up to 30%. Already, many of the water supply systems in southern Australia are fully allocated and there is a pressing need to return more water to the environment.

Remarkably, after two national water audits since 2000, water managers still have a relatively poor ability to assess the current, and forecast the future, status of this important resource. A major reason for this problem is that more than 600 different agencies currently hold all relevant water data.

Australia's National Water Initiative³⁹ will be stalled until there is a breakthrough in the way we handle and utilise water data. Progress is being made but, without this, planning, regulatory and trading reforms will be slow to happen.

3.8 The transition to the 2008 theme structure set out in Table 3.3 for the Water for Healthy Country Flagship occurred through the second Science Investment Process (2007–08) where a number of themes were amalgamated and realigned into 'pure Themes'. The July 2008 Water for a Healthy Country Flagship business plan outlined that this change had enabled CSIRO to successfully differentiate itself from the rest of the National Innovation System by establishing a breadth of capacity and structured, cross-disciplinary boundaries which allow the organisation to focus on fewer but larger initiatives in the water sector. Table 3.4 shows that there is also a correlation between several of the larger contracts and the theme structure within the Flagship.

Table 3.4

Relationship between key projects and research themes in the Water for a Healthy Country Flagship

Theme	Project	Partner(s)	Background
Urban Water	Urban Water Security Research Alliance	Queensland Government Griffith University University of Queensland	The Alliance was formed in 2007 to address South-East Queensland's emerging urban water issues. It is a \$50 million partnership over five years under which the Queensland Government makes a 50 per cent cash contribution and CSIRO and the universities make in-kind contributions. The Urban Water Security Research Alliance's primary focus is on emerging water issues including security and recycling.

³⁹ According to CSIRO documentation on 14 July 2006, COAG expressed an ongoing commitment to the continuing water reform agenda as expressed in the National Water Initiative and agreed that the resources and efforts need to be prioritised to deliver six fundamental reform elements of the National Water Initiative: conversion of existing water rights into secure and tradable water access entitlements; completion of water plans that are consistent with the National Water Initiative through transparent processes and using best available science; implementation of these plans to achieve sustainable levels of surface and ground water extraction in practice; establishment of open and low cost water trading arrangements; improvement of water pricing to support the wider water reform agenda; and implementation of national water accounting and measurement standards, and adequate systems for measuring, metering, monitoring and reporting on water resources.

Theme	Project	Partner(s)	Background
Regional Water	Murray-Darling Sustainable Yields Project	National Water Commission	The National Water Commission Annual Report for 2009–10 stated that the October 2008 CSIRO report on the \$11.96 million Murray-Darling Sustainable Yields Project was vital in underpinning the development of the new Murray-Darling Basin Plan. ⁴⁰ The Annual Report also indicated that in March 2008, COAG decided to extend the CSIRO Murray-Darling Basin Sustainable Yields Project, which had been funded by the Commission, to other regions, including northern Australia. The Commission supplied funding of \$6 million to enable CSIRO to run the Northern Australia Sustainable Yields Project, which began in September 2008. There are also Sustainable Yields projects in Western Australia and Tasmania.
Integrated Water Information Systems	Water Information Research and Development Alliance	Bureau of Meteorology	Through the <i>Water Act 2007</i> the Bureau of Meteorology was given responsibility for compiling and delivering comprehensive water information across the water sector in Australia. CSIRO is contributing to this initiative through the Water Information Research and Development Alliance. This alliance is a five-year research and development plan to develop the knowledge and tools required for improved management of Australia's water resources. Under the Water Information Research and Development Alliance arrangements, CSIRO will contribute \$20 million and the Bureau of Meteorology \$30 million.

Source: CSIRO documentation.

3.9 CSIRO has in place formal advisory arrangements including the Sector Advisory Councils and Flagship Advisory Committees to obtain external stakeholders' advice and comment on the organisation's overall research strategy. The Flagship Advisory Committee for the Water for a Healthy Country Flagship has been meeting for several years. It is apparent through

⁴⁰ The intention of the *Water Act 2007* is for water resources to be better managed in the national interest. The Murray-Darling Basin Authority was established as the authority responsible for implementing the rules and provisions of the Act. A key responsibility for the Murray-Darling Basin Authority is to develop a plan for managing all of the basin's water resources. The Water for the Future program provides funds for more efficient irrigation infrastructure and for purchasing water from entitlement holders. Australian Bureau of Agricultural and Resource Economics – Bureau of Rural Sciences, *Research Report 10.10 – Financial performance of irrigation farms in the Murray–Darling Basin, 2006-07 and 2007–08*, November 2010, p. 2.

the minutes of these meetings that the committee has assisted in positioning the Flagship in key areas such as the Murray-Darling and precursor work to the Water Information Research and Development Alliance.

3.10 Since the beginning of 2009, the Flagship Advisory Committee has focused on the future of the Flagship, including positioning the research themes for future projects. For many of the themes this involves an incremental approach to adjusting research activities. The Committee also noted in relation to the Urban Water Theme that CSIRO is one of a number of research providers, and the costs of dealing with CSIRO were considered by stakeholders to be too high. While this theme has been able to attract several large-scale projects, this also indicates that CSIRO needs to further engage with stakeholders to differentiate its research from that provided by other research organisations.

Redirection of the Energy Transformed Flagship

3.11 Unlike the Water for a Healthy Country Flagship, which developed along an evolutionary path based on clear external demand for research, the Energy Transformed Flagship has encountered more difficulty in defining its goal. The Energy Transformed Flagship is focused on reducing greenhouse gas emissions. This can be traced back to initial planning for the Flagship. The Energy Transformed Flagship 2002–03 *Draft Business Plan Framework* stated:

Australia has one of the most cost effective energy conversion and delivery systems in the developed world. This is based on abundant and high quality fossil fuels consisting mainly of coal and gas. However, this energy mix, coupled with the lack of large hydro and nuclear generation sources, has also endowed Australia with the highest GHG [greenhouse gas] emissions per capita and unit of GDP in the world.⁴¹ With the increasing global pressure on GHG emissions, the Australian energy industry has a dilemma – how to maintain our internationally competitive energy services while making significant reductions in our GHG emissions to satisfy our international environmental obligations.⁴²

3.12 That plan set the following challenge:

⁴¹ The December 2003 business plan for the Flagship indicated that Australia's total greenhouse emissions aggregate to some 1.4 per cent of global emissions.

⁴² Commonwealth Scientific and Industrial Research Organisation, *Draft Business Plan Framework – Energy Transformed*, 11 November 2002, p. 1.

The energy-GHG challenge in simplistic terms is to develop and use Australia's rich endowment of energy resources in ways that generate the maximum economic, social and environmental benefit to Australia, without compromising our material well-being and international competitiveness. And this largely depends on solving the dilemma between having cost-effective energy services and low GHG emissions from the energy sector.⁴³

3.13 The *2005–06 Energy Transformed Business Plan* reaffirmed the Flagship goal. However, in September 2008 the Energy Transformed Flagship Advisory Committee questioned the appropriateness of the Flagship goal.⁴⁴ A May 2008 report on the outcome of the third Science Investment Process noted that there was a need for realignment in the Energy Group, and deferred decision-making on a revised Flagship goal pending a planned energy review of the Energy Group, which incorporates the Flagship. Subsequently, in 2009, two reviews were undertaken which focused on fossil fuel and alternative energy respectively. Both of the reviews considered specific themes and streams undertaking research in each area. The reviews noted that there:

- was a degree of convergence between research being undertaken by the Flagship and other areas in CSIRO;
- were a range of factors that needed to be considered in setting the direction of the research;
- was opportunity to merge various research activities; and
- were some favourable aspects of research being undertaken, particularly in the Energy Futures Theme and Low Emission Distributed Energy Theme.

3.14 Following these reviews, the CSIRO Appraisal and Investment Committee agreed to the establishment of two new portfolios in the Energy Group including:

⁴³ *ibid.*, p. 15.

⁴⁴ The minutes of the September 2008 Energy Transformed Flagship Advisory Committee Meeting reported that:

There was some feeling that it should not be the mission of the Flagship (or CSIRO) to reduce GHG emissions. That is the role of the Government to set up systems and processes (such as an ETS [Emissions Trading Scheme]) to meet targets. The Flagship role should be to develop technologies and technology pathways to achieve the targets.

- creating a new coal portfolio to accelerate demonstration and deployment of lower emissions technologies through the coal value chain; and
- grouping petroleum and geothermal activities into a new portfolio to catalyse regional leadership in gas, oil and geothermal technologies.

3.15 The creation of these portfolios resulted in a restructure of the Energy Transformed Flagship as a number of research activities were transferred from the Energy Transformed Flagship to the new portfolios. Following this restructure the focus of the Flagship shifted to integrated energy/carbon modelling and multi-disciplinary renewable energy technologies, including electricity storage and intelligent energy management. The changes to the theme structure for the Flagship are set out in Table 3.5.

Table 3.5

Changes to the research themes within the Energy Transformed Flagship

Flagship	Themes	
	2008	2010
Energy Transformed	Energy Futures	Carbon Futures
	Low Emissions Electricity	Sustainable Stationary Energy and Transport
	Low Emission Transport	
	Low Emission Distributed Energy	Local Energy Systems

Source: CSIRO documentation.

3.16 The new focus of the Energy Transformed Flagship on renewable energy represents a change from the previous planning direction provided to the Flagship, which had a focus on reducing emissions associated with the generation of electricity from coal. In line with the refocus, CSIRO advised the ANAO in February 2011 that a new goal for the Energy Transformed Flagship was to be submitted to the Flagship Oversight Committee for consideration in March 2011. This timeframe coincides with the release of the *Garnaut Climate Change Review Update 2011 – Low Emissions Technology and the Innovation Challenge*, which commented on areas where public institutions should be undertaking research, and the role of the private sector and government in introducing new energy technology.

The development of the new Flagships

3.17 The three new Flagships established in 2007–08 and the Sustainable Agriculture Flagship established in 2010 have all had their development finalised through the Science Investment Process. The ANAO focused on two of these Flagships: the Climate Adaptation Flagship and the Sustainable Agriculture Flagship. The development of these Flagships is outlined in the sections below. This analysis shows that both Flagships evolved out of existing CSIRO research activities but that the funding arrangements for the establishment of each of these Flagships were different.

Aggregation of research themes within the Climate Adaptation Flagship

3.18 The *2009–10 CSIRO Annual Report* set out the goal for the Climate Adaptation Flagship as follows:

To equip Australia with practical and effective adaptation options to climate change and variability and in doing so create \$3 billion per annum in net benefits by 2030.⁴⁵

3.19 The April 2007 overview of the Climate Adaptation Flagship defined the key terms adaptation, vulnerability and mitigation within the context of the Flagship as set out in Table 3.6.

⁴⁵ Commonwealth Scientific and Industrial Research Organisation, *CSIRO Annual Report 2009–2010*, CSIRO, Australia, 2010, p. 20.

Table 3.6**Definition of key terms – Climate Adaptation Flagship**

Term	Definition
Climate adaptation	Both the actions of adjusting practices, processes and capital in response to the actuality or threat of climate change as well as changes in the decision environment such as social and institutional structures and altered technical options. Adaptation helps to moderate potential damages, to take advantage of opportunities, or to cope with the consequences of climate change.
Vulnerability to climate change	The residual risk after sectors, enterprises or communities have adapted to the impacts.
Mitigation of climate change	Strategies that reduce the sources of greenhouse gases or enhance their sinks, to subsequently reduce the probability of reaching a given level of climate change. [^]

Note [^]: The principal purpose of the Energy Transformed Flagship is concerned with mitigation of climate change through reducing greenhouse gas emissions. The Sustainable Agriculture Flagship includes a research theme that also focuses on carbon emission mitigation.

Source: CSIRO, *Climate Adaptation National Research Flagship - Supporting a more resilient and prosperous Australia in a changing and variable climate - Version 4*, 23 April 2007, pp. 3–4.

3.20 The 2009–10 Annual Report outlines the activities of the Flagship including:

- developing regional and national scale climate change projections and vulnerability assessments to support adaptation;
- addressing urban coastal vulnerability in settlements by creating design, infrastructure and management solutions to enhance adaptive capacity;
- developing conservation strategies to maximise resilience in marine and terrestrial ecosystems;
- effective adaptation options for Australia’s primary industries and rural regions; and
- supporting the information needs of Australia’s Asia–Pacific neighbours in their efforts to adapt to climate change.

3.21 This Flagship represents a consolidation of activities within CSIRO that had been occurring over several years. The *CSIRO Operational Plan 2004–05* indicated that CSIRO cross-divisional work on climate-related research commenced in 1988 and encompassed the areas of adaptation to climate change and variability. That plan outlined that, in 2003, this work was

reviewed to reflect science advances, changing policy demands and changing priorities within CSIRO such as the Flagship Program.

3.22 A September 2005 briefing for the Science Sub Committee outlined COAG's interest in climate change, including agreement on priority areas and sectors for the national adaptation framework, which was to be presented to COAG at the end of 2006. In April 2007, COAG announced that it was establishing a Climate Change Adaptation Framework. As part of this framework, the Australian Government provided \$43.6 million in funding to support the establishment of a new Flagship focusing on Climate Adaptation within CSIRO. A March 2008 briefing to the Science Sub Committee outlined a plan to migrate existing activities that were being undertaken elsewhere in CSIRO to the Climate Adaptation Flagship based on an alignment of these activities to those planned for the Flagship.

3.23 In 2009, the Department of Climate Change and Energy Efficiency's, *National Framework for Climate Change* noted that close links would need to be established within the adaptation research community, including with the National Climate Change Adaptation Research Facility, which was established by Griffith University in 2007, and the Climate Adaptation Flagship. Consistent with this outcome, CSIRO established a relationship with Griffith University through CSIRO Flagship Collaboration Fund cluster arrangements.

3.24 During 2009, the Flagship Stakeholder Advisory Group was informed that CSIRO was expanding efforts in the adaptation component of their climate change strategy and had reorientated existing areas to be able to deliver this outcome. Later in 2009, the Science Investment Process acknowledged that while the Flagship had made excellent progress, it needed to develop some bigger projects to anchor the Flagship's strategy and outcomes.

Transition to the Sustainable Agriculture Flagship

3.25 The Sustainable Agriculture Flagship was launched in February 2010. The goal for the Sustainable Agriculture Flagship is:

To secure Australian agriculture and forest industries by increasing productivity by 50 per cent and reducing net carbon emissions by at least 50 per cent by 2030.⁴⁶

⁴⁶ Commonwealth Scientific and Industrial Research Organisation, *CSIRO Annual Report 2009–2010*, CSIRO, Australia, 2010, p. 34.

3.26 The Flagship comprises four themes which focus in the following areas:

- reducing net greenhouse gas emissions while increasing storage of new carbon in our lands;
- advancing agricultural productivity and environmental health;
- informing land use planning, policy and natural resource management; and
- addressing global food and fibre security challenges through partnerships in Australia and overseas.

3.27 Similar to the process for the Water for a Healthy Country Flagship and the aggregation of research activities into the Climate Adaptation Flagship, the Sustainable Agriculture Flagship represents the aggregation of research activities from a number of areas within CSIRO. This aggregation process commenced in early 2005 through the development of the Agriculture Sustainability Initiative.

3.28 The development of the Agricultural Sustainability Initiative and its transition to a Flagship occurred through the Science Investment Process. Documents developed through this process highlighted the need for interaction between research undertaken in the agriculture field and research undertaken by other Flagships, most notably the Climate Adaptation and Water for a Healthy Country Flagships. This is consistent with impact statements released by the then Chief Scientist in late 2010 which comment on the need for research in these fields and understanding the interrelationship.

3.29 Unlike the other Flagships, however, the funding for establishing the Sustainable Agriculture Flagship has relied on existing and new contracts with external stakeholders; rather than on additional funding from government. A key new contract was a Funding Deed signed in April 2009 with the Department of Agriculture, Fisheries and Forestry for CSIRO to undertake a Soil Carbon Research Program. The funding for this program was provided under the Climate Change Research Program, which was a component of the Australian Government's *Australia's Farming Future Initiative*. Further funding

was also provided by the Grain Research Development Council with in-kind contributions from the research partners.⁴⁷

3.30 In March 2011 the *Garnaut Climate Change Review Update 2011 – Transforming Rural Land Use* and the *Garnaut Climate Change Review Update 2011 – Low Emissions Technology and the Innovation Challenge* were released. These reports both commented on the ongoing need for research and development in the areas of soil carbon, biosequestration and biochar.⁴⁸ CSIRO, through the Sustainable Agriculture Flagship, is among a number of research institutions undertaking research in these areas.

Common elements of the selected Flagships

3.31 The National Research Priorities and challenges facing Australia are reflected in the goals and development of the selected Flagships. CSIRO has used the experiences from rolling out the original Flagships in 2003 to inform the development and implementation of more recent Flagships. While the drivers and demand for research vary between Flagships and/or can change over time, in many areas, CSIRO had a history of undertaking research prior to the introduction of the Flagship Program. Therefore, while some Flagships received new funding at their outset, the research undertaken, to an extent, often represents a consolidation and redirection of existing research.

⁴⁷ Research partners include University of Western Australia; Department of Primary Industries, Victoria; Department of Natural Resources and Water, Queensland; University of New England; Murray Catchment Management Authority; University of Tasmania; and Department of Water, Land and Biodiversity, South Australia.

⁴⁸ Biochar is a fine-grained and porous substance similar in appearance to charcoal. Biochar is produced by the combustion of biomass under oxygen-limited conditions. Modern industrial bioenergy systems involve pyrolysis and gasification, the heating of a biomass feedstock under controlled conditions to produce combustible synthesis gas ('syngas'), and oil ('bio-oil') that can be burnt to produce heat, power, or combined heat and power. Biochar, the third combustible product produced in pyrolysis, is the solid charred and carbon-rich residue. Biochar may be an efficient way of sequestering carbon in soils used for some types of agricultural production. Appendix 2 provides more information surrounding biochar.

4. Funding and Expenditure

This chapter examines the sources of Flagship funding and associated expenditure.

Sources of funding

4.1 Since 2003, CSIRO has received funding from government to establish and expand the Flagship Program. In conjunction with this funding, CSIRO has directed an increasing proportion of its overall budget appropriation to the Flagship Program. The funding model for CSIRO also involves sourcing external revenue from a range of stakeholders to fund research projects. These projects range from relatively small projects to large-scale multi-year projects.

Funding sourced directly from Government

4.2 The government has agreed to provide funding to the Flagship Program on three occasions as set out in Table 4.1.

Table 4.1

Specific funding allocated to the Flagship Program

Year	Amount	Purpose
2003–04	\$20 million	Establishment of six initial Flagships.
2004–05	\$305 million over seven years	Funding provided under the Australian Government's 2004 <i>Backing Australia's Ability – Building Our Future Through Science and Innovation</i> initiative ⁴⁹ to support the development of the six initial Flagships. \$96.8 million of this funding was specifically set aside for the Flagship Collaboration Fund.
2007–08	\$174 million over four years	Establishment of three additional Flagships, including the Climate Adaptation Flagship. Additional funding was also allocated to the Energy Transformed Flagship and to the Flagship Collaboration Fund (\$17.5 million).

Source: CSIRO documentation.

4.3 CSIRO allocates funding across the research program through its Science Investment Process. CSIRO has used this process to progressively increase the proportion of its overall budget that it allocates to the Flagship Program to around 45 per cent of the total CSIRO investment in 2009–10.

⁴⁹ This initiative, which aims to encourage and support science and innovation, is the extension of the initial *Backing Australia's Ability* initiative that commenced in 2001. Commonwealth Government, *Backing Australia's Ability – Building Our Future Through Science and Innovation*, Canberra, 2004, p. 9.

4.4 The CSIRO Quadrennium Funding Agreement 2007–08 to 2010–11 outlines forecast expenditure on the Flagship Program as set out in Table 4.2.

Table 4.2

Planned funding of Flagship Program as per the Quadrennium Funding Agreement 2007–08 to 2010–11

	2007–08 \$ million	2008–09 \$ million	2009–10 \$ million	2010–11 \$ million
Funding for Flagship Program	75.6	85.3	98.2	114.9
Other government funding to be redirected to the Flagship Program	173.5	174.9	178.9	182.2
Total government funding of the Flagship Program	249.1	260.2	277.1	297.1

Source: Quadrennium Funding Agreement.

4.5 The Portfolio Budget Statements 2011–12 (PBS) indicated that the Flagship Program will receive \$566.18 million in 2011–12, with progressive increases over the forward estimates.⁵⁰

External Revenue

4.6 External revenue is funding not sourced directly from the Australian Government through a budget appropriation to CSIRO. External revenue is derived from a number of sources including contracts with a variety of organisations, including:

- Australian, state, territory and local government agencies;
- the Australian private sector;
- overseas entities;
- Cooperative Research Centres (CRCs), which are collaborative partnerships between publicly funded researchers and end users. The CRCs are funded by the Australian Government through the Department of Innovation, Industry, Science and Research and by CRC participants through cash and in-kind contributions; and

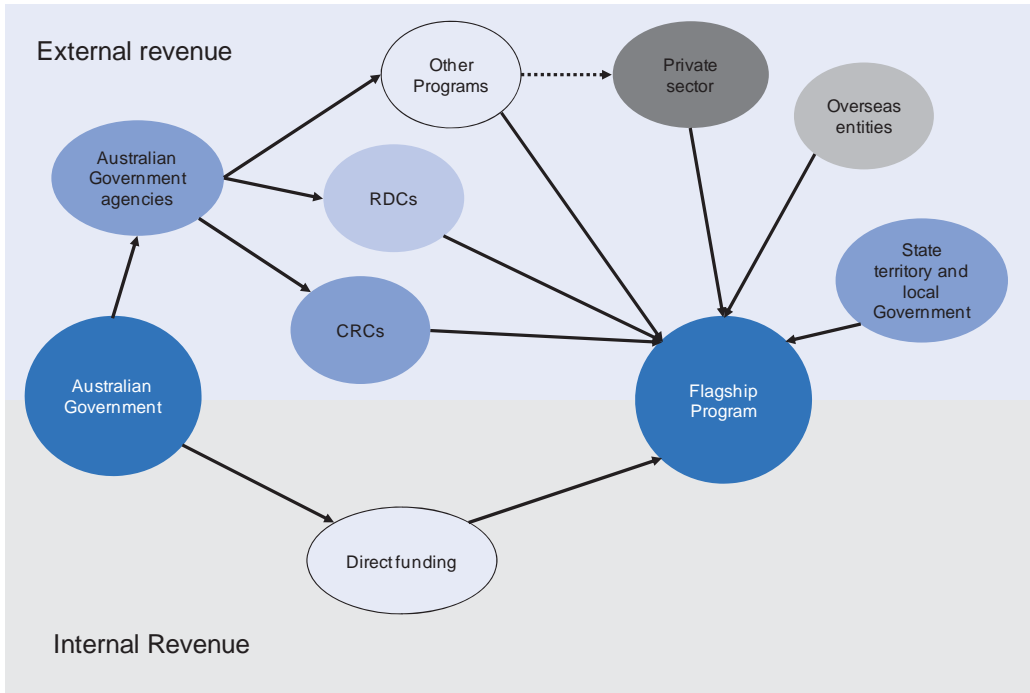
⁵⁰ The budget set out in the PBS is calculated on a different basis to the figures previously included in the Quadrennium Funding Agreement (see paragraph 4.11).

- Research and Development Corporations (RDCs), which are the Australian Government’s primary funding bodies for rural research and development in Australia. The RDCs are in the Australian Government’s Agriculture, Fisheries and Forestry Portfolio.

4.7 Figure 4.1 depicts the sources of funding of the Flagship Program.

Figure 4.1

Sources of funding of the Flagship Program



Source: ANAO analysis.

4.8 In 2009–10, CSIRO allocated \$534.9 million to the Flagship Program. This comprised \$363.2 million in direct government funding (of which the selected Flagships represented 41.5 per cent) and \$171.7 million of external revenue (of which the selected Flagships represented 56 per cent). Table 4.3 sets out the proportion of the Flagship Program funding profile of each of the Flagships. The selected Flagships are highlighted (refer Appendix 3 for further information on selected Flagship funding and expenditure).

Table 4.3

2009–10 Flagship Program funding breakdown (2009–10)

Flagship	Proportion of direct Government funding		Proportion of external revenue	
	\$ million	per cent	\$ million	per cent
Light Metals	29.1	8.0	7.7	4.5
Preventative Health	35.7	9.8	5.8	3.4
Energy Transformed	24.7	6.8	9.5	5.5
Food Futures	29.8	8.2	8.2	4.8
Water for a Healthy Country	58.9	16.2	41.9	24.4
Wealth from Oceans	45.2	12.5	20.2	11.7
Minerals Down Under	49.2	13.6	27.2	15.8
Climate Adaptation	29.7	8.2	14.8	8.6
Future Manufacturing	23.4	6.4	6.4	3.8
Sustainable Agriculture	37.4	10.3	30.0	17.5
Total	363.2	100	171.7	100

Source: CSIRO data provided to the ANAO on 23 November 2010.

Research funding arrangements

4.9 CSIRO research involves a variety of funding models. These include:⁵¹

- **Full cost consulting**—Horizon 1 applied research projects.⁵² These consulting projects are entirely funded by an external organisation;
- **Co-investment projects**—Horizon 2 and 3 research projects.⁵³ These are funded by both CSIRO and the external organisation. Under this

⁵¹ Other CSIRO transaction models include: joint ventures and centres; relationship arrangements; equity investments; licensing; and development and maintenance of Major Capital Items of research infrastructure and of National Research Facilities and Collections.

⁵² Horizon 1 activities are defined as those that are at the heart of an organisation, and which usually produce the majority of the profits and the cash flow. They are critical to short-term performance, and the cash they generate and the skills they nurture provide resources for growth. Baghai, M, Coley, S and White, D, *The Alchemy of Growth*, Texere Publishing, USA, 1999.

⁵³ Horizon 2 activities are described as fast-moving activities in which a concept is taking root or growth is accelerating. Although substantial profits from Horizon 2 activities may be four or five years away, they already have customers and revenue. Horizon 2 initiatives are seen as complementing or replacing existing core businesses in a few years by extending them or by taking the organisation’s business in new directions.

Footnote continued on the next page...

arrangement, CSIRO will provide internal funding for up to 50 per cent of the project depending on the nature and expected impact of the project;

- **Research alliances**—a program of research activity comprising several projects that are co-funded by the alliance members. The funding arrangements of these projects are similar to those of the co-investment projects; and
- **Core research projects**—Horizon 3 strategic research projects that are fully funded by CSIRO.⁵⁴

4.10 Flagships can include any of these models, however, if a Flagship enters into contracts that involve either co-investment or alliance arrangements, they are also able to lock in a proportion of their direct government funding.

Budget and expenditure for the Flagship Program

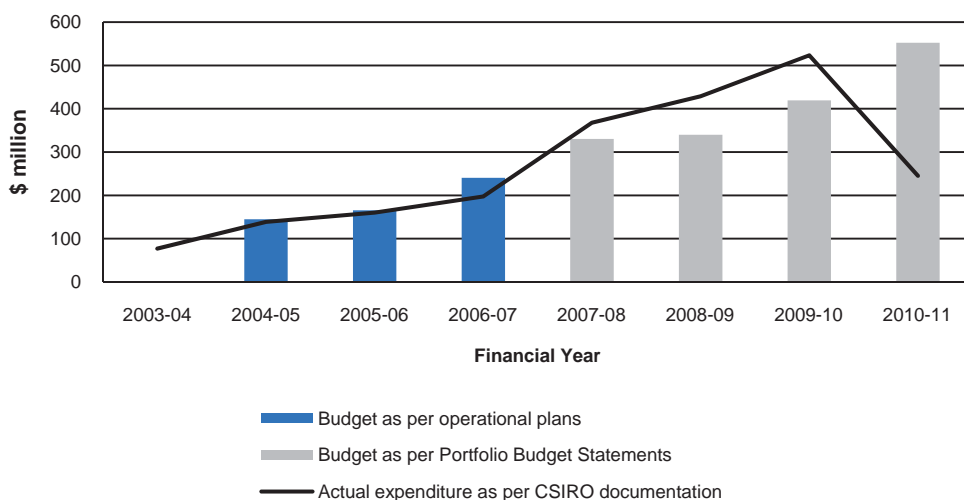
4.11 Since the Flagship Program commenced in 2003–04, CSIRO has spent \$2.1 billion across the 10 Flagships. Figure 4.2 shows strong growth in the Flagship Program budget over time. Significant increases in years such as 2007–08 represent the allocation of additional Flagship funding associated with the introduction of new Flagships, while underpinning the growth has been CSIRO’s decision to allocate a greater proportion of its overall funding to the Flagship Program. The reason for the discrepancies between the actual expenditure and PBS figures and the large change in the budget for the Flagship Program between 2009–10 and 2010–11 is discussed in paragraphs 4.16 and 4.17.

Horizon 3 activities are defined as the research projects that mark the first steps towards new businesses, even though they might not produce profits for a decade, if ever. They are described as ‘embryonic’, but they are nevertheless real activities and investments, even if they are small. Baghai, M, Coley, S and White, D, *The Alchemy of Growth*, Texere Publishing, USA, 1999.

⁵⁴ A focus of the Flagship Program has been on deriving external revenue and applied research and as a result it has tended to focus less on core research and more on the other transaction models. Divisional Science Reviews in 2009 identified this as an area of tension between the Divisions and the Flagships (see paragraph 6.2 to 6.6).

Figure 4.2

Actual expenditure against budget (as at December 2010)



Note: The Flagship Program budget was reported in the PBS from 2007–08. The budget figures for years prior to 2007–08 were taken from the operational plans, which reported on the Flagship Program budget since 2004–05.

Source: PBS and CSIRO documentation provided on 23 November 2010 and 7 February 2011.

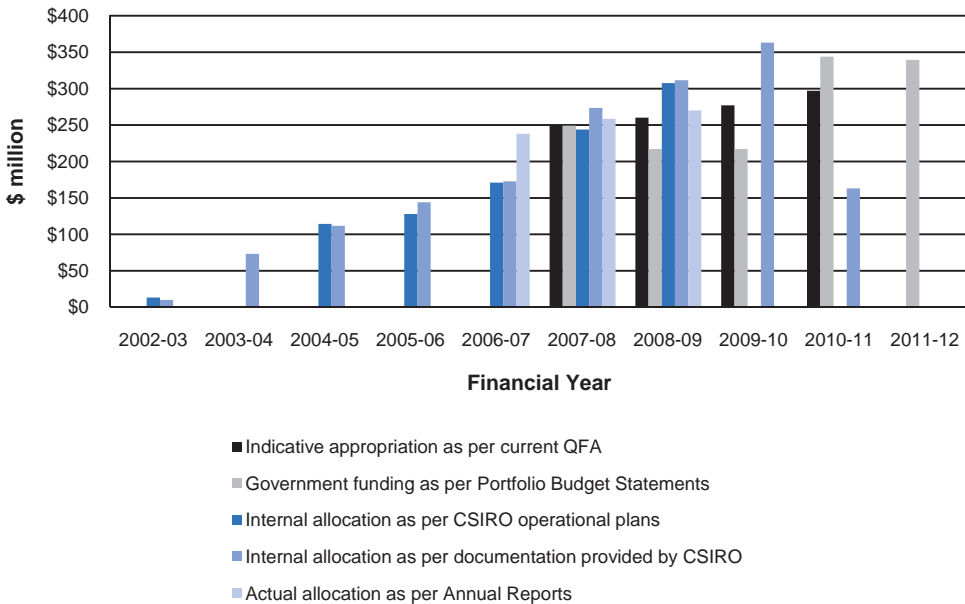
4.12 Figure 4.2 also shows a pattern in recent years of actual expenditure exceeding forecast expenditure. The budget performance of the Flagship Program and the selected Flagships is analysed in further detail in the remainder of this chapter.

Government funding

4.13 The 2002 report on the implementation of the Portfolio Performance Framework commented that:

The PMF [Portfolio Performance Framework] must fit within the current organisation-wide planning, budgeting and reporting processes.

4.14 The Flagship planning and budgeting processes undertaken through the Portfolio Performance Framework were to provide input to the strategic planning process and promulgate through the internal budgeting process into the PBS and the operational plan. Figure 4.3 compares the portion of the Flagship Program budget that is derived from total Australian Government funding, as outlined in a variety of sources.

Figure 4.3**Allocation of government funding to the Flagship Program (as at May 2011)****Notes:**

1. The indicative funding was reported in the PBS from 2007–08.
2. The 2003–04, 2009–10 and 2010–11 operational plans do not include the internal allocation to the Flagship Program.
3. The actual allocation to the Flagship Program was not reported in CSIRO Annual Reports prior to 2006–07 and from 2009–10.

Source: Quadrennium Funding Agreement 2007–08 to 2010–11, PBS, CSIRO operational plans, CSIRO Annual Reports and CSIRO documentation provided to the ANAO on 3 June 2010, 23 November 2010 and 7 February 2011.

4.15 Figure 4.3 shows a misalignment between the budget figures obtained from various sources. A degree of difference is expected due to the differences in timing for the preparation of the estimates. For example, the indicative appropriations for the years 2007–08 to 2010–11 as outlined in the Quadrennium Funding Agreement were set in 2006–07, whereas the budgets as represented in the PBS are set in May of the preceding year. Therefore, the PBS budget should be more precise than the Quadrennium Funding Agreement budget in the later years of the agreement as the PBS can factor in adjustments such as increases in the Australian Government efficiency dividend. Other timing differences arise within a year such as the PBS being finalised for the Commonwealth Budget, which is prior to the completion of

CSIRO's Science Investment Process, which ultimately determines the internal budgets and is usually finalised in August of the financial year.

4.16 CSIRO introduced the Science Investment Process in 2005. Given this initiative it would reasonably be expected that the accuracy of the budget processes within CSIRO would have improved since that time. CSIRO has recognised the weaknesses in the arrangements surrounding the Flagship Program estimates. Through the 2010–11 PBS, CSIRO has commenced an ongoing process to take action to address these weaknesses and advised:

In prior years the calculation for the PBS was based upon estimates from the current CSIRO Annual Report plus any additional information (projections) at that time. Acknowledging that the preparation of the PBS does not coincide well with our internal budget (science prioritisation) process we reviewed the process for possible improvements. Base[d] upon the review it was agreed that we would provide financial estimates for PBS based upon the current year's actual financial performance plus any additional information at the time.⁵⁵

4.17 This change in process for estimating the Flagship Program budget is one of the main drivers for the large increase between 2009–10 and 2010–11 as shown in Figure 4.2.

4.18 While CSIRO is taking positive steps to improve the accuracy of its budget information, it remains important that all estimates, particularly those that are made publicly available, are able to be easily reconciled. This becomes even more important when the timing of CSIRO's internal processes do not align with external processes such as the Budget. Further, in recent years, the removal of information from documents such as operational plans and annual reports has diminished the transparency of financial information available to external stakeholders. This reduces the capacity to form judgements on whether reforms, such as the Science Investment Process, have improved the accuracy of the budgeting process.

⁵⁵ Email from CSIRO dated 14 April 2011.

Recommendation No.1

4.19 To improve the consistency and accuracy of financial reporting, the ANAO recommends that CSIRO review and amend, as required, internal and external budget preparation and reporting arrangements for the Flagship Program.

Agency Response

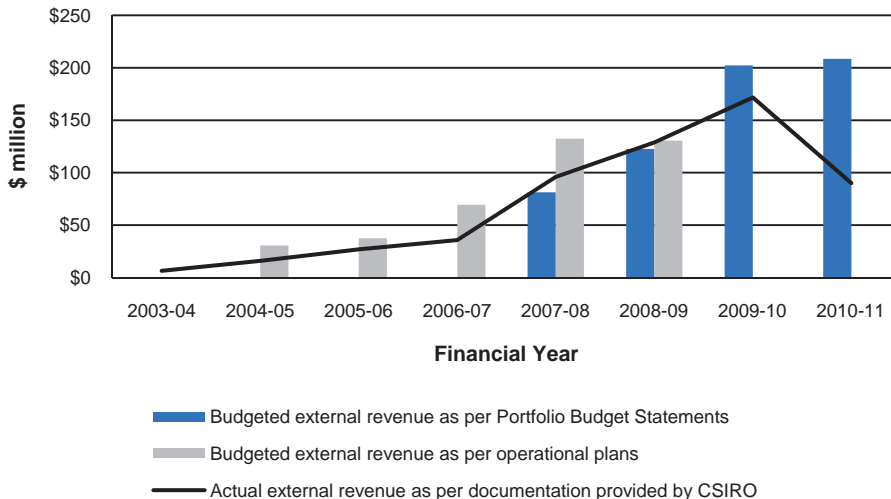
4.20 Agreed.

External revenue

4.21 The *CSIRO Strategic Plan for 2003–2007* sets out the importance of growing the external revenue of CSIRO. Since the beginning of the Program, Flagships have generated \$571 million in external revenue to December 2010. Figure 4.4 compares the budgeted and actual external revenue of the Flagship Program from 2003–04 to 2010–11.

Figure 4.4

Budgeted and actual external revenue (as at December 2010)



Notes:

1. The Flagship Program did not generate any external revenue in 2002–03.
2. The 2003–04, 2009–10 and 2010–11 operational plans do not include the budgeted external revenue of the Flagship Program.
3. The budgeted external revenue of the Flagship Program was reported in the PBS from 2007–08.

Source: PBS, CSIRO operational plans and CSIRO documentation provided to the ANAO on 23 November 2010 and 7 February 2011.

4.22 In the early years of the Flagship Program, the external revenue targets were not achieved. This was recognised in the 2006 Lapsing Program Review of the CSIRO budget, which stated that:

Flagship external revenue has not met original targets. At this stage in the development of the Flagships, many Flagship partners are more ready to commit 'inkind' resources rather than direct cash investment with CSIRO. These substantial inkind contributions from partners have ensured that research goals have not been delayed. The revised revenue expectations were reflected in a change to forward estimates.⁵⁶

4.23 Since that time, the level of external revenue has increased, with the 2007–08 and 2008–09 results exceeding the levels forecast in the PBS, noting that there were issues surrounding the accuracy of the budget figures contained in PBS documents produced prior to 2010–11. The external revenue result in 2009–10 was below the budget indicated in the PBS for that year, however, documentation provided by CSIRO to the ANAO in February 2011 included a budget which was \$21 million less than the external revenue budget contained in the PBS, meaning that performance in that year was in line with internal CSIRO information.

4.24 A comparison of Figure 4.3 and Figure 4.4 shows that in those years where external revenue targets were not achieved, the proportion of CSIRO's appropriation directed to the Flagship Program exceeded the budgeted amounts. Whereas, in 2008–09, when the external revenue forecast was achieved, the proportion of CSIRO's appropriation directed to the Flagship Program closely reconciled to the budget figure outlined in the operational plan. In February 2011, CSIRO advised the ANAO that Flagship Directors and Group Executives are accountable for delivering a balanced budget and there is no supplementation of Flagship financial positions through additional appropriation if external earnings are not met.

Sources of external revenue for selected Flagships

4.25 Through the audit the ANAO sought to compare the sources and composition of the external revenue for the selected Flagships. However, CSIRO was unable to provide data in a manner which would enable this comparison. The issues encountered included:

- data for the selected Flagships being provided in different formats;

⁵⁶ Inter-Departmental Committee, *Lapsing Program Review of CSIRO*, October 2006, p. 33.

- a combination of Flagship and non-Flagship data being provided for the Climate Adaptation Flagship, with no indication as to what proportion of the overall contract value relates to the Flagship;
- specific client data provided in February 2011 not reconciling to general client data provided in November 2010 (the data for the Energy Transformed Flagship could be reconciled); and
- a mixture of current and completed contracts in data provided.

4.26 Therefore, while a limited reliance can be placed on this data, the data did clearly indicate that all the Flagships within the audit scope derive a significant proportion of their external funding from Australian Government programs administered by other agencies such as the Department of Agriculture, Fisheries and Forestry's Rural Research and Development Priorities and the Australian Government's 2004 National Water Initiative. This means that the Flagship Program, in addition to being heavily reliant on direct funding from the Australian Government, is also largely dependant on funding indirectly received from the Australian Government.

Funding and expenditure of the Flagship Collaboration Fund

4.27 The Flagship Collaboration Fund is designed to strengthen collaboration between the Flagships, universities and other publicly funded research institutions by building partnerships with these organisations in support of delivering Flagship goals. Under the Flagship Collaboration Fund, CSIRO enters into partnership arrangements and is a research funder rather than a research provider.

4.28 As set out in Table 4.1, the Flagship Program was allocated \$305 million in 2004, of which \$96.8 million was directed at the Flagship Collaboration Fund. A further \$174 million was allocated to the Flagship Program in 2007, of which \$17.5 million was set aside for the Flagship Collaboration Fund. This funding was initially allocated for the period ending 30 June 2011, by which time it was anticipated that the Flagship Collaboration Fund would be exhausted. Table 4.4 outlines the distribution of the Flagship Collaboration Fund.

Table 4.4**Distribution of Flagship Collaboration Fund funding (2003–04 to 2010–11, in \$ million)**

Flagship Collaboration Fund component		2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Collaboration Research Program	Clusters	-	-	-	5.7	10.4	10.8	12.4	13.7
	Projects	-	-	0.1	1.1	3.2	1.6	2.5	1.7
Visiting fellowships		-	0.1	0.5	0.3	0.8	0.2	0.3	0.1
Postgraduate scholarships		0.1	0.2	0.6	0.9	0.9	1.1	1.3	1.4
Flagship Collaboration Fund administration		-	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Total		0.1	0.4	1.3	8.2	15.5	13.9	16.7	17.0

Notes:

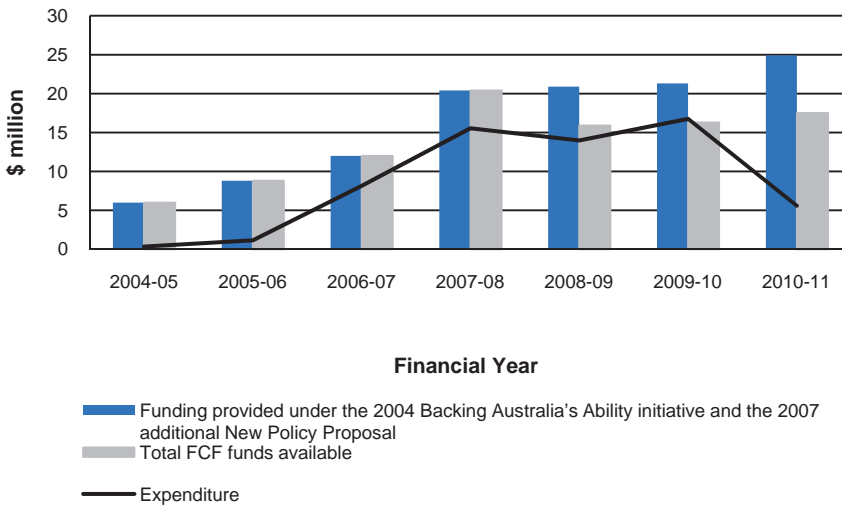
1. The lack of distribution of Flagship Collaboration Fund funding in some Flagship Collaboration Fund components during the first three years was due to the delayed establishment of the Fund (see paragraph 4.30).
2. 2010–11 figures are budgeted figures.

Source: CSIRO documentation provided to the ANAO on 1 December 2010.

4.29 Table 4.4 shows that a large proportion of the Flagship Collaboration Fund funding has been allocated to the Collaboration Research Program, particularly to clusters.⁵⁷ This proportion has increased from 69.5 per cent in 2006–07 to 80.6 per cent as budgeted for 2010–11. Figure 4.5 compares the actual Flagship Collaboration Fund funding and expenditure from 2004–05 to 2010–11.

⁵⁷ The Collaboration Research Program provided funding to research institutions located both in Australia and overseas through:

- Flagship clusters, which are three-year collaborative research programs; and
- one-year research programs. These projects can either stem from ideas generated from within CSIRO where there is a specific need to engage outside expertise, or from external organisations.

Figure 4.5**Flagship Collaboration Fund actual funding and expenditure (2004–05 to 2010–11)**

Source: CSIRO documentation provided to the ANAO on 1 December 2010 and 7 February 2011.

4.30 CSIRO initially experienced difficulty in expending the Flagship Collaboration Fund due to:

- delays in establishing the Flagship Collaboration Fund;
- scaling up activity to a fully operational level; and
- finalising agreements relating to Flagship Collaboration Fund clusters and projects.

4.31 In 2008–09 and 2009–10, expenditure was in line with budget, however, these budgets were less than the expenditure projected through the associated New Policy Proposal. CSIRO advised the Minister that the re-phasing of the Flagship Collaboration Fund in May 2008 was in response to the increased efficiency dividend of \$23.6 million in 2008–09. CSIRO used the Flagship Collaboration Fund as part of its approach to managing the increased efficiency dividend by:

- re-phasing the planned growth of Flagship Collaboration Fund activity by reducing the funds available by \$20 million over four years;
- subsequently extending activity beyond the original end date of 2010-11; and

- by starting several clusters later than planned.

4.32 The *CSIRO 2009–10 Annual Report* states as follows with respect to the Flagship Collaboration Fund:

During 2009–10, the Fund reached its most significant year of expenditure of \$17 million. To date, \$56 million has been disbursed and \$96 million committed from the original \$114 million provided by the Australian Government.⁵⁸

4.33 The \$96 million of funding committed as part of the Flagship Collaboration Fund includes \$56 million of disbursed Flagship Collaboration Fund funding and \$40 million that has been committed over the next four years, including \$17.1 million in 2010–11, \$14.5 million in 2011–12, \$7.5 million in 2012–13 and \$1.6 million in 2013–14. In February 2011, CSIRO advised the ANAO that based on current projections, the remaining \$17.5 million would be committed and expended by the end of 2013–14.

⁵⁸ Commonwealth Scientific and Industrial Research Organisation, *CSIRO Annual Report 2009–2010*, CSIRO, Australia, 2010, p., p. 173.

5. Performance Reporting

This chapter outlines the performance reporting arrangements and assesses their effectiveness in demonstrating Flagship performance.

Background

5.1 Performance reporting within CSIRO occurs at several levels. These include external reporting through the Annual Report using a series of Key Performance Indicators (KPIs), and internal reporting through an annual Enterprise Performance Report.⁵⁹ A feature of internal reporting is a layered framework of reporting based upon the structure of the Portfolio Performance Framework.

5.2 A key focus for the Flagships, which cascades through the goals, themes, streams and projects, is delivering impact. Therefore the measurement of impact, and the path to impact, is an important indicator of Flagship performance.

CSIRO Annual Report

5.3 Prior to 2007–08, reporting on the Flagships was dispersed across the CSIRO Annual Report, providing limited visibility on the performance of the program as a whole. The *2007–08 CSIRO Annual Report* outlined a new outcome statement and output framework, which took effect at the commencement of the strategic planning period in July 2007. Under this revised framework, Flagships were Output 1 of CSIRO's outcome and output framework. This was changed in 2009–10 to an outcome and program framework with Flagships being Program 1 for CSIRO.⁶⁰

5.4 Since 2007–08, reporting on performance of the Flagship Program in Annual Reports has evolved. The *CSIRO Annual Report 2009–10* included five KPIs designed to measure and report on performance. Of the five KPIs, only two are similar to the targets that were included in the previous Annual Report, and this prevented the assessment of trends in performance. Instead,

⁵⁹ CSIRO's annual reporting requirements are set out in the *Science and Industry Research Act 1949* and the *Commonwealth Authorities and Companies Act 1997*.

⁶⁰ There are four programs within CSIRO's output and program framework National Research Flagships being program one and the largest in terms of planned expenditure in 2010-11.

the ANAO focused on the composition of the KPIs and the related performance data as set out in Table 5.1.

Table 5.1

Key Performance Indicators for the Flagship Program in *CSIRO Annual Report 2009–10*

No.	Key Performance Indicator	Performance statement in Annual Report	ANAO comment
1	Evidence of growing economic, social, environmental and intangible benefits through demonstrated adoption of Flagship outputs	Independent evaluations of a small sample of CSIRO activities concluded with high confidence that CSIRO is delivering high value for money. This value consists of a mix of benefits already flowing and a substantially richer set of forward opportunities for Australia to deal better with major risks and opportunities.	This KPI is high level and therefore difficult to measure. There is no benchmark and the statement of performance is based on a review that used case studies from the Flagships and other research activities. The case studies presented in the Annual Report were subject to a number of assumptions.
2	Maintain or increase the number of publications	The number of publications produced by CSIRO trended upward from 2000 to 2006. Since that time, journal articles have continued to increase while other categories of publications have been more variable year on year.	This is a relatively commonly used output indicator of scientific performance. However, the statement combines publications from Flagship research and non-Flagship research and is therefore of limited value in indicating Flagship performance. The Annual Report notes that separate data for Flagships publications will be provided when an 'e-Publish' system is fully functional.
3	Maintain or increase financial support by Flagship partners	Flagship partners continue to increase their financial support to National Research Flagships. Financial support increased by 33 per cent between 2008–09 and 2009-10.	The comparison between 2008–09 and 2009–10 is misleading as it does not note the increase attributable to the establishment of the Sustainable Agriculture Flagship at the start of 2009–10. This Flagship's external revenue represented 70 per cent of the increase in external revenue for all Flagships between 2008–09 and 2009-10. Also, as Chapter 4 shows, the Flagships did not achieve their external revenue targets in 2009–10, suggesting underperformance against this KPI.

No.	Key Performance Indicator	Performance statement in Annual Report	ANAO comment
4	Maintain customer satisfaction	Customers and stakeholders are satisfied with the professionalism and quality of CSIRO work. Areas for improvement include stakeholder communication and relationship management with partners (see paragraph 6.26).	The performance information provided against this KPI is not specific to the Flagships as the stakeholder review it was based on was related to all areas of CSIRO (see paragraph 6.28).
5	Investment of the Flagship collaboration funds as per agreed guidelines	Investment of Flagship Collaboration Funds in 2009-10 was consistent with the agreed guidelines.	The KPI does not demonstrate performance of the Flagship Collaboration Fund, rather it focuses on governance. [^]

Note [^]: In February 2011 CSIRO informed the ANAO that indicators of Flagship Collaboration Fund performance were being modified in response to a review of the Fund in April 2010.

Source: ANAO analysis of *CSIRO Annual Report 2009–10*.

5.5 In addition to KPIs, the *CSIRO Annual Report 2008–09* introduced a series of objectives for each Flagship. These objectives were derived from the 2008–09 business plans for each of the Flagships. The report used examples to demonstrate progress against each of these objectives. Generally there was a clear link between the objective and factors indicating progress for the selected Flagships.⁶¹

5.6 The *CSIRO Annual Report 2009–10*, while including a series of achievements for that year, did not set out Flagship objectives as per the *CSIRO Annual Report 2008–09*. This reduced the visibility of alignment between internal planning processes and external reporting in the *CSIRO Annual Report 2009–10*.

Assessing impact

5.7 Central to CSIRO's success is the ability to demonstrate the impact of its research. In that regard, the *CSIRO Annual Report for 2008–09* stated:

CSIRO's research outcome focus is primarily dependent on delivering results with relevance and impact for Australia. Impact through demonstrated

⁶¹ For the Energy Transformed Flagship there was no clear link between the progress statement for one of the objectives.

benefits to industry, the environment and the community is the ultimate measure of CSIRO's success. Due to the nature of scientific research and development, the delivery of impact is – on average – five to 15 years. We have, therefore, developed a performance framework which uses lead indicators to monitor the path-to-impact.⁶²

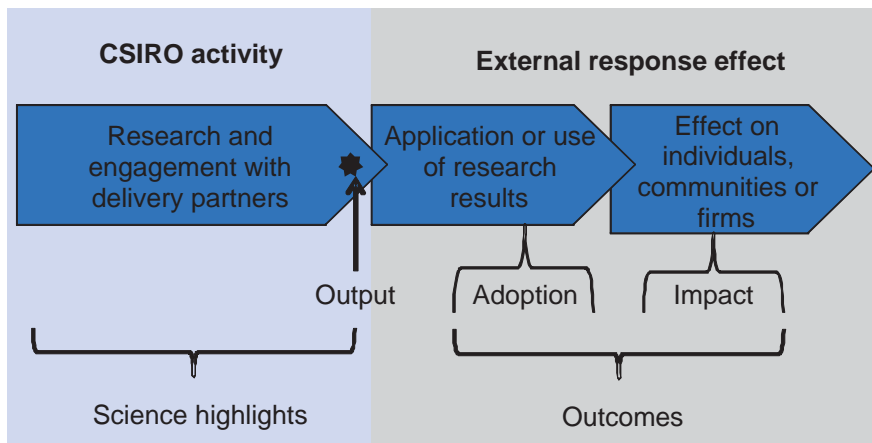
5.8 The 2006 review of Flagships defined route to impact as follows:

“Route to impact” therefore refers to the development pathway(s) through which a research output is delivered to the end-user, including product or process development, positioning and commercial considerations or activities necessary to achieve maximum impact in a timely manner.⁶³

5.9 This definition focuses on research output. As depicted in Figure 5.1, impact is concerned with the application of research, and not the research output itself. The diagram shows that the application of scientific research is somewhat removed, in terms of time and control, from the science output produced by CSIRO.

Figure 5.1

Path-to-impact



Source: Adapted by the ANAO from CSIRO documentation.

⁶² Commonwealth Scientific and Industrial Research Organisation, *CSIRO Annual Report 2007–08*, CSIRO, 2008, p. 6.

⁶³ National Flagship Initiative Review Panel, *Review of the National Research Flagships*, 2006, p. 13.

5.10 Figure 5.1 uses several key terms that are defined below:

- **Science highlight**—is a major scientific or engineering achievement.
- **Adoption**—refers to the application or use of the results of CSIRO research.
- **Impact**—is a proven benefit to Australia that has been achieved through the application or utilisation of the results of CSIRO research.

Economic analysis of impact

5.11 A 2007 Productivity Commission report commented that:

The majority of the benefits of research are often generated by a few successful projects. In the case studies analysed by the Commission, nine out of the 75 studies generated about two thirds of the cumulative gains (in present value terms) and 20 per cent of projects (15 projects) generated 80 per cent of the gains.⁶⁴

5.12 Since 2006, CSIRO has made several attempts to determine the economic impact of its research. An October 2006 report by an economic consulting firm, engaged by CSIRO to provide input to the Lapsing Program Review, contained a series of indicative assessments of the impact of CSIRO research in certain areas.

5.13 Included in the assessments were the activities of three Flagships, including the Water for a Healthy Country Flagship.⁶⁵ By aggregating the estimated economic value of the research being undertaken in the various themes within the Water for a Healthy Country Flagship, the 2006 assessment suggested an option value⁶⁶ in place as a result of the Flagship at about \$900 million present value (October 2006). That report noted that Flagship engagement was occurring alongside a wide range of other stakeholders and other investment dollars, but that Flagship engagement appeared likely to add substantially to the value of options delivered. However, the assessment indicated that this additional value was on the back of substantial value that

⁶⁴ Productivity Commission, *Public Support for Science and Innovation*, March 2007, pp. 150-151.

⁶⁵ The other two Flagships assessed were Light Metals and Preventative Health.

⁶⁶ The difference between the intrinsic value of an option and its actual value is called the option value. It is called option value because it is the additional value that comes from the option not to exercise if that is a more profitable course. Graeme Pietersz, *Moneyterms*, [Internet]; 2005, available from <<http://moneyterms.co.uk>> [accessed 5 November 2010].

was anticipated in any case as result of the wider investment in water planning. The review indicated that:

Without the investment of other stakeholders, CSIRO would probably add little value - and this wider investment is therefore key to realising Flagship engagement.⁶⁷

5.14 In late 2009, an external consultant engaged by CSIRO reported on the outcome of an impact evaluation on the Water for a Healthy Country Flagship. The purpose of this report was to: provide an evaluation of the Flagship's deliverables to date, against stated objectives; consider potential future impacts from the Flagship; and develop frameworks to enable monitoring and evaluation of the future impacts of the Flagship. The report indicated that Flagship research can reasonably be expected to contribute to, influence or direct decisions relating to current and planned investment worth a total of \$11.52 billion. It also indicated that to exceed the level of investment in the Flagship, the efficiency gains due to its research would only need to be 2.2 per cent.⁶⁸ The report stated:

...that it is highly likely that efficiency gains exceeding 2.2 per cent will result from the input of the Flagship to these investment decisions and that efficiency gains in the 5 to 10 per cent range could be conservatively expected.⁶⁹

5.15 The report identified a number of issues that made quantifying the impact of Flagship research more difficult. These included:

- a need to work with the end users of its research to enhance the end users' ability to monitor and quantify the impact of their adoption of Flagship research; and
- an absence of a systematic approach to identifying and maintaining information about how (and by whom) its research is used and the outcomes of this adoption.

5.16 With respect to both these issues the report stated as follows:

The difficulties posed by patchy data collection (there is generally extensive information about research inputs, activities, and outputs; however this is

⁶⁷ Acil Tasman, *Review of the Impact of some recent CSIRO research activities*, October 2006, p. D9.

⁶⁸ The report noted that benefits from Flagship research associated with improved environmental flows and water quality may not be measurable in economic terms.

⁶⁹ Deloitte, *Research Impact Evaluation for the Water for a Healthy Country Flagship*, October 2009, p. 10.

rarely matched by details of adoption and use of outputs, or of the impacts arising from this use) have been compounded by external stakeholders not measuring the economic impacts of the policy and investment decisions that they have made. There is also a lack of standard, accepted metrics for the valuation of water or non-market environmental values of water. This creates a problem for the Flagship in ‘valuing’ its impacts, because even where it can be clearly shown that the Flagship has contributed to, influenced or directed a policy or investment decision, in most cases it is not currently possible to quantify what the economic impact of the decision has or will be, either in absolute terms or in comparison to the impacts of alternative available decisions.⁷⁰

5.17 The report indicated that work was underway within CSIRO to examine the feasibility of developing the SAP Research Portfolio Management software system so that it could address the need for a standard repository for up-to-date performance information. In October 2010, the ANAO was informed by CSIRO that this system was piloted in the Water for a Healthy Country Flagship but that CSIRO had concluded that the system, without modification, was unsuitable.

5.18 The *CSIRO Annual Report 2009–10* used a report that was not specific to Flagships as the basis for demonstrating performance against KPI 1.⁷¹ This report was prepared in July 2010 by the same economic consulting firm engaged by CSIRO in 2006. The purpose of the 2010 report, like the 2006 report, was to provide input to a Lapsing Program Review of the CSIRO budget. The July 2010 report stated that:

Developing a balanced assessment of the impact and value, even of a relatively straightforward and focused research program, is difficult. Even research that has already appeared to ‘hit a brick wall’ often retains latent insights and capabilities that add to the store of future opportunities. In other cases, delivered benefits can take years and even decades to emerge.⁷²

5.19 The July 2010 report further stated:

In CSIRO’s case, there is certainly a long and proud history of impact and value. However, this impact and value was largely delivered under operating

⁷⁰ Deloitte, *Research Impact Evaluation for the Water for a Healthy country Flagship*, October 2009, p. 10.

⁷¹ KPI 1 - Evidence of growing economic, social, environmental and intangible benefits through demonstrated adoption of Flagship outputs.

⁷² Acil Tasman, *Assessment of CSIRO Impact & Value - Report prepared as input to CSIRO’s Lapsing Program Review*, July 2010, p. 5.

models that differ in substantial ways from the current model, which focuses on Flagships, Transformational Capability Platforms and a large portfolio, mission-focused operating model. This changing focus in CSIRO's approach and management limits the scope for relying heavily on past experience and 'banked' value to demonstrate the likely value for future investments. Importantly CSIRO's major change in direction could certainly introduce bias in assessing the value of the current operating model from only understanding the value of 'banked' impact.⁷³

5.20 The *CSIRO Annual Report 2009–10* includes a list of case studies from the economic consultant's July 2010 report.⁷⁴ Four of these case studies related to the selected Flagships. The impacts, as presented in the Annual Report, were necessarily tightly focused and did not provide background on any assumptions being made. Refer to Appendix 2 for the selected Flagship case studies and background on the cited impact.

5.21 Successive reviews and reports have concluded that the research of the various Flagships is delivering benefits and having impact. However, the same reviews and reports have also outlined the difficulties in being able to accurately demonstrate or quantify these benefits and impacts. The reviews and reports show that measuring the economic impact of research accurately, while potentially based on sound economic analysis, involves the application of a series of constraining variables including:

- a range of long-term assumptions surrounding factors that may influence economic circumstances;
- anticipating outcomes from complex and competing areas of research that may be at varying levels of maturity; and
- evaluating the impact of the application of research by external stakeholders who may incorporate other factors in decision-making processes surrounding policy setting and investments.

5.22 However, it should be recognised that the purpose of research is also to advance knowledge in certain areas, an example of which is set out in the following case study.

⁷³ *ibid.*

⁷⁴ The same case studies were included in the internal *2009–10 CSIRO Enterprise Performance Report*.

Case Study

Greenhouse gas mitigation through land use

An August 2009 CSIRO report, *An Analysis of Greenhouse Gas Mitigation and Carbon Biosequestration Opportunities from Rural Land Use*, was prepared in response to a request by the Queensland Premier's Council on Climate Change. The report provided an assessment, based on a review of current knowledge and consultation with a cross-section of scientists and land management experts, of the greenhouse gas sequestration/mitigation potential likely to be achieved through change in rural land use and management.

Chapter 22 of the 2008 *The Garnaut Climate Change Review* (Garnaut Review)⁷⁵ focused on transforming land use and included a table outlining the potential for emissions per annum reduction and/or removal from Australia's agriculture, forestry and other land use sectors. The CSIRO report revisited the Garnaut Review estimates for terrestrial greenhouse gas sequestration. CSIRO advised the ANAO that the broad thrust of the Garnaut Review was supported but there were definitional issues or updated science assessments that explain differences between the Garnaut Review and the CSIRO report. CSIRO commented that the report went to some lengths to identify the uncertainties and research needs.

In November 2010 the Minister for Climate Change and Energy Efficiency announced the Terms of Reference for an update to the Garnaut review. The 2011 review updates elements of the 2008 review where improvements in expert knowledge had implications for the key findings and recommendations of the 2008 review. The 2011 update considered a range of areas including the potential for greenhouse gas abatement within the land sector including the work undertaken on behalf of the Queensland Government by CSIRO in this area. The update commented that the realisation of mitigation opportunities in this area will require significant investment in research and development and in many cases a high carbon price.⁷⁶

Source: ANAO analysis of CSIRO documentation.

Portfolio Performance Framework performance reporting arrangements

5.23 The objective of establishing the Portfolio Performance Framework in CSIRO in 2002 was to provide a mechanism for tracking and reporting progress against the strategic goals of the Flagship Program to ensure they are having a national impact. Key elements of the Portfolio Performance Framework performance assessment elements include:

- Flagship goals;

⁷⁵ The 2008 Garnaut Climate Change Review examined the impacts of climate change on the Australian economy, and recommended medium to long-term policies and policy frameworks to improve the prospects for sustainable prosperity.

Commonwealth of Australia, *Garnaut Climate Change Review* [Internet]; 2008, available from <http://www.garnautreview.org.au/domino/Web_Notes/Garnaut/garnautweb.html> [accessed 19 November 2010].

⁷⁶ *Garnaut Climate Change Review Update 2011 – Transforming Rural Land Use*, 2011, p. 22.

- Flagship roadmaps;
- theme roadmaps; and
- Annual Performance Goals (APGs) for research streams.

Flagship goals and roadmaps

5.24 Table 5.2 outlines the current goals of the selected Flagships and the limitations in being able to assess progress towards the goals.

Table 5.2

Flagship goals

Flagship	Flagship goal	ANAO comment
Water for a Healthy Country	To provide Australia with solutions for water resources management, creating economic gains of \$3 billion per annum by 2030, while protecting or restoring our major water ecosystems.	This goal is more closely aligned to science output and adoption. However the economic gains that can be directly attributed to CSIRO research may be difficult to quantify net of external influences.*
Energy Transformed	To halve greenhouse gas emissions and double the efficiency of the nation's new energy generation, supply and end use.	This goal does not have a timeframe. Notwithstanding this, changes in greenhouse gas emissions and increases in energy efficiency while potentially partially attributable to CSIRO research are likely to be influenced by a range of factors not attributable to CSIRO research.
Climate Adaptation	To equip Australia with practical and effective adaptation options to climate change and variability and in doing so create \$3 billion per annum in net benefits by 2030.	The financial impact of this goal will be difficult to assess and will likely be subject to a range of variables that are beyond CSIRO control.
Sustainable Agriculture	To secure Australian agricultural and forest industries by increasing productivity by 50 per cent and reducing net carbon emissions intensity by at least 50 per cent by 2030.	This goal is broad and it is unlikely that CSIRO will be able to monitor progress against the productivity target. Any reduction in net carbon emissions in these sectors, while potentially partially attributable to CSIRO research, is likely to be influenced by a range of factors not attributable to CSIRO research.

Note*: In late 2009 an external consultant commented that given the often considerable time-lags that exist between commencement of research and the delivery of final impacts from research to adoption, it is expected that the Flagship will build up gradually over time to this annual level of impact. Reasonable interim expectations for the Flagship may be that its work delivers economic gains averaging at least \$100 million per annum by 2015 and \$1 billion per annum by the early 2020s.

Source: ANAO analysis of the *2009–10 CSIRO Annual Report* and *2009–10 CSIRO Operational Plan*.

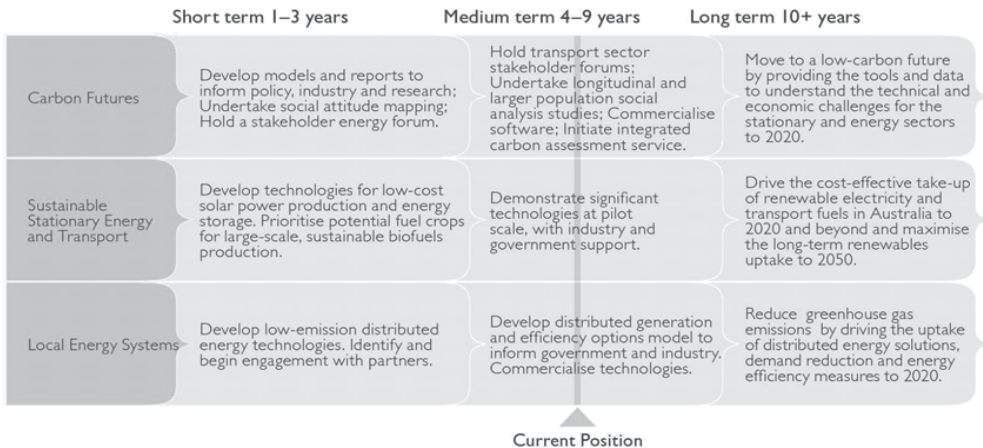
5.25 The *CSIRO Annual Report 2009–10* does not attempt to specifically assess progress against the Flagship goals. Instead, Flagship progress is

indicated by reference to progress against a Flagship roadmap.⁷⁷ The 2008–09 and the 2009–10 CSIRO Annual Reports included a roadmap for each of the Flagships.⁷⁸ A copy of the roadmap for the Energy Transformed Flagship from the *CSIRO Annual Report 2009–10* is included in Figure 5.2 as an example.

Figure 5.2

Example of Flagship roadmap from 2009–10 Annual Report

Energy Transformed Flagship Roadmap



Energy Transformed was restructured in July 2009 which resulted in a reduction and change of themes from four to three.

Note: The heading boxes are the research themes within the Flagship. The grey boxes summarise short, medium and long terms goals for each theme.

Source: *CSIRO Annual Report 2009–10*.

5.26 The roadmaps depicted in the *CSIRO Annual Report 2009–10* show the current position of each Flagship as a grey vertical line. For the Climate Adaptation, Sustainable Agriculture and Energy Transformed Flagships the current position is shown as a straight line from top to bottom across all themes. Whereas, the roadmap for Water for a Healthy Country Flagship in the

⁷⁷ Each Flagship theme has a statement, which includes a number of standard elements. Among these, is a theme roadmap that is intended to provide the planning and performance link between near-term annual goals and long-term theme goals.

⁷⁸ The 2009–10 *CSIRO Enterprise Report* included the same roadmaps.

CSIRO Annual Report 2009–10 shows each theme at different points on the roadmap, with the current position shown as a staggered line.

5.27 The Energy Transformed Flagship is an original Flagship, and was the subject of a significant restructure in 2009. This would suggest that the various research themes within the Energy Transformed Flagship should be at different stages along the Flagship roadmap. However, the Energy Transformed Flagship roadmap depicted in the *CSIRO Annual Report 2009–10*, shows a straight, vertical line similar to the Sustainable Agriculture Flagship.

5.28 In February 2011, CSIRO advised that post the Energy Transformed Flagship restructure, the roadmap goals were translated from the four to three themes while maintaining the original targets for historic periods and adjusting targets for future periods. When the Flagship's progress was assessed against these criteria, the outcome was that all three areas have progressed equally. While the restructure has removed a number of technologies from the portfolios, it did not have an impact on the maturity of development in each technology area that was in scope for the restructured Flagship.

5.29 Annual performance is reported internally within CSIRO through the Enterprise Performance Report (previously known as the Organisation Performance Report). The *CSIRO 2007–10 Enterprise Performance Report* also included Flagship roadmaps consistent with those included in the *CSIRO Annual Report 2009–10*. The *CSIRO 2007–10 Enterprise Performance Report* set out each Flagship Director's assessment of progress towards theme goals in 2009-10 using a green-amber-red traffic light rating system.⁷⁹ The assessment of the four selected Flagships from the Enterprise Performance Report is set out in Table 5.3

⁷⁹ The *CSIRO Enterprise Performance Report 2008–09* provided the following definition of each rating:

- Green rating indicates a theme is on track to reach its theme goals;
- Amber rating gives a warning signal that some adjustment on timing or resourcing may be required in part of the theme for it to achieve its goal; and
- Red rating indicates that the theme is not on track to achieve its goal.

Commonwealth Scientific and Industrial Research Organisation, *2008–09 CSIRO Enterprise Performance Report*, 2009.

Table 5.3**Progress towards theme goals 2009–10**

Flagship	Green	Amber	Red	Total
Water for a Healthy Country	4	-	-	4
Energy Transformed	3	-	-	3
Climate Adaptation	4	-	-	4
Sustainable Agriculture	3	1	-	4

Source: CSIRO 2007–10 Enterprise Performance Report.

5.30 Table 5.3 shows that one of the research themes within the Sustainable Agriculture Flagship is lagging behind the other three research themes. As such, to be consistent with this assessment, a staggered line on the Flagship roadmap to reflect the different stages of theme progress would be more appropriate.

Annual Performance Goals

5.31 Progress towards theme goals is monitored and reported at the stream level through APGs. Like for theme goals, Flagship Directors assess progress towards APGs using a traffic light rating system. The July 2009 guidelines on the development of APGs did not define the meaning of each rating, nor did it provide any metrics or guidance on how to rate performance against APGs.

5.32 Progress towards APGs is formally reported three times per year (at the end of October, February and June). The late 2010 *CSIRO 2007–10 Enterprise Performance Report* used APGs aggregated at the Flagship Program level as a mechanism for demonstrating stream progress. That report stated that:

Over the six years of the Flagships program the main reason given for delay in achieving APGs has been that planned facilities or resources (other than people) have been unavailable or inadequate for the task (accounting for 24 per cent of all red or amber APGs). Changes in policy or strategy by an external research or delivery partner is the second most often selected reason (19 per cent).⁸⁰

5.33 The implementation of APGs commenced in 2002, and has been the subject of a number of reviews over that time. These reviews have drawn

⁸⁰ Commonwealth Scientific and Industrial Research Organisation, *2007–10 CSIRO Enterprise Performance Report*, CSIRO, Australia, 2010.

similar conclusions about the need to improve the articulation and measurement of APGs. In 2008, an internal audit report recommended that APGs should be reviewed against the SMART criteria for goal setting, which requires goals to be specific, measurable, achievable, relevant and timely.

5.34 CSIRO has defined different types of APGs which have evolved over time. The July 2009 guidelines on the development of APGs outlined the following APG structure:

- **Research APG**—an annual target that represents the scientific and technical research progress that is required in a particular year in order for a stream to meet its short, medium and long-term objectives;
- **Path-to-Impact APG**—an annual target that represents the required progress at stream-level in a particular year to ensure the adoption and impact of research outputs. This includes, but is not limited to, development of relationships with specific industry, community or government organisations critical for adoption and impact; and
- **Capability Development APG**—an annual target that represents progress in developing key research capability in line with agreements with the relevant capability leaders.

5.35 The 2009 guidelines indicate that the APGs are developed from the theme roadmaps, and each stream should have at least one research, path-to-impact and capability APG. The 2009 guidelines outlined that APGs:

- are not the same thing as a project milestone;
- do not track the performance of individuals;
- do not reflect whether the underlying science is high or low quality; and
- are not designed to provide a comprehensive picture of the activities going on within a stream.

5.36 An ANAO review of the 2009–10 APGs for the four selected Flagships identified the following :

- APGs for some themes include more specific timeframes than other themes in the same Flagship;
- Research APGs tended to be more specific and measurable than Path-to-Impact APGs;

- Path-to-Impact APGs use a disparate range of measures to indicate performance, and in a number of instances the key focus appears to be engagement, which formerly was an APG;⁸¹ and
- in some instances, Capability APGs tend to focus on divisional responsibilities for capabilities, which under the matrix-based management model might be regarded as a risk to Flagship output and not a performance goal for the Flagship.⁸²

5.37 The performance of the Flagships as reported in the late 2010 *CSIRO 2007–10 Enterprise Performance Report* is set out in Table 5.4.

Table 5.4

APG performance for all Flagships 2009–10

Rating	Type of APG		
	Research	Path-to-impact	Capability
Green	251	203	178
Amber	43	60	31
Red	4	7	6
No. of APGs	298	270	215

Source: *CSIRO 2007–10 Enterprise Performance Report*.

5.38 In the report CSIRO assessed that over 81 per cent of APGs were on track to support the achievement of theme goals. Seventeen per cent of APGs indicated that some adjustment on timing or resourcing was required, and two per cent were not on track to support the attainment of the theme goal.

5.39 A more detailed comparison of APG performance over the period since the Flagships were first established is constrained by a number of factors including:

- weaknesses in the definition and measurement of APGs, which CSIRO has sought to address over time;

⁸¹ As noted in paragraphs 5.14 to 5.17 CSIRO has identified difficulties surrounding the collection of data relating to path-to-impact.

⁸² *CSIRO - the way we work* (2010), which describes organisational arrangements in CSIRO, outlines that Divisions are responsible for developing and maintaining scientific capabilities, provide science leadership, line manage research staff and deliver science outputs as agreed with the Portfolios. Portfolios, which include Flagships, are responsible for developing and delivery against a portfolio strategy including financial resources and a revenue pipeline. The CSIRO operating model is discussed in further detail in Chapter 2.

- significant restructuring of the themes within Flagships such as the Energy Transformed Flagship; and
- restructuring of the APGs, making comparison of APG performance between 2009–10 and previous years difficult.

5.40 CSIRO has undertaken an ongoing process of refining its APG performance reporting framework and if a degree of stability can be achieved this could address some of the underlying issues. However, as noted in paragraph 5.35, APGs do not reflect milestones nor do they represent an aggregation of all stream activities. As such, a varying degree of judgement is involved in APG definition and assessment. Consequently, there is a risk that APGs suggest a level of accuracy in performance measurement that cannot sustain more rigorous assessment, without a structured quality assurance regime. The 2010 Lapsing Program Review supports this conclusion and within this context recommended as follows:

CSIRO should further develop its performance measurement policies and processes, supported by appropriate information technology, to assist in performance planning, monitoring and reporting. Specific objectives should be to:

- identify appropriate measures to inform decision making and performance assessment,
- increase the rigour with which performance measures are defined and the reliability of performance data for collation, reporting and analysis, and
- support improved monitoring and measurement of economic, social and environmental impact.⁸³

5.41 The first two dot points within this recommendation support a conclusion that the performance measurement and reporting regime within CSIRO requires improvement. In implementing this part of the recommendation a careful balance will need to be achieved between the desire to achieve consistency and accuracy in performance assessment and reporting, and the need to maintain relevance across a diverse research portfolio and minimise associated administrative overhead. Implementing the final dot point of the recommendation will be particularly challenging. Developing reliable performance data that addresses economic, social and environmental impact

⁸³ Inter-Departmental Committee, *Program Review of CSIRO*, September 2010, p. 14.

will be a complex proposition that would need to address a range of factors beyond the direct influence of CSIRO.

5.42 In February 2011 CSIRO advised the ANAO that it had commenced the Impact 2020 Project in December 2010. The goal of this project is to increase the visibility of CSIRO's future impact pipeline for the next 10–20 years by:

- clearly asserting CSIRO's future impact to 2020 and beyond for each Flagship;
- aligning future pipeline and science investment decisions with intended impact; and
- creating an environment where we can pull science and technology through the system and balance risk and reward for projects and portfolios.

5.43 The Impact 2020 Project Charter outlines that to achieve this goal it is likely that modifications will be required to the Science Investment Process, project planning and management arrangements within CSIRO and that appropriate monitoring arrangements will need to be put in place. Achieving the Impact 2020 Project goal will be particularly challenging and until such arrangements are established, CSIRO should consider how to best assess and present the impact of Flagship research through external reporting.

6. Internal and External Reviews

This chapter discusses internal and external reviews which have either focused on elements of the Flagship Program or commented on the operation of the Flagship Program within CSIRO.

Background

6.1 Since the inception of the Flagships there have been a number of reviews, which have encompassed or directly focused on Flagships. These reviews have included:

- **Divisional Science Reviews**—focus on the CSIRO Divisions, which provide the research capability to the Flagships;
- **Flagship Reviews**—external panel reviews of the specific Flagships; and
- **Lapsing Program Reviews**—a four-yearly review undertaken by an Inter-Departmental Committee which focuses on the CSIRO budget. The Committee is informed by a series of related reviews commissioned by CSIRO.

Divisional Science Reviews

6.2 CSIRO prepares an annual Science Health Report which provides analysis and benchmarking of some scientific outputs. A key input to the Science Health Report is Divisional Science Reviews. An initial cycle of the reviews, covering all CSIRO Divisions, was completed during 2004–07. These reviews were undertaken during the initial phases of the Flagships, and their focus was on Divisions, consequently they contained limited reference to Flagship research.

6.3 The Science Health Report for 2008–09 indicated that a second round of Divisional Science Reviews had commenced in late 2008 and is due to be completed in 2011. Reviews completed at the time of audit fieldwork commented on the increasing focus within the Divisions on Flagship-related research, which is an outcome of the Science Investment Process. The reviews have made some positive comments and also identified where improvement could be made to the interaction between Flagships and the Divisions. For example, the review of the Land and Water Division commented:

Overall, the Division appears to have been largely subsumed in the business of the Water for a Healthy Country (WfHC) Flagship. This has been beneficial in

that it has helped focus the scientists of the Division on the needs of the outside world, and the Flagship has definitely been associated, and perhaps has been a prime mover, with a change in the attitudes of the staff of the Division. Prior to the Flagship and its operation, the perception of the Panel is that the energy levels and research of the Division needed to be stimulated and the Flagship has certainly gone a long way to bringing about the change. It has also encouraged an increased level of interaction between scientists within the Division working in different disciplines, although this has still some way to go.⁸⁴

6.4 That review also commented that:

The Panel noted there was only limited interaction between the different Capability groups within the Division and less than was considered desirable. This is a conundrum in that the Flagship, on the face of it, has been successful in bringing together different disciplines from this Division and other Divisions to address particular problems. This needs to be examined carefully, but certainly within the Division, the Panel saw a number of opportunities where scientists from different capability groups could have had synergistic interactions and did not.⁸⁵

6.5 This series of Divisional Science Reviews also highlighted a degree of tension between some Flagships and Divisions in an organisational sense as set out in Table 6.1.

⁸⁴ Review Committee, *Land and Water Review*, October 2009, p. 3.

⁸⁵ *ibid.*, p. 6.

Table 6.1

Summary of Flagship related-findings from CSIRO Divisional Science Reviews (February 2009 to October 2009)

Division	Panel comment
Land and Water	The panel concluded that there was a serious mismatch between the urgent need to reinvest in and to reinvigorate several of the Division's core capabilities, and the fact that almost all of its funding comes from various Flagships, leaving little flexibility for strategic science investment by the Division itself.
Sustainable Ecosystems	The panel commented that the Sustainable Ecosystems contributes virtually all of its research capability to Flagships. While the Flagships were seen to be important in delivering the organisation's research to end-users, the removal of any flexibility at the Divisional level carries with it the potential for stagnation and lack of focus, particularly with those individuals who are regularly moved from project to project or those who are spread too thinly across many projects. Some discretionary funding to enable the Divisional Chief to support new innovation and project options would allow invigoration of the Division's research capability base. The panel was also conscious of the large investment of time, resources and intellectual capital required to service the matrix structure and noted that CSIRO needs to ensure that this process does not diminish the scientific effort of its management and staff.
Materials Science and Engineering	The review commented that the matrix structure has been established to remove the silo mentality of the past, and thus facilitate interdisciplinary research. Comments from the researchers have suggested that the Flagships themselves are in some cases becoming virtual and impersonal silos.
Minerals	The Panel commented that the flagship programs were designed originally to fund projects with long-term objectives and with the capability of transforming aspects of the industry. Whilst the Committee was advised by end users that they thought that the Flagship initiative was a very positive one, the Committee believes that they do not give sufficient recognition to the need for development of science capability. Pressure on the Flagships to obtain high levels of external funding exacerbates this situation.

Source: ANAO analysis of CSIRO documentation.

6.6 These findings suggest that there continues to be a range of cultural, resourcing and structural issues surrounding the Flagships and the broader change program undertaken within CSIRO. Given the scale of the change program that has been undertaken in CSIRO in recent years, and the prominence of the Flagships in this process, measures developed by CSIRO to address these issues need to consider the underlying factors within the context of broader organisational research objectives.

Flagship Reviews

6.7 Flagship Reviews are another input to the Science Health Reports. These reviews are intended to maximise the likelihood of achieving the

planned outputs and outcomes of the Flagship Program. Flagship Reviews are conducted by an expert review committee and are intended to be prospective and output and outcome oriented. The reviews focus on:

- determining whether the right research challenges are being tackled to enable the outcome and output objectives to be met;
- identifying whether CSIRO and its research collaborators have, or can build, competitive research capabilities for tackling these particular challenges and sufficient capacity for timely delivery; and
- assessing the path-to-impact, covering issues such as engagement with likely delivery partners for the outputs and strategies for addressing barriers to adoption and use of research results.

6.8 The Water for a Healthy Country, Preventative Health, Food Futures, Light Metals and Wealth from Oceans Flagships were the subject of specific Flagship reviews. The Energy Transformed Flagship was reviewed through two broader reviews of the Energy Group.

6.9 The review of the Water for a Healthy Country Flagship, which was undertaken from September to October 2009, commented that:

The Flagship is addressing a major issue with current and emerging science questions of national significance. Stakeholders were in agreement on the importance of the Flagship to the reform of water management arrangements in Australia and advised that demand for its research outcomes is only likely to increase in the medium term. The Flagship is to be commended on its delivery of major products to the Council of Australian Governments within tightly prescribed timelines and on the impact of those products.

The urgency of project delivery which has been imposed by Governments on the Regional Water Theme in particular over the last 2 years has been a reflection of the standing of the Flagship and the strength of the CSIRO brand, but potentially poses a number of ongoing risks to future capacity which it would be timely to address at this point. Many of the recommendations go to this issue, and to the impact on career scientists of the necessary responsiveness to current water crises.⁸⁶

6.10 The report made seven general recommendations concerning building research capability, investment in fundamental research (see comment against Land and Water Division in Table 6.1) and the opportunity to enhance research

⁸⁶ Review Committee, *Water for a Healthy Country Review*, October 2009, p. 3.

opportunities through collaborative projects. In respect to path-to-impact, one recommendation commented as follows:

Adoption pathways are generally well defined and relationships with adopters are strong. However this success raises expectations which will require management by the executive to maintain the appropriate research focus and resist pressure to operate in a quasi-consultancy mode in support of a high profile government agenda.⁸⁷

6.11 The review assessed the performance of the Flagship against the criteria of science quality and stakeholder impact. These assessments are summarised in Table 6.2.

Table 6.2

2009 Review of Water for a Healthy Country Flagship

Theme	Science quality	Stakeholder impact
Integrated Water Information Systems	Favourable	Strong
Healthy Water Ecosystems	Favourable	Strong
Regional Water	Strong	Benchmark ⁸⁸
Urban Water	Strong	Strong
Flagship	Strong	Benchmark

Source: *Water for a Healthy Country Review*, October 2009.

Lapsing Program Reviews

6.12 The current Quadrennium Funding Agreement ends in June 2011. Government guidelines require that a review of the CSIRO budget be conducted at the end of each funding agreement by an Inter-Departmental Committee. The Inter-Departmental Committee is chaired by CSIRO and comprises representatives from the Department of Finance and Deregulation, Department of Treasury, Department of Innovation, Industry Science and Research and Department of Prime Minister and Cabinet. The review examines whether CSIRO is operating appropriately, effectively and efficiently and may recommend the continuation of funding as a Lapsing Program. Since the first

⁸⁷ *ibid.*, p. 4.

⁸⁸ The benchmark rating was defined as ‘Sustained scientific leader – well recognised in the international research community for this’. Review Committee, *Water for a Healthy Country Review*, October 2009, p. 34.

Flagships were established there have been two Lapsing Program Reviews, the first in 2006 and the most recent in 2010.

6.13 There are a range of inputs to Lapsing Program Reviews including a series of reports by consultants engaged by CSIRO. A key input to both reviews has been reports prepared by economic consultants which seek to estimate the impact of CSIRO research. These reports have been used as a basis for CSIRO reporting and are discussed in Chapter 5.

6.14 Inputs to Lapsing Program Reviews directly relevant to Flagships have included a 2006 Review of the Flagship Program and a 2010 Review of the Flagship Collaboration Fund. These reviews are outlined below. Also outlined is a research report on stakeholder opinions of CSIRO, which was an input to the 2010 Lapsing Program Review.

2006 Review of the Flagship Program

6.15 The report of the 2006 Lapsing Program Review commented on the appropriateness of the Flagship Program and stated:

The Review notes that over 80% of CSIRO's research is focused on National Research Priorities and that, in the current triennium CSIRO has successfully established six National Flagship programs that address major national objectives including: clean, cost-efficient energy; more productive and sustainable use of water; sustainable economic growth through new and more competitive enterprises; healthier, more productive lives for Australians; sustainable wealth from our oceans; growth and prosperity for regional Australia.⁸⁹

6.16 A key input to the 2006 Lapsing Program Review was the Review of the National Research Flagships conducted by an external panel. The terms of reference for that review required an examination of the appropriateness of the goals of the Flagships; the extent to which they align with national priorities and their general positioning within the National Innovation System; the effectiveness of Flagship performance to date; and the extent to which efficiencies have emerged from their introduction.

6.17 This review offered a positive view of the Flagships, noting that their full effectiveness would take some years to determine and optimise. The review contained a series of recommendations that suggested a continuation of

⁸⁹ Inter-Departmental Committee, *Lapsing Program Review of CSIRO*, October 2006, p. 3.

ongoing change processes within CSIRO. The review identified a need for CSIRO to improve its sophistication in articulating the route to impact of research and recommended:

In recognition of the critical importance of 'route to impact' on both the magnitude of the impact and in refining research outputs, the Panel recommends that Flagships adopt a high level of sophistication, urgency and rigour in assessing, defining and navigating route to impact. This will require improved capabilities in product-business and commercial development skills available to the Flagships; and considerable input by the Flagship Advisory Committees.⁹⁰

6.18 In September 2007, the Flagship Oversight Committee was briefed on the status of the implementation of this recommendation as follows:

The current performance framework (PPF [Portfolio Performance Framework]) currently identifies "research" and "delivery" performance goals. Our ability to explicitly articulate delivery pathways (i.e. route to impact) has varied across the Flagships. The Flagship Oversight Committee will consider ways of improving this process at a generic level. Steps are already in train to improve the level of commercial and business development expertise for Flagships.⁹¹

6.19 As noted in paragraphs 5.7 to 5.22, defining the path-to-impact and quantifying impact are ongoing challenges that CSIRO is seeking to address. The 2010 Lapsing Program Review also contained a recommendation in this regard.

2010 Review of the Flagship Collaboration Fund

6.20 The 2006 Review of the Flagships commented that:

The Panel noted the specific funding made available through Backing Australia's Ability 2 (BAA2) [*Backing Australia's Ability – Building Our Future Through Science and Innovation* initiative] for the establishment of a Flagship Collaboration Fund. While implementation has been slower than might have been desirable, the Panel commends CSIRO for the innovative scheme that has resulted, in particular the concept of Flagship Clusters. These have outstanding potential to allow Flagships to access a broader research skills

⁹⁰ National Flagship Initiative Review Panel, *Review of the National Research Flagships - an initiative of CSIRO*, August 2006, p. 7.

⁹¹ Response from CSIRO to the Review of CSIRO's National Flagship Initiative-update, September 2007.

base, to engage some of Australia's best and brightest and to enhance the delivery of Flagship outcomes.⁹²

6.21 A key input to the 2010 Lapsing Program Review was an April 2010 independent panel review, commissioned by CSIRO, of the Flagship Collaboration Fund. The Review of the Flagship Collaboration Fund concluded:

The Panel strongly endorses the continuation of the FCF [Flagship Collaboration Fund] and its broad objectives of contributing to National Research Flagship program goals, building capability across the national innovation system and building longer term research collaborations.⁹³

6.22 The review noted that the Flagship Collaboration Fund governance arrangements and underpinning systems and processes were sound but commented that:

The Panel found that accessing accurate and comprehensive performance and trend information about the FCF to be problematic. While summary financial data was readily available, only limited performance information is held centrally within CSIRO and other basic information such as publications data had to be extracted manually.⁹⁴

6.23 The review recommended that fund performance information and overall monitoring be enhanced to better assess program performance. A May 2010 briefing to the CSIRO Executive Team, which included the response to the recommendation from this review, stated as follows:

The FCF management anticipated the Panel's views and are planning to enhance the FCF performance reporting and underlying data requirements to seek more visibility as part of the CSIRO performance management framework.⁹⁵

6.24 More broadly the review recommended:

That the Flagship Collaboration Fund be continued with its broad objectives being to contribute to longer term National Research Flagship program goals, to building research capability across the national innovation system, and to

⁹² National Flagship Initiative Review Panel, *Review of the National Research Flagships - an initiative of CSIRO*, August 2006, p. 12.

⁹³ CSIRO Flagship review panel, *Review of CSIRO Flagship Collaboration Fund*, May 2010, p. 5.

⁹⁴ *ibid.*, p. 19.

⁹⁵ Memorandum to the CSIRO Executive Team - Review of the Flagship Collaboration Fund, 27 May 2010, Attachment 1.

enhancing longer term research collaborations; and that its funding be doubled over the course of the 2011-15 period in order for the initiative to reach its full potential. The Panel believes this funding should be sought from the Government as an additional hypothecated component of the CSIRO appropriation without affecting other federally funded research budgets.⁹⁶

6.25 As noted in Chapter 4, CSIRO experienced difficulty in expending the Flagship Collaboration Fund in the early years of the program. A review of documentation surrounding the 2009 round of Flagship Collaboration Fund clusters⁹⁷ assessments shows that not all applications were assessed as suitable, suggesting that any expansion of the Flagship Collaboration Fund would need to be carefully considered. Since 2007, CSIRO has also reduced expenditure against the Flagship Collaboration Fund to address a broader shortfall in CSIRO funding following the application of the increased efficiency dividend.

6.26 In April 2010, an external consultant reported on the outcomes of research to inform the development of an over-arching communication strategy targeted at improving key stakeholders' knowledge and understanding of CSIRO. This research involved interviews with stakeholders from the Australian Government (government departments and political offices), industry, peak bodies and universities. The research looked at CSIRO's effectiveness of collaboration with partners and commented that:

Both university and industry stakeholders believe that their collaboration with CSIRO is hampered by what they perceive as CSIRO's over-zealous approach to protecting their intellectual property and broader arrangements governing research partnerships. However, some stakeholders recognise that CSIRO's commercial focus means that its operating environment is different to that of a university.⁹⁸

6.27 The report of the September 2010 Lapsing Program Review, which relied on both the review of the Flagship Collaboration Fund and stakeholder research, recommended that:

⁹⁶ CSIRO Flagship review panel, *Review of CSIRO Flagship Collaboration Fund*, May 2010, p. 6.

⁹⁷ The Review of the Flagship Collaboration Fund recommended that the effectiveness of the Flagship Collaboration Fund be further enhanced through adjusting the balance of expenditure across the four components of the initiative to give greater priority to collaborative research programs (clusters) by directing around 80 per cent of funding to clusters, 10 per cent to Postgraduate Scholarships, and 10 per cent to research projects and visiting fellows, which should be utilised by the Flagships at their discretion based on flexibility and need.

⁹⁸ Ogilvy Illumination, *Communications research - Maximising engagement with stakeholders*, April 2010, p. 17.

The Department of Innovation, Industry, Science and Research, in consultation with CSIRO and other research agencies as relevant, should critically examine collaborative research arrangements and funding with a view to ensuring the efficient use of resources and effective research collaboration.⁹⁹

2010 Stakeholder Reviews

6.28 The April 2010 external consultant's report on stakeholder input to CSIRO's communication strategy encompassed the whole of CSIRO. As such it did not specifically seek to assess the Flagship Program. One area where it did comment on the Flagships related to the strategic direction of CSIRO, with the research report commenting:

Rather than voicing criticisms of CSIRO's strategic direction, many participants commented that they were not aware of it. This was seen to be a function partly of confusion over the role and direction of CSIRO's research Flagships as opposed to its divisions.¹⁰⁰

6.29 One particular stakeholder consulted as part of the review commented on the number of internal reviews undertaken by CSIRO, saying:

One of the criticisms I have is that they seem to be always internally reviewing themselves or their programs. I mean every meeting I go to there's another review of the research of the sector or the flagship or something and you know I just find that a bit frustrating.¹⁰¹

Consolidating the findings of reviews

6.30 CSIRO has a strong cultural commitment to reviewing and gaining feedback on its work and this has extended to the Flagship Program. In March 2007, the Productivity Commission commented that :

...CSIRO has been the subject of a multiplicity of reviews throughout its recent history. Current priority setting, performance management and evaluation processes reflect its reaction to those investigations, the response by Government and other changes in the external environment. The revised processes (and the organisation's current view of its role) have been in place

⁹⁹ Inter-Departmental Committee, *Program Review of CSIRO*, September 2010, p. 51.

¹⁰⁰ Ogilvy Illumination, *Communications research - Maximising engagement with stakeholders*, April 2010, p. 16.

¹⁰¹ *ibid.*, p. 16.

for a relatively short period of time and thus firm conclusions cannot as yet be drawn regarding their impact.¹⁰²

6.31 The reviews outlined in this chapter have largely focused on specific functions or organisational structures within CSIRO. The exception to this is the 2006 review of the Flagship Program, which was an input to the Lapsing Program Review of CSIRO. This review occurred in the early phases of the Flagship Program and during a period when CSIRO was continuing to implement a process of significant organisational change.

6.32 As noted in Chapters 2 and 3, two reviews were undertaken of the Energy Group during 2009. Unlike Divisional Science Reviews and Flagship Reviews, the reviews of the Energy Group encompassed the Divisions and the Flagships within the Energy Group. These reviews resulted in significant restructuring of the Energy Group and also provided different opinions on the operation of the matrix-based management model within CSIRO.

6.33 There have also been a number of internal audits which have reviewed the operation of CSIRO in a range of areas and made a number of findings. These audits have encompassed the Science Investment Process, Portfolio Performance Framework, Flagship governance, the operation of the matrix-based management model, and performance management.

6.34 A critical factor determining the success of the Flagship Program is stakeholder engagement and support through the Flagship Advisory Committee. The benefits of these are demonstrated in Chapter 3, particularly with respect to the Water for a Healthy Country Flagship.

6.35 The reviews, audits and stakeholder consultation arrangements have contributed to continuous improvements in the way CSIRO undertakes its functions and interacts with stakeholders. However, there is a risk that if appropriate arrangements for consolidating and considering the issues identified though these activities are not in place, that broader insight into mechanisms to improve the operation of CSIRO and stakeholder interaction may not be identified as they emerge. Examples where this was evident included the interaction between the Divisions and the Flagships within CSIRO, the operation of the matrix-based management model, the positioning

¹⁰² Productivity Commission, *Public Support for Science and Innovation*, Productivity Commission, March 2007, pp. 465-466.

of research to align with external demand, and performance reporting arrangements.

Recommendation No.2

6.36 To inform the ongoing management and administration of the Flagship Program, the ANAO recommends that CSIRO implement arrangements to better capture and consolidate the findings of internal and external reviews, internal audits and stakeholder input.

Agency response

6.37 Agreed.



Ian McPhee
Auditor-General

Canberra ACT
8 June 2011

Appendices

Appendix 1: Detailed Agency Response

CSIRO welcomes the ANAO report and accepts its key findings and recommendations. CSIRO is very pleased that the ANAO has reflected positively on:

- Our approach to continually improve the management of the program as Flagships have evolved over time, and that this approach has provided a sound structural framework for administering Flagship research;
- Our responsiveness and pro-activity around regularly reviewing the program and taking account of stakeholder input;
- Recognising that Flagships are delivering benefits and having impact; and,
- The general strategy for growing the Flagship program, particularly around interdisciplinary complex research domains. This is very well aligned with strategic objectives for the CSIRO National Research Flagship program over the 2011-15 strategy period.

CSIRO recognises the need to further improve its practices in the areas identified in the report, including:

- More rigorous public financial reporting (aligning financial budget, forecasting and reporting processes through the PBS, Operational Plans and Annual Reports);
- Improving ways for capturing and consolidating learning from reviews and stakeholder input; and,
- Improving our systematic impact planning assessment and evaluation, and associated governance mechanisms for assuring our return on investment to the nation in terms of our planned research impacts.

The agency is already undertaking a number of initiatives and investments in this regard. In relation to the ANAO recommendations, both are accepted and response plans will be developed to address each of the issues identified. The CSIRO Flagship Oversight Committee will provide oversight of the agency responses to assure the CSIRO Board and Executive Team that improvement plans are effective, timely and efficient:

- Recommendation 1 - Agreed.
- Recommendation 2 - Agreed.

Appendix 2: Case studies on impact included in the CSIRO Annual Report 2009–10

Case Study	Impact	Issue
Climate Adaptation Flagship	High-value from reduced costs of dealing with climate pressures, and increased insurance against limited international mitigation response. Conservative value of \$2 billion plus.	<p>The \$2 billion dollar figure represents the estimated Net Present Value (July 2010) of research over the period 2010 to 2030. The figure is based on estimated Gross Domestic Product foregone as a result of climate change over the period 2010 to 2100, and the expectation that adaptation might reduce those losses by half. The \$2 billion Net Present Value is based on an estimate of the Climate Adaptation Flagship's contribution to any reduction to this loss. The report suggests that the assumptions used to arrive at this figure is conservative and take into account the fact that the Flagship has only been operating a short period of time. The report provides a series of examples, one of which relates to the application of research surrounding fire truck safety that appears to be research that occurred prior to when the Flagship was established.</p>

Case Study	Impact	Issue
<p>Biochar - Sustainable Agriculture Flagship</p>	<p>CSIRO adding to a field now receiving substantial attention. Plausible role for biochar¹⁰³ as a substantial contributor to lower cost abatement, given its complementarity with several aspects of farm production and with steel production, with potential value of many billions of dollars under a carbon target policy.</p>	<p>A February 2009 CSIRO report titled <i>Biochar, climate change and soil: A review to guide future research</i> identified a range of research gaps and challenges. The July 2010 economic consultant's report outlined that biochar has received considerable attention in the recent greenhouse gas policy debates and suggested that views about biochar's potential contribution to national greenhouse gas mitigation and adaptation strategies are polarised, ranging from 'silver bullet' to minor contributor status. The report indicated that CSIRO work in biochar was not explicitly valued, but that there was potential for very high value if the work leads to acceptance of certain applications of biochar for purposes of carbon accounting under international protocols. The economic consultant's report suggested a potential value of biochar of many billions of dollars under a carbon target policy, but this figure was not specific to CSIRO research and the report indicated a number of uncertainties surrounding valuing the biochar within this context. In March 2011 the <i>Garnaut Climate Change Review Update – Transforming Rural Land Use</i> commented that further research was required to determine potential benefits and other potentially adverse impacts of biochar.¹⁰⁴</p>

103

Biochar is a fine-grained and porous substance similar in appearance to charcoal. Biochar is produced by the combustion of biomass under oxygen-limited conditions. Modern industrial bioenergy systems involve pyrolysis and gasification, the heating of a biomass feedstock under controlled conditions to produce combustible synthesis gas ('syngas'), and oil ('bio-oil') that can be burnt to produce heat, power, or combined heat and power. Biochar, the third combustible product produced in pyrolysis, is the solid charred and carbon-rich residue. Biochar may be an efficient way of sequestering carbon in soils used for some types of agricultural production.

104

Garnaut Climate Change Review Update – Transforming Rural Land Use, (March 2011), p. 30.

Case Study

Impact

Issue

Commercialisation in place for automotive and stationary applications will support returns to CSIRO, with plausible revenue streams valued at tens of millions of dollars. More speculative, but potentially very high-value, via accelerated moves to lower emission vehicles and more effective use of renewables.

In 2005 CSIRO entered into an UltraBattery commercialisation and distribution agreement with the Furukawa Battery Company. In 2007 CSIRO created a spin out company Ecoult Pty Ltd to develop and commercialise stationary battery-based storage solutions, which was acquired in May 2010 by East Penn. This followed an August 2009 announcement that East Penn would receive a \$32.5 million grant from the US Government to expand its production capacities to test and manufacture the UltraBattery for hybrid automotive applications. The July 2010 economic consultant's report indicated uncertainty surrounding the rate at which hybrid vehicles will gain market share, and the market penetration of the UltraBattery, which impacted on its capacity to estimate revenue from the UltraBattery. Additionally, the consultant was not provided with commercial information surrounding the battery licence payments, royalty arrangements and market projections. The report also considered the application of the UltraBattery to stationary energy, including wind generation. The report indicated that the greatest uncertainty of the scale of demand for the UltraBattery technology in stationary applications, was the extent to which technical grid stability issues are a key constraint on wind growth, and the extent to which the technology will achieve market share in conjunction with this roll-out and/or allow a more rapid rate of deployment of wind generation.

The UltraBattery - Energy Transformed Flagship¹⁰⁵

¹⁰⁵ The UltraBattery improves the performance of traditional lead-acid batteries by combining the low-cost and durability of this technology with a supercapacitor. Supercapacitors can store more charge than conventional capacitors but share a capacitor's ability to release that energy very quickly. This means they are useful for short term, high-energy applications such as when an appliance is switched on or an electric car accelerates. Supercapacitors allow manufacturers to use smaller, lighter and cheaper batteries to achieve the required level of performance, avoiding the need to fit oversize batteries to cope with sudden surges in power.

Case Study	Impact	Issue
<p>Murray-Darling Basin Sustainable Yields Project - Water for a Healthy Country Flagship</p>	<p>Conservative estimate of \$2.8 billion linked to more efficient deployment of the investment of funds already committed to buyback and water infrastructure efficiencies.</p>	<p>The 2006 report prepared by the economic consultant estimated the value of this research at \$700 million. The 2010 report acknowledged that it did not take into account the new policy platform that emerged with the change of government, or the scale of early commitment of Government funds. The report outlined that based on highly stylized assumptions, and corresponding modelling of Basin values over 30 years, the return on the investment in building this capability would be of the order of \$2.8 billion in present value terms. The report indicated doubt that this is a fair indicator of overall value, and that it was plausible that the figure could be substantially more through avoidance of major planning errors. As noted in paragraphs 5.14 to 5.17 one of the difficulties in determining impact of research is associated with external stakeholders not measuring the impact of policy or investment decisions that they have made. In October 2010 CSIRO was asked at Senate Estimates what role it had in the development of the sustainable diversion limits and the publication of the guide to the Murray-Darling plan. CSIRO advised that it had no role in this area, and that its role in the development of the basin plan was to provide scientific advice to the Murray-Darling Basin Authority, and the Authority had obviously taken that on board with a range of inputs to formulate the plan. This indicates that to determine the impact of CSIRO research, it is not only the impact of policy or investment decisions made by the stakeholder that need to be measured, but also the extent that CSIRO research was relied upon in making these decisions.</p>

Source: ANAO analysis of CSIRO documentation.

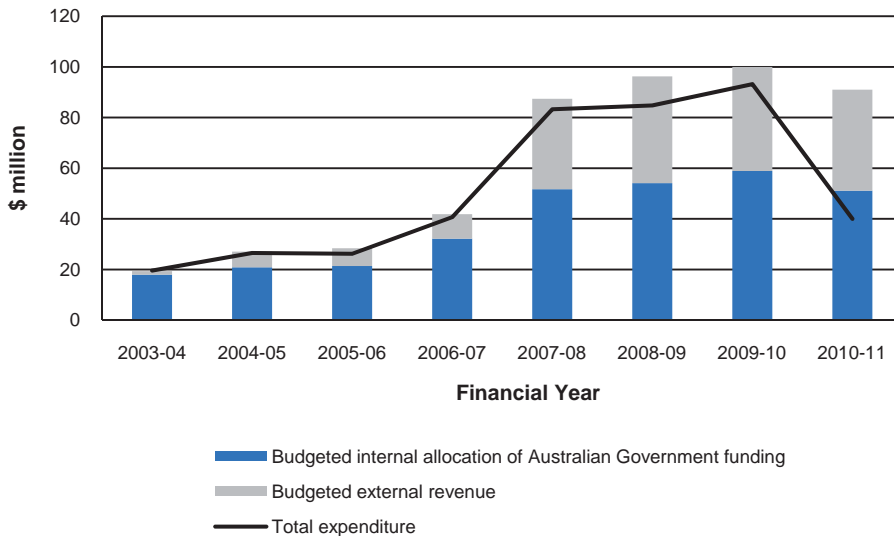
Appendix 3: Funding and expenditure of the selected Flagships

Funding and expenditure of the Water for a Healthy Country Flagship

1. Since its inception in 2003–04, total expenditure on the Water for a Healthy Country Flagship has been \$414.2 million. Of the 10 Flagships, the Water for a Healthy Country Flagship receives the greatest amount of funding, with a budget of \$91.1 million in 2010–11. A comparison of expenditure to budget forecasts is set out in Figure A 1.

Figure A 1

Actual expenditure against budget of the Water for Healthy Country Flagship (as at December 2010)



Source: CSIRO data provided to the ANAO on 23 November 2010 and on 7 February 2011.

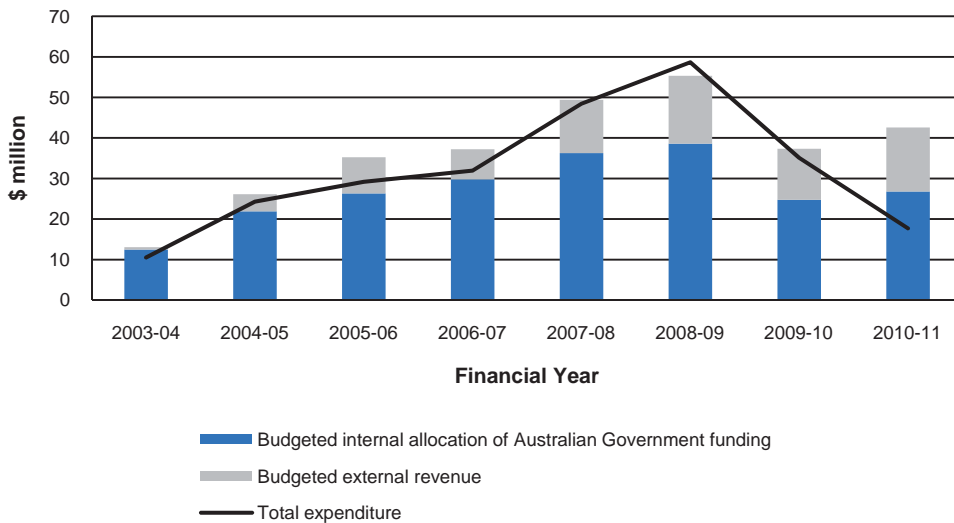
2. Expenditure on the Water for a Healthy Country Flagship aligned with budget until 2007–08, after which total expenditure was less than the budget of the Flagship. The tripling of the external revenue of the Flagship in 2007–08 relates to several large projects which are set out in Table 3.4. In 2009–10, the Water for a Healthy Flagship was the Flagship that generated the highest amount of external revenue.

Funding and expenditure of the Energy Transformed Flagship

3. Since its inception in 2003–04, total expenditure on the Energy Transformed Flagship has been \$255.8 million. A comparison of expenditure to budget forecasts is set out in Figure A 2.

Figure A 2

Budget and expenditure Energy Transformed Flagship (as at December 2010)



Source: CSIRO data provided to the ANAO on 23 November 2010 and on 7 February 2011.

4. The actual expenditure of the Energy Transformed Flagship has generally remained under budget. CSIRO attributes this to a range of factors:
- initial targets for external revenue being stretch targets, and as such there was an inherent risk that these targets may not be met;
 - limited demand for research in this area in the formative years of this Flagship;
 - refocusing of the activities of the Flagship in 2007–08; and
 - inadequacies in business development processes impacting on the capacity to reliably project external revenue earnings until 2009.

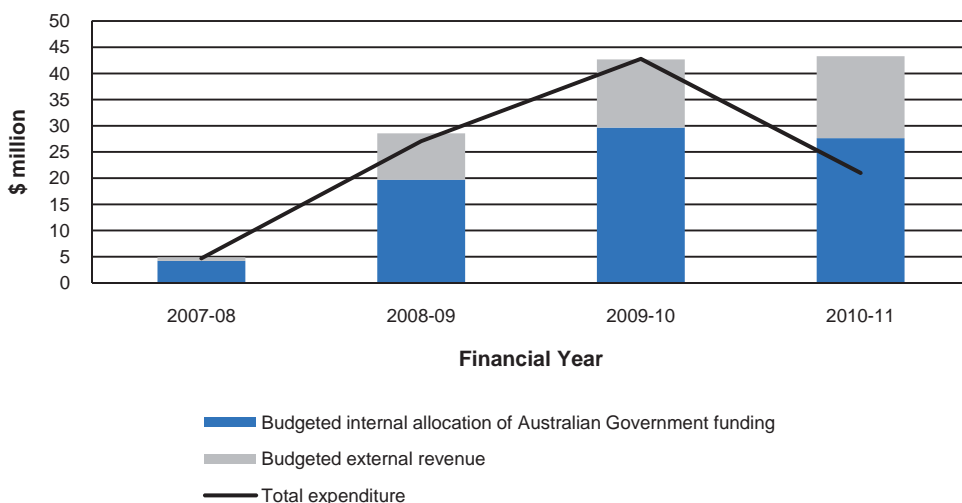
- The decline in external revenue from 2008–09 to 2009–10 corresponds with a restructure of the Flagship that resulted in a number of activities being moved to newly created portfolios within the Energy Group.¹⁰⁶

Funding and expenditure of the Climate Adaptation Flagship

- Since its inception in 2007–08, total expenditure on the Climate Adaptation Flagship has been \$95.5 million. A comparison of expenditure to budget forecasts is set out in Figure A 3.

Figure A 3

Actual expenditure against budget of the Climate Adaptation Flagship (as at December 2010)



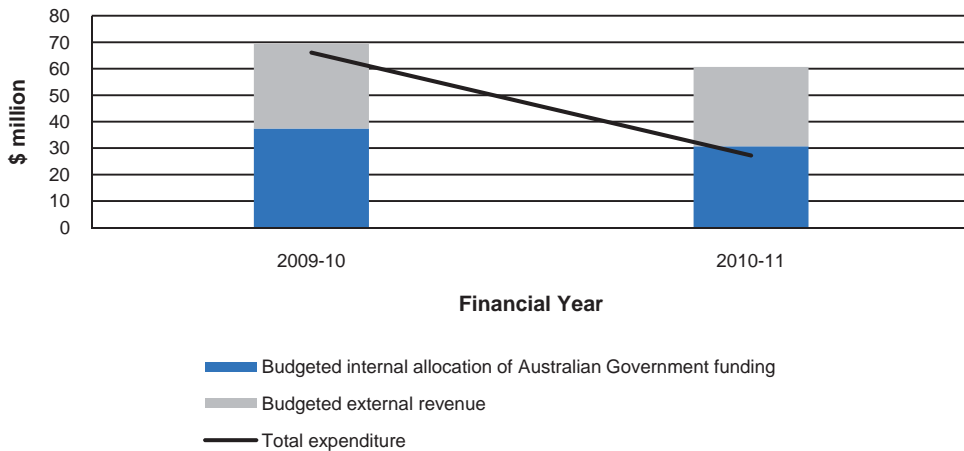
Source: CSIRO data provided to the ANAO on 23 November 2010 and on 7 February 2011.

- Expenditure on the Climate Adaptation Flagship has aligned with budget. Over the last two years, the level of external revenue generated has exceeded budget.

Funding and expenditure of the Sustainable Agriculture Flagship

- Since its inception in 2009–10, total expenditure on the Sustainable Agriculture Flagship has been \$93.3 million. A comparison of expenditure to budget forecasts is set out in Figure A 4.

¹⁰⁶ This restructure is discussed in Chapter 3.

Figure A 4**Actual expenditure against budget of the Sustainable Agriculture Flagship (as at December 2010)**

Source: CSIRO data provided to the ANAO on 23 November 2010 and 22 February 2011.

9. The Sustainable Agriculture Flagship did not generate the targeted external revenue in its first year of operation. Despite this shortfall, the Sustainable Agriculture Flagship generated \$29.9 million of external revenue in 2009–10. This makes this Flagship the second highest contributor to external revenue earnings of all Flagships during that year. In 2009–10, expenditure on the Sustainable Agriculture Flagship was slightly under budget, which is attributable to the shortfall in external revenue.

Index

A

Annual Performance Goals (APGs), 19, 25, 46, 96, 99–102

C

Climate Adaptation Flagship, 22, 50, 59–60, 68, 70–71, 73, 83, 120, 126

E

Energy Transformed Flagship, 22–23, 26, 36, 46, 59–61, 65–67, 69, 73, 83, 89, 97–98, 102, 107, 122, 125

External revenue, 14, 17, 23–24, 36, 73–77, 81, 82, 88, 124–127

F

Flagship Collaboration Fund, 15, 36–37, 44, 49, 70, 73, 83–86, 89, 109–112

Flagship goals, 15, 18, 23–25, 36, 52, 60, 83, 95–96

Flagship Oversight Committee, 20–22, 31, 52, 53, 58, 67, 110, 119

Funding, 13–17, 19, 22–23, 32–33, 35–38, 41–42, 44, 49, 58–59, 64, 68–69, 71–79, 83–86, 106, 108, 110, 112–113, 124–126

I

Impact, 14, 18, 20, 24–25, 33, 35, 39, 41, 45, 47–50, 54, 57, 59–60, 71, 77, 87, 89–96, 98, 100–103, 107–110, 114, 119–120, 123

K

Key Performance Indicators (KPIs), 19, 25, 87–89, 93

L

Lapsing Program Review, 19, 25, 32, 82, 91, 93, 102, 104, 108–112, 114

M

matrix-based management model, 16, 18, 21–22, 45, 55–58, 101, 114

P

Portfolio Performance Framework, 16, 21, 23–24, 45–48, 53–54, 61, 78, 87, 95, 110, 114

S

Science Investment Process, 16, 21–22, 26, 45, 47–52, 59, 61–63, 66, 68, 70–71, 73, 80, 103–104, 114

W

Water for a Healthy Country Flagship, 22, 59, 60–65, 71, 91–93, 97, 107–108, 114, 123–124

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