

The Auditor-General
Audit Report No.51 2001–2002
Performance Audit

Research Project Management

**Commonwealth Scientific and Industrial
Research Organisation (CSIRO)**

Australian National Audit Office

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of Australia 2002

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Canberra ACT
23 May 2002

Dear Madam President
Dear Mr Speaker

The Australian National Audit Office has undertaken a performance audit in the Commonwealth Scientific and Industrial Research Organisation in accordance with the authority contained in the *Auditor-General Act 1997*. I present this report of this audit, and the accompanying brochure, to the Parliament. The report is titled *Research Project Management*.

Following its tabling in Parliament, 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 'P. J. Barrett'.

P. J. Barrett
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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Abbreviations/Glossary

Commercial Practices Manual	Manual
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CVS	Customer Value Survey
Division	CSIRO's semi-autonomous operating and business units for research and commercial matters. Each has its own special set of skills and capabilities.
IP	Intellectual Property
PLP	Project Leaders Program
PSS	Project Support System
Sector Advisory Committees	Sector Advisory Committees advise on strategic directions for research and development for industry Sectors.
UNIBIS	CSIRO's main financial ledger and accounting system.

Summary and Recommendations

Summary

The Commonwealth Scientific and Industrial Research Organisation

1. CSIRO is a large national research organisation employing over 6500 staff organised in 21 divisions across 66 sites in Australia. Its primary functions are to carry out scientific research to assist Australian industry and to further the interests of the Australian community; to contribute to national and international objectives and responsibilities of the Commonwealth Government; and encourage or facilitate the application and use of the results of its own or any other scientific research.
2. In 2000–2001 CSIRO spent around \$700 million on its research and development activities. Its funding comes mainly from Commonwealth budget appropriation funds—around 67 per cent in 2000–2001. The remaining funding is revenue from external parties.
3. CSIRO plans and resources research on the basis of 22 industry ‘Sectors’. There is a Sector Advisory Committee for each Sector comprising stakeholders, customers and other experts which, inter alia, develop Sector priorities and three-year plans for research.

Managing research projects

4. CSIRO estimates that it manages around 3000 research projects each year.¹ These projects are intended to provide:
 - benefit to Australia’s industry and economy;
 - environmental benefit to Australians;
 - social benefits to Australians; and
 - support Australia’s national and international objectives through excellence in science and technology and in the provision of advice and services.

¹ CSIRO’s management information systems do not allow a reliable count of the number of research projects currently under-way. CSIRO also carries out routine tests and analyses for clients on a fee-for-service basis as well as monitoring and investigation of new scientific opportunities and issues, and engaging in educational activities.

5. There are three main types of projects:
- appropriation projects, which are funded solely from appropriation sources, have no external client and for which intellectual property (IP) is held fully by CSIRO;
 - co-investment projects, funded by a mix of appropriation and external revenues, and IP is usually shared; and
 - consulting projects, which are intended to be fully funded by external clients and where IP is usually held by the client.
6. These projects vary widely in size, duration and topic. Most are small (costing less than \$20 000 per year) but the three hundred largest projects account for half of all expenditure. Around half the projects are applied research; just 4 per cent represent pure basic research.²

The audit

7. The objective of this audit was to assess the effectiveness of CSIRO in administering research projects to deliver required results. In particular, the audit examined:
- structures for project management in CSIRO;
 - the alignment of projects with strategic objectives;
 - the adequacy of project planning;
 - the monitoring and reviewing of project performance; and
 - CSIRO's approach to assessing project outcomes.
8. The audit focused on research activities that were either formally designated as projects, or were managed in a similar way, and on relevant supporting administrative and information systems.³ The audit did not assess the quality of scientific analysis or outcomes, although it did address CSIRO's assessment of, inter alia, project outcomes.

² Applied research generally has a particular application in view, pure basic research is focused mainly on the advancement of knowledge, without looking for long-term benefits. These and other categories are discussed further at Appendix 1.

³ Some research activities (such as ongoing monitoring of overseas literature) are not appropriate to be defined as projects. The scale of these activities cannot be quantified from CSIRO systems.

9. The ANAO was assisted in the audit by the technical advice of project management experts. The audit criteria also drew on competencies of project management developed by the Australian Institute of Project Management, adapted to recognise the particular needs and context for management of scientific research projects. The audit methodology included analysis of project management practices in five CSIRO divisions and reviews of a sample of 76 research projects from these divisions. The choice of divisions and projects was agreed with CSIRO. In aggregate, the five divisions broadly reflected the overall distribution of projects in CSIRO.

Strategic reforms in CSIRO

10. During the course of the audit CSIRO was engaged in a process of organisational review and change. In mid-2001 CSIRO issued a *Strategic Action Plan: A new CSIRO for a New Century* addressing issues such as: organisational structures, performance measurement and project management. In particular CSIRO undertook a review of project management during conduct of the audit. The ANAO communicated its preliminary findings to the internal review team at an early stage to inform the review's proposed actions.

Audit conclusion

11. CSIRO has an international reputation for scientific excellence, with external reviews indicating it delivers positive returns to the Australian community. It has wide experience in managing research projects. However, further strengthening of several aspects of project management arrangements is required in order to provide appropriate assurance that research projects, which are funded by substantial Commonwealth and private sector investment, are conducted in a cost-effective manner. This is particularly the case for research activities funded by appropriation moneys.

12. CSIRO's framework for project management has been upgraded in recent years and is supported by related corporate policies and divisional practices. However, there are insufficient corporate standards and guidance on project management; and some existing policies are not well implemented. The impacts of these weaknesses are most notable for appropriation-funded projects but also affect the quality and consistency of project management for co-investment and consulting projects. A [more structured, corporate approach to project management](#) would provide greater assurance that sound practices are being appropriately applied, reducing the likelihood that a small low-risk task is excessively managed, or that a large, high-risk task is managed with insufficient rigour. In this context, CSIRO has recently commenced a major initiative to improve project management in the organisation and which addresses these issues.

13. CSIRO places strong emphasis on [aligning its research portfolio](#) with industry-based Sector priorities, with supporting processes to properly allocate funds to programs, sub-programs and projects. The prioritisation of individual projects was supported by systematic criteria in some areas of CSIRO, but not in others. As well, the extent of supporting documentation varied across divisions. Addressing all these matters systematically would increase assurance that the optimal portfolio of projects is chosen.

14. [Project planning](#) in CSIRO has improved in recent years, particularly for co-investment and consulting projects, where external accountabilities create pressure for good planning. All such projects examined by the ANAO met corporate requirements for documented project plans/proposals, including a project budget. However, there are no similar requirements for appropriation projects; only a third of such projects included a plan and only half had a budget. Other areas that require strengthening to support planning for cost-effective research delivery include: the omission from project budgets of corporate overheads; diversity of practice in pricing projects; and the absence of structured, project level, risk assessments.

15. There are a range of processes to regularly [monitor and review project progress](#). These processes have a particular focus on maintaining scientific quality, and are robust in this regard. However, processes to monitor changes to project scope and risks were not well documented and less systematic and transparent, particularly for appropriation projects. Furthermore, CSIRO's ability to monitor and review project costs and timeliness was significantly reduced by inadequate or inconsistent data in key management information systems. CSIRO is considering relevant enhancements to policy and systems which, if implemented well, should markedly improve its corporate governance in these areas.

16. CSIRO employs a range of means to [assess project outcomes](#). In particular, it regularly assesses its scientific performance through international scientific literature, benchmarking publications and other initiatives, and assesses customer satisfaction. These assessments indicate that CSIRO ranks highly for the quality of its scientific research and that some projects deliver substantial returns to the community. Stakeholders also consider CSIRO delivers high quality scientific advice.

17. CSIRO has a policy of undertaking [systematic post project review](#), with a focus on the more 'significant' projects. However, this policy is not widely implemented, thus reducing CSIRO's ability to assess outcomes of individual projects and to identify lessons for management improvement.

18. Limitations in the conduct of project completion reviews and management information meant that the ANAO could only draw on limited data on cost and timeliness results. These data, whilst being subject to a number of caveats,

suggest costs are exceeding contracted revenue for many projects. Occasionally, appropriation funds have been used to fund overspends in consulting or co-investment projects. As well, project milestones are often met later than planned. A more systematic collection and analysis of such data would provide greater insight into these important aspects of project performance.

Recommendations and CSIRO response

19. The ANAO made nine recommendations aimed at strengthening CSIRO's corporate approach to project management, including: project planning, costing and risk assessment; monitoring of project progress; and appropriate review on completion.

20. CSIRO agreed with all recommendations in this report and their response, in summary, was as follows:

CSIRO generally accepts and agrees with the findings and recommendations of the audit. They are consistent with the conclusions of a prior internal review utilising an international consultant conducted by CSIRO in late 2001 and identified as a need in the early part of 2001 in CSIRO's *Strategic Action Plan*.

CSIRO recognises that continued growth towards a global scientific enterprise is dependent on a number of factors which we are addressing via the implementation of a *Strategic Action Plan*. One of the nine strategic priorities is 'operating excellence', and CSIRO has launched a number of strategic initiatives in support of operating excellence. These include:

- a new strategic investment process to improve the process for choosing the right things to do;
- introduction of a CSIRO Business Development Plan, that focuses on a global business strategy, key account management process, pricing strategy, partnership strategy, and value proposition/analysis;
- promulgation of the *Managing by Project Policy and Guidelines*, which includes distribution of corporate and divisional overheads in project costing;
- establishment of the *Project Management Improvement Project*, which includes: the development and introduction of project management policies, corporate guidelines and systems/tools across CSIRO; implementation of effort logging by July 2002; elimination of subsidies from Research Services and Consulting projects and implementation of a Value Based Pricing model; and
- bringing a One-CSIRO approach to support systems across the Organisation.

Effective project management is the key to increasing our capability to deliver creative science and innovative solutions in a timely way. We are committed to project management improvement in this context, recognising that scientific research is a very different activity from, say, delivering a large engineering project. We further recognise that well-managed projects use funds effectively, build customer confidence, and lead to further projects that contribute to our business growth.

Key Findings

Structures for Project Management in CSIRO (Chapter 2)

21. CSIRO faces a complex task in managing a diverse portfolio of research projects. With such diversity, a systematic and structured approach to project management makes it more likely that project management approaches, risk management and overall effort are appropriate to the task to be managed. It also assists managers in determining the appropriate project management approaches for tasks and provides assurance to CSIRO that minimum standards are being met.

Guidance and standards

22. CSIRO does not have a project management manual or guidance, nor clearly articulated standards of project management practice. Various CSIRO policies do, however, address some aspects of project management, particularly for co-investment and consulting projects.

23. The most relevant document for these projects is the Commercial Practices Manual, which is a statement of CSIRO policies on its commercial operations. The Manual, however, is not intended by CSIRO to be a project management guide. Furthermore, some of the policy is at a very broad level, limiting its contribution to the practice of project management.

24. There is no corporate guidance on the management of appropriation projects, notwithstanding their importance in CSIRO's research portfolio. Reflecting this, the ANAO found that these projects tended to lack important elements of structured project management. They were less likely than other types of projects to have project plans, be fully budgeted, have a risk assessment conducted, be effectively monitored, or be subject to a project completion review.

25. CSIRO would benefit from guidance and articulated standards on project management. Particular areas that warrant attention are:

Definition of project	Develop definition(s) to address full range of project types.
Alignment of projects with strategic priorities	Build on better practice in some divisions to apply consistent criteria in selecting projects.
Costing	Establish costing policy for appropriation projects.
Project risk assessment and management	Extend current corporate risk management framework to project-level.
Project monitoring	Develop guidance and supporting procedures for monitoring of project scope, costs, timeliness and risks.
Project outcomes evaluation	Build on current policy on commercial projects to address appropriation projects and develop minimum procedures to implement policy.

26. CSIRO has recognised the need to upgrade its approach to project management, and in late 2001 established a *Project Management Improvement Project*. The aim of the Initiative is to establish minimum standards for project management, based on a risk management approach and it is expected to deliver new standards and other tools progressively during 2002.

Project identification

27. CSIRO has a corporate definition of a project; however, the ANAO found divisions used widely varying approaches to categorising, recording and creating projects. This variation in practices has several consequences. It leads to inconsistency in project management, as activities that may be managed as a project in one division, or work area, would be managed quite differently in another. It also reduces the quality of information recorded on management information systems; this in turn weakens the ability of these systems to support higher level project management and governance.

Project management skills

28. CSIRO recognises the importance of developing staff skills in project management, and its major training program for project leaders addresses project management. The ANAO found that this training provides a sound overview of project management techniques. However, attendance is not mandatory. In practice attendance varied widely between divisions, limiting the program's effectiveness in supporting a consistent approach to project management.

Supporting management information

29. CSIRO manages many thousands of projects. It requires sound management information to manage them effectively and support appropriate accountability. CSIRO has developed a Project Support System (PSS) to meet this need. PSS initially had a financial management focus, but has been developed to capture some core project and activity information, including finance and staff allocation details.

30. PSS's effectiveness as a reporting and monitoring tool is, however, markedly reduced by different approaches to both defining projects (see paragraph 27) and to recording projects. In addition, the PSS includes many activities as 'projects' that are ongoing activities and not research projects in the sense envisaged by the available guidance. The impact of these limitations in business rules and resulting practices on the reliability of management information is reflected in PSS indicating over 6000 projects currently underway; however CSIRO considers that there are actually some 3000 to 4000 projects currently.

31. CSIRO acknowledges that the definition of a project in PSS is not clear and that this undermines the reliability of the data. It is undertaking a review to clarify the different types of activities that should be recorded in PSS.

32. The ANAO found that the effectiveness of PSS in supporting review and decision-making is also reduced by some fields being optional. These include important elements of project management information such as effort logging, milestones and risks. In addition, data entered into some mandatory fields was of poor quality. For example, the project budget field sometimes contained only a temporary or estimated budget, which was not updated after the project commenced.

Alignment of Projects with Strategic Priorities (Chapter 3)

33. CSIRO plans and resources research on an industry Sector basis. Every three years CSIRO undertakes a major priority-setting process to guide its research investments in each Sector for the following triennium. The aim is to identify the mix of research areas that offers the highest return (in financial or public good terms) on CSIRO's funds; these priorities are expressed in Sector Plans which are implemented by relevant divisions through the choice of individual research projects consistent with these Plans.

34. CSIRO divisions reviewed in this audit devote substantial effort to aligning projects with Sector Plans. They do this by firstly allocating funds for the coming

triennium to broad areas of research (referred to as programs) in line with Sector priorities, and then identifying projects to undertake within each program. These processes vary in their formality and quality of documentation. In some divisions the processes for identifying projects are structured and systematic using explicit criteria. However, other divisions, or parts of divisions, use a less structured process, involving discussions between the program manager and more junior staff managers. This gives less assurance than the clearer, criteria-based ranking processes used elsewhere in CSIRO that the optimal portfolio of projects is chosen.

35. Senior managers responsible for programs demonstrated appropriate awareness of the role and importance of Sector Plans. However, other managers involved in selecting projects were less consistent in their knowledge and use of Sector Plans in guiding the development and approval of projects.

Reference to Sector Plans in project documentation

36. The Commercial Practices Manual requires that the project plan for co-investment and consulting projects ‘must be in line with the Sector Plan’ (see paragraph 13); and the ANAO found that all projects, including appropriation projects, are coded to a particular Sector as this is a mandatory requirement in the PSS. The Manual includes a pro-forma research plan as a guide which includes addressing the project’s links to Sector Plans. In practice only around 25 per cent of the project plans or approval documentation reviewed by the ANAO mentioned the Sector or Sector Plan relevant to the project. Of these, less than half specifically identified how the project contributed to implementing the relevant Sector Plan. However, most indicated that a link existed, but did not specify what this was.

37. Appropriation projects, which are not guided by the Commercial Practices Manual, have even less documented evidence in project plans or approvals of the alignment of such projects to Sector Plans.

Project Planning (Chapter 4)

Use of project plans

38. CSIRO policy articulates the need for project plans for co-investment and consulting projects. The key planning document is the project proposal submitted to a partner or client. All co-investment and consulting projects examined by the ANAO had a proposal which contained the information required by the Manual. They generally had clear objectives and deliverables, and set out the origin and rationale of the project. They also identified project staffing, liaison

arrangements and accountabilities, whole-of-life budgets and milestones (where these milestones were linked to payments).

39. However, less than one in five projects had plans that addressed critical paths, intermediate milestones and contained a full identification of risks to CSIRO.

40. During the course of the audit there were some initiatives to improve the capacity and quality of project plans. For example, two divisions examined are implementing an enhanced project plan pro-forma for new projects, to assist internal decision-making and project management

41. CSIRO policy also requires that co-investment and consulting projects have plans for commercialisation of project findings or for further application of findings in research if the findings are not immediately able to be commercialised. However, the ANAO found that only three of the five divisions examined consistently implemented this policy.

42. CSIRO does not have a corporate requirement for appropriation projects to have a plan. As a result, the use of project plans for appropriation projects was less frequent than for co-investment and consulting projects. Only some 30 per cent of appropriation projects in the ANAO sample had a documented project plan.

Project costing

43. CSIRO has introduced several initiatives to improve project costing. These include the introduction of the Project Support System (PSS) in 1997 and setting out some policies for costing co-investment and consulting projects in the Commercial Practices Manual (in particular this requires that the full costs of such projects are identified).

44. The ANAO found that all of the divisions audited had procedures for costing co-investment and consulting projects, consistent with this requirement, including the use of standardised costing templates. All the co-investment and consulting projects examined by the ANAO had a whole of life budget.

45. There is no policy on costing appropriation projects, despite these projects accounting for 30 per cent of research expenditure. Accordingly, only around half of appropriation projects in the ANAO sample had a project cost budget.

46. CSIRO policy also requires that indirect overheads (such as information technology services) be included in project cost budgets. However, the ANAO found that these overheads (which amounted to over \$45 million in 2000–2001) are not presently passed to the divisions; instead they are funded directly out of appropriation allocations by CSIRO corporate headquarters. This practice

amounts to an additional contribution, or unplanned subsidy, to co-investment and consulting projects. CSIRO has acknowledged that this practice should be examined, and in 2002 agreed to the recommendation of an internal working group that a review of the treatment of corporate overheads be performed.

Project pricing

47. CSIRO's pricing policy requires the price of consulting projects to cover the estimated full costs.⁴ At the time of audit fieldwork the pricing policy was very broad and divisions implemented the policy in different ways (for example, some used a percentage mark up on costs and others a multiple of salaries). In addition, as corporate overheads are not allocated to research projects consulting projects are effectively under priced to the extent to which corporate overheads are absent from costings.

48. For co-investment projects divisions negotiate the price (or CSIRO contribution) on a case by case basis depending, on for example, the extent to which CSIRO retains IP in the project. There were no clear guidelines to assist in this process, leading to diversity of pricing practices.

49. In recognition of the risks from diverse practices in pricing projects, CSIRO is implementing, and training staff in, a new approach of 'value based' pricing. This approach aligns the pricing policy with CSIRO's investment model (described at paragraph 1.11) and seeks to address the pricing issues identified in this report.⁵

Project risk planning

50. CSIRO has a standard risk assessment methodology which seeks to identify all risks to the organisation. This includes a corporate risk management policy and manual, complemented by training.

51. Project risk assessments are primarily the responsibility of project leaders, who are expected to apply the corporate framework to their project. CSIRO policy considers that risk assessment is a key part of research project management and should address both *contractual* risks (such as the nature of the client or legal risks) and *project* risks (such as the nature of the project or techniques used).

⁴ The estimated full costs must also include the commercial pre-tax rate of return and tax equivalent regime components. These on-cost factors are set corporately by CSIRO on industry benchmarks and approved by its Minister.

⁵ The Productivity Commission considered such an approach was appropriate for agencies where commercial operations were a major component of overall activity. See *Cost Recovery by Government Agencies* (Productivity Commission, 2001).

52. The ANAO found that the focus of risk assessments was mainly on contractual risks, where there is a requirement that they be conducted. However, some 15 per cent of relevant projects sampled did not have the required contract risk assessment.

53. The conduct of structured *project* risk assessments is not mandatory. As a result, while project risks were often identified and discussed amongst staff, none of the projects in the ANAO's sample had a project risk assessment consistent with that suggested by CSIRO policy.

Monitoring and Reviewing Project Performance (Chapter 5)

Approaches to monitoring projects

54. All divisions audited had arrangements for monitoring and reviewing project progress. These arrangements generally included regular meetings and various levels of review, culminating in reports to Sector Advisory Committees on implementation of Sector Plans. However, the effectiveness of these arrangements varied.

Monitoring scientific quality

55. The quality of CSIRO's scientific research is central to its effectiveness. All divisions had rigorous processes in place to maintain scientific quality. These typically included compulsory review of scientific reports and results by supervisors (and usually several other scientists). Internal quality assurance of scientific material produced by projects was a particular feature of project management practice. Some divisions also commissioned regular review of important programs by external scientists of international standing to ensure that its scientific resources are appropriate and consistent with world better practice.

Monitoring project scope

56. One of the major challenges in project management is to control scope change in projects and thus ensure that projects remain relevant to needs. CSIRO policy recognises this and CSIRO advised that project scope change is managed as part of the project review arrangements discussed above (see paragraph 54).

57. However, there is limited structure in the way in which these arrangements address project scope change, increasing the risk of inconsistencies in the rigour of scope change management and control and supporting management information. For example, while there was evidence of appropriate approval of

scope changes requiring contract variation, this was not the case for appropriation projects. In these instances inadequate documentation prevented the ANAO from establishing whether there had been appropriate approval of scope change and adequate consideration of the implications, consequences and reasons for the change. Overall, scope changes were poorly documented.

Monitoring project risks

58. CSIRO policy recognises the importance of reviewing risks, and project risks are considered as part of general divisional project review processes. However, since CSIRO research projects do not have individual project risk assessments (see paragraph 53) risk review is informal and unstructured. For example, none of the projects reviewed by the ANAO maintained an issues log, as recommended in project management training,⁶ nor was there was a structured process for reviewing, through the life of a project, the risks and mitigation strategies identified in the contract risk assessment.

59. CSIRO is developing a computer-based risk management system which, inter alia, will be able to support project risk monitoring and review.

Monitoring project costs

60. CSIRO has no policies or standards for the tracking of project costs. However, CSIRO staff are generally focused on the need to deliver results within available budgets. However, inadequate or inconsistent data in the Project Support System (PSS) affects the capacity of CSIRO to monitor individual project costs effectively. For example, the varying approaches to entering/defining projects into PSS weakens the system's ability to provide reliable project cost management information, particularly for appropriation projects.

61. The reliability of data on actual labour costs, a major component of project costs, also varies widely. One division requires staff to record the actual time staff spent on projects in PSS. This represents better practice within CSIRO. In contrast other divisions examined rarely reviewed or revised these costs. A consequence of these practices was that the staffing costs recorded in PSS are often not accurate after the first year of a project.

62. CSIRO's ability to monitor cost against budget for appropriation projects is also affected by the practice of some divisions not to record budgets for these projects on PSS. This limits CSIRO's ability to monitor, identify and assess for action cost overruns.

⁶ CSIRO project leader training recommends use of issues logs. The logs are designed to record issues that may affect the progress of a project and allow managers to track the status of the issues until they are resolved.

63. Notwithstanding the above difficulties, recording of costs was more comprehensive for consulting projects. The data available for these projects indicated that over a third of active projects had recorded costs which exceeded their contracted revenue.

64. The ANAO also found that, occasionally, appropriation funds had been used to cover over-runs in co-investment and consulting projects, rather than commercial reserves, a problem that CSIRO has itself identified.

Monitoring project timeliness

65. CSIRO does not have guidance or policies on the tracking of project progress. As a result, divisions vary in the means and extent to which timeliness data is collected and analysed for management review.

66. Three of the five divisions examined are, to varying extent, monitoring timeliness of the achievement of milestones for co-investment and consulting projects. Two divisions do not record milestone achievement in any divisional system. None of the five divisions had systems in place to monitor achievement of milestones in appropriation projects.

67. Limitations in reliability of data recorded on PSS means that there were insufficient data to draw general conclusions about the timeliness of CSIRO's research projects. However, data was extracted for two divisions, which showed a median delay on meeting milestones of 42 and 28 days respectively. This suggests that some projects are significantly delayed. A more systematic collection and analysis of such data would provide greater insight into the effectiveness of an important element of project management.

Assessing Project Outcomes (Chapter 6)

Methods for assessing project outcomes

68. The recent *Strategic Action Plan* stressed the importance of CSIRO's science base to its future strategies. Reflecting this, CSIRO regularly monitors its scientific performance, in terms of its contribution to scientific research and knowledge through international scientific literature benchmarking. CSIRO is also planning, as part of the implementation of the *Strategic Action Plan*, to conduct detailed assessment of its performance in scientific publications.

69. CSIRO's policy is to collect data on customer satisfaction. However, at the time of audit fieldwork customer satisfaction measurement was not consistently implemented, with two of the five divisions examined not collecting such information. Those that were conducting surveys did so in different ways, so that survey results were not comparable. CSIRO has since implemented a new

customer satisfaction instrument across CSIRO, known as the Customer Value Survey, to address these problems.

70. CSIRO also requires each division to develop an annual plan for the conduct of evaluation of completed projects and contracts (project completion reviews). Such reviews are a policy requirement. However, none of the divisions under review had such a plan. Reflecting this, such reviews were rarely conducted and tended to focus on scientific issues, reducing CSIRO's ability to assess outcomes of individual projects and to identify lessons for management improvement. CSIRO and relevant staff advised that this was due to competing resource demands and budgetary requirements to start the next project. There is no requirement for appropriation projects to undergo such a review, and none of the appropriation projects examined by the ANAO had been reviewed.

Project outcomes achieved

71. This audit did not directly assess the quality of scientific analysis by CSIRO or the scientific outcomes of its research projects. However, recent external reviews and benchmarking of CSIRO's scientific performance indicate that CSIRO ranks highly on international comparisons for the quality of its research. An independent review found that some projects deliver substantial returns to the community. Stakeholders also considered CSIRO provided high quality scientific advice.

72. The limitations in reliability of data on project costs discussed earlier greatly hampers CSIRO's ability to assess cost outcomes for finished projects. However, two (limited) analyses of cost outcomes were undertaken for this audit. The first indicated that just under half of a small sample of completed co-investment and consulting projects exceeded their planned costs, in some cases by over 50 per cent. A second analysis of completed consulting projects showed total revenue of \$17.5 million against costs of \$19.6 million for these projects.

73. These analyses, and CSIRO data which demonstrate that some of the costs of current consulting projects are covered by appropriation funds, suggests that the funding of consulting projects merits management attention. This has been recognised by CSIRO, which is intending to introduce a number of measures to reduce cross-subsidisation.

74. In the absence of project completion reviews or reliable quantitative data, there is limited information on timeliness outcomes. However, analysis of a small sample of projects analysed by the ANAO indicated that the majority were late (by between one and eight months). This suggests that project timeliness is also an issue meriting management attention, as has been identified in CSIRO's Customer Value Survey.

Recommendations

Set out below are the ANAO's recommendations with Report paragraph references and CSIRO's abbreviated responses. More detailed responses are shown in the body of the report. The ANAO considers that all recommendations warrant the same priority.

Recommendation

No. 1

Para. 2.32

Corporate project management approach

The ANAO recommends that CSIRO develop and implement a corporate approach to the management of research projects, including:

- business rules incorporating risk based standards and other guidance for the management of projects, including appropriation projects;
- consistent identification of activities that should be managed as research and development projects;
- ensuring key management information systems contain reliable data;
- ensuring relevant staff have project management skills; and
- arrangements to ensure compliance with corporate project management standards and guidance.

CSIRO response: Agreed.

Recommendation

No. 2

Para. 3.16

Project alignment

The ANAO recommends that, to reinforce the alignment of projects with strategic priorities, CSIRO employ explicit criteria in selecting projects and identify in project planning the contribution of the project to agreed industry Sector or divisional priorities.

CSIRO response: Agreed.

Recommendation

No. 3

Para. 4.13

Project implementation plans

The ANAO recommends that, in order to facilitate a more robust approach to project management, CSIRO develop guidance and supporting practices to ensure that projects have appropriate, documented and readily accessible implementation plans.

CSIRO response: Agreed.

Recommendation

No. 4

Para. 4.22

Project costing

The ANAO recommends that CSIRO enhance its costing policies to provide clear policy and guidance on:

- costing of appropriation projects; and
- the distribution of corporate overheads to research projects.

CSIRO response: Agreed.

Recommendation

No. 5

Para. 4.39

Project risk assessment and management

The ANAO recommends that project planning address project risk assessments and management to an agreed standard, including project delivery risks.

CSIRO response: Agreed.

Recommendation

No. 6

Para. 5.14

Scope change

The ANAO recommends that CSIRO articulate standards and procedures for approving, managing and documenting scope change for projects.

CSIRO response: Agreed.

Recommendation

No. 7

Para. 5.39

Cost monitoring and control

The ANAO recommends that CSIRO record on PSS budgets and the actual effort expended on projects, including for appropriation projects, and develop procedures on the monitoring and funding of project cost over-runs.

CSIRO response: Agreed.

Recommendation

No. 8

Para. 5.47

Milestones monitoring

The ANAO recommends that achievement of milestones is recorded in relevant information systems.

CSIRO response: Agreed.

Recommendation

No. 9

Para. 6.17

Project completion review

The ANAO recommends that, in order to maximise organisational learning from project management experience, CSIRO implement a systematic approach to project completion review that addresses the key aspects of project performance.

CSIRO response: Agreed.

Audit Findings and Conclusions

1. Introduction

This Chapter provides the context for the audit, and outlines relevant previous ANAO audits and the objective, scope and methodology of this audit, as well as the structure of the report.

Commonwealth Scientific and Industrial Research Organisation


1.1 The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a large national research organisation employing over 6500 scientific, technical and support staff across 66 sites in Australia. Its primary functions are to carry out scientific research to assist Australian industry and to further the interests of the Australian community; to contribute to national and international objectives and responsibilities of the Commonwealth Government; and encourage or facilitate the application and use of the results of its own or any other scientific research.

1.2 In 2000–2001 CSIRO spent around \$700 million on its research and development activities comprising \$450 million directly on research projects (such as salaries and equipment) and around \$250 million on activities supporting these projects (such as training, accommodation and other support services).

1.3 CSIRO plans and resources research on the basis of 22 industry ‘Sectors’ covering research in agribusiness industries; environment and natural resources; manufacturing, information and services industries; and minerals and energy industries. There is a Sector Advisory Committee for each Sector comprising stakeholders, customers and other experts. The Committees act as planning and consultation fora to foster an outward, client-oriented focus and guide CSIRO’s external relationships. Each Committee (supported by CSIRO staff) develops priorities and a three-year plan for research; monitors CSIRO’s environment; provide information about the strategic research needs of industry; and reviews progress in implementing plans. Once the Sector Plan is agreed by the CSIRO Board the relevant objectives are incorporated into each division’s Operational Plan. Collectively the Sector Plans constitute CSIRO’s Research Plan.

1.4 Research is performed by the 21 divisions of CSIRO. The divisional structure is based on scientific disciplines rather than Sectors, as this allows experts in particular areas (such as entomologists) to work together. The relationship of Sectors to divisions is set out in Figure 1.

Figure 1
CSIRO's Sector and divisional structure

CSIRO DIVISION - SECTOR MATRIX																					
	ALLIANCES and SECTORS																				
	Agribusiness					Environment & Natural Resources				Information, Manufacturing & Service Industries						Minerals & Energy Industries					
	Field Crops	Food Processing	Forestry, Wood & Paper Industries	Horticulture	Meat, Dairy & Aquaculture	Textiles, Clothing & Footwear	Biodiversity	Climate & Atmosphere	Land & Water	Marine	Built Environment	Chemicals & Plastics	Information & Communication Technologies	Integrated Manufactured Products	Measurement Standards	Pharmaceuticals & Human Health	Radio Astronomy	Services	Energy	Mineral Exploration & Mining	Mineral Processing & Metal Production
DIVISIONAL GROUPS																					
Agri-Food & Fibre																					
Food Science Australia	●	●		●	●						●										
Forestry & Forest Products			●			●	●	●		●									●		
Livestock Industries		●		●	●	○	●		○						○						
Plant Industry	●	●	●	●	●	●	●														
Environment & Natural Resources																					
Atmospheric Research							●												○		
Entomology	●		●	●	●	●	●	○		●	●				●						
Land & Water	●			●	●		●	●	●	●									●	●	○
Marine Research				●		●	●		●						●					○	○
Sustainable Ecosystems	●		●	●	●	●	●	●	●							○		○	○		
IT, Manufacturing & Services																					
Australia Telescope National Facility															●						
Building Construction & Engineering						○	●	○		●	●		●							●	●
Health Sciences and Nutrition	●	●		●											●						
Manufacturing Science & Technology										●	●		●				●	●	●	●	
Mathematical & Information Sciences	○	●	●	○	●	○	●	●	●	●		●	●		○	●			●	●	●
Molecular Science										●	●				●					●	●
Telecommunications & Industrial Physics							●			●		●	●	●		●	●	●	●		
Textile & Fibre Technology					●																
Sustainable Minerals & Energy																					
Energy Technology							●	●	●										●	○	●
Exploration & Mining																			●	●	●
Minerals																			●	●	○
Petroleum Resources																			●		●

● and ○ indicate Sectors to which a Division plans to contribute in 2001-02. An open circle indicates a contribution of less than \$300,000

Source: CSIRO

Strategic reforms in CSIRO

1.5 During audit fieldwork CSIRO was in the process of significant organisational review and change. In mid-2001 CSIRO issued a *Strategic Action Plan: A new CSIRO for a New Century* which identified its strategic priorities, change projects and set out over 20 actions to be implemented. These actions address issues such as:

- organisational structures and governance;
- internal communication;
- performance measurement;
- project management;
- CSIRO's external relationships; and
- staff development.

1.6 Overall, the Plan envisaged an increase in CSIRO revenues by 50 per cent by 2006. Several actions undertaken as part of the Plan were particularly relevant to the audit. These were a review of project management, improved costing and pricing methodologies and a study to eliminate cross-subsidies from research services.

CSIRO funding

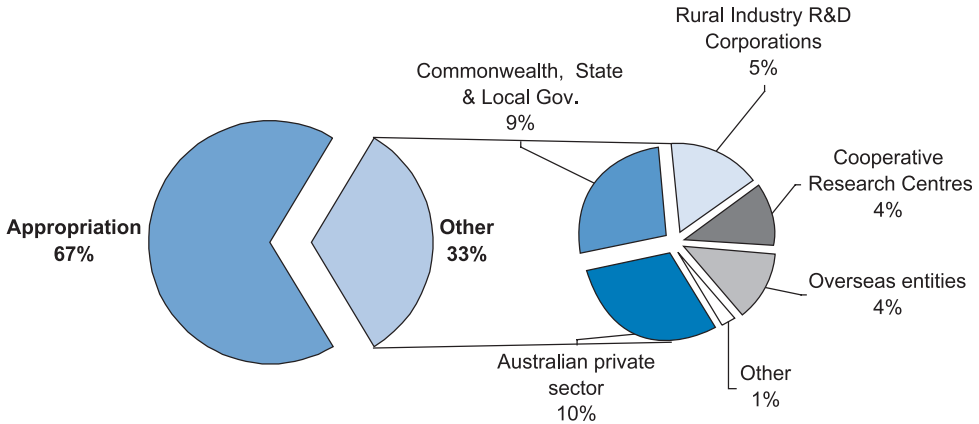
1.7 CSIRO's funding comes mainly from Commonwealth budget appropriation funds—\$510 million or around 67 per cent in 2000–2001. The remaining \$248 million funding is revenue from external parties. This is consistent with the Government's requirement that at least 30 per cent of CSIRO's revenue come from external sources.⁷

1.8 As Figure 2 demonstrates, about one-third of the external funding is provided by the Australian private sector. The Commonwealth is the second largest external funder through payments from other Commonwealth departments, research and development agencies and similar bodies.

⁷ A review of the value of maintaining external earnings in the Commonwealth Scientific and Industrial Organisation (CSIRO), Australian Nuclear Science and Technology Organisation (ANSTO) and the Australian Institute of Marine Science (AMIS) is currently being undertaken by the Government's Chief Scientist. At the time of the audit the report was yet to be finalised and released.

Figure 2

Distribution of CSIRO revenue by funder: 2000–2001

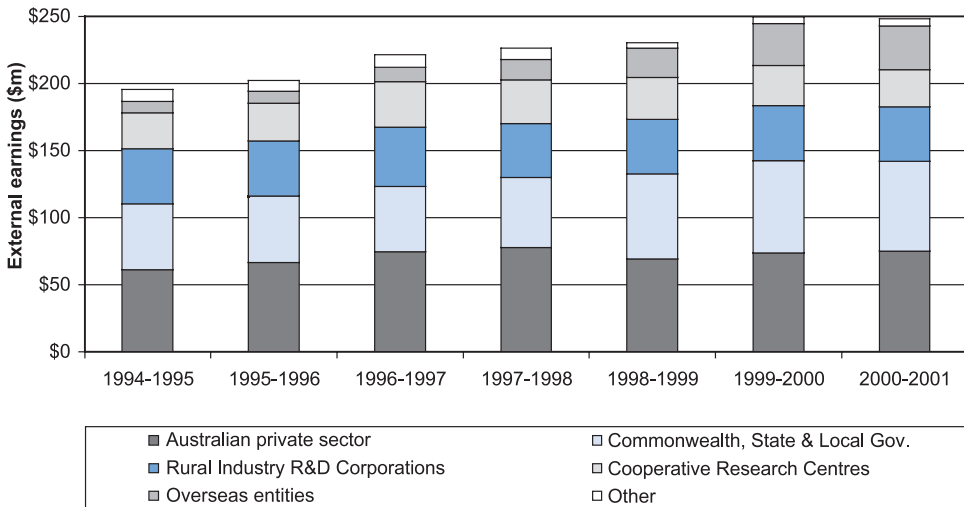


Source: CSIRO

1.9 CSIRO is required by Government to earn 30 per cent of its revenue from external sources and has steadily increased its revenues from these sources in recent years, as Figure 3 shows. Most of the increase is attributable to growth in funding from overseas entities, other government agencies and the Australian private sector.

Figure 3

External funding for CSIRO: 1994–1995 to 2000–2001



Source: CSIRO

Research projects in CSIRO

1.10 CSIRO estimates that it manages around 3000 research projects each year.⁸ Cost-effective management of these projects is essential to CSIRO achieving its desired outcomes which are intended to provide:

- benefit to Australia's industry and economy;
- environmental benefit to Australians;
- social benefits to Australians; and
- support Australia's national and international objectives through excellence in science and technology and in the provision of advice and services.

1.11 CSIRO classifies research projects under an investment model. In this model, projects are allocated according to whether they have an external client (and funding) and the type of research. The categories of projects are described below in Table 1.

⁸ CSIRO's management information systems do not allow an exact count of the number of research projects currently under-way. CSIRO also carries out routine tests and analyses for clients on a fee-for-service basis as well as monitoring and investigation of new scientific opportunities and issues, and engaging in educational activities.

Table 1
Summary of types of projects in CSIRO

<i>Type of project</i>	<i>Nature</i>	<i>Example</i>
<i>CSIRO appropriation projects</i>	Projects funded solely from appropriation sources. There is no external client. CSIRO would hold the intellectual property associated with these projects.	<ul style="list-style-type: none"> ¥ A project to reduce costs in a type of digital radio system and to explore applications of the new technologies developed. ¥ A project to improve the cost effectiveness of urban water services.
<i>Co-investment projects</i>	Projects funded by a mix of appropriation and external revenues. There is an external client and intellectual property is usually shared between the client and CSIRO.	<ul style="list-style-type: none"> ¥ A project to use models of atmospheric processes to assess the impact of commercial passenger aircraft on atmospheric ozone. Partly funded by a private aircraft company. ¥ A project to evaluate characteristics to yield improvement of wheat. Partly funded by a rural research and development organisation. ¥ A project to model the risk of agrochemical contamination of water resources. Partly funded by an international agricultural agency.
<i>Consulting projects</i>	Under CSIRO's investment model it intends that these projects will be totally externally funded with an appropriate profit margin. However, in the past many such projects have included appropriation funding as illustrated in Figure 4 and discussed at 1.13.	<ul style="list-style-type: none"> ¥ A project to develop and maintain a drilling computer program for a mining company. ¥ A project to identify potential impacts of climate change funded by a government agency.

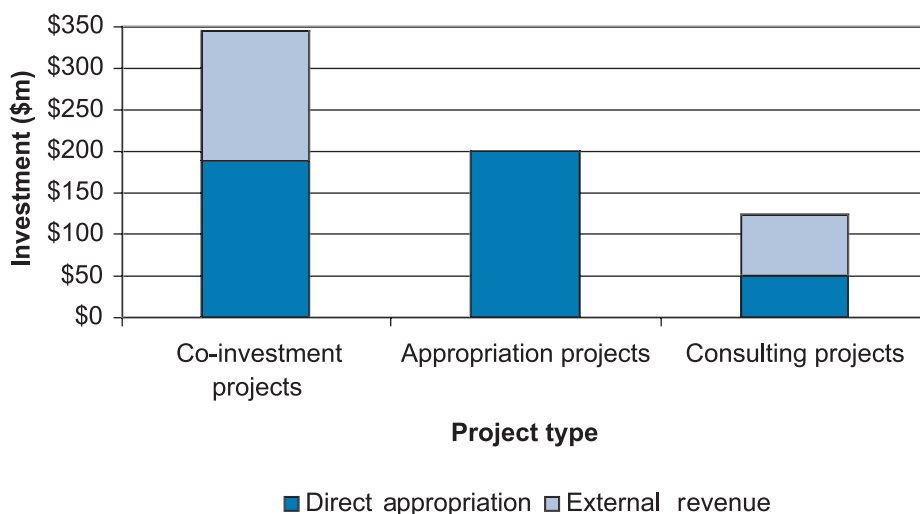
Source: ANAO analysis of CSIRO information

1.12 Appropriation projects consume nearly half of CSIRO's appropriation budget and account for around 30 per cent of all expenditure on research projects in CSIRO. These projects rarely have immediate commercial application, though they are often expected to have an eventual commercial impact.

1.13 As shown in Figure 4, co-investment projects account for about half of all research expenditure, with appropriation projects the next largest category. In the past, CSIRO has also contributed appropriation funding to consulting projects, notwithstanding that CSIRO does not usually gain intellectual property from such projects. The funding of such projects including the extent of appropriation funding is discussed further at 6.32. CSIRO policy is now that consulting projects are funded solely from external sources.

Figure 4

CSIRO research expenditure by type of project: 2000–2001⁹



Source: CSIRO

1.14 There is wide variation in the size and type of projects.¹⁰ As Figure 5 shows, most CSIRO projects are relatively small. For example, CSIRO had over 1500 projects with annual expenditure in 2000–2001 of under \$20 000; these account for just over one per cent of total expenditure. By contrast there were 337 projects which cost \$500000 or more during the same year; these accounted for nearly half of total expenditure.

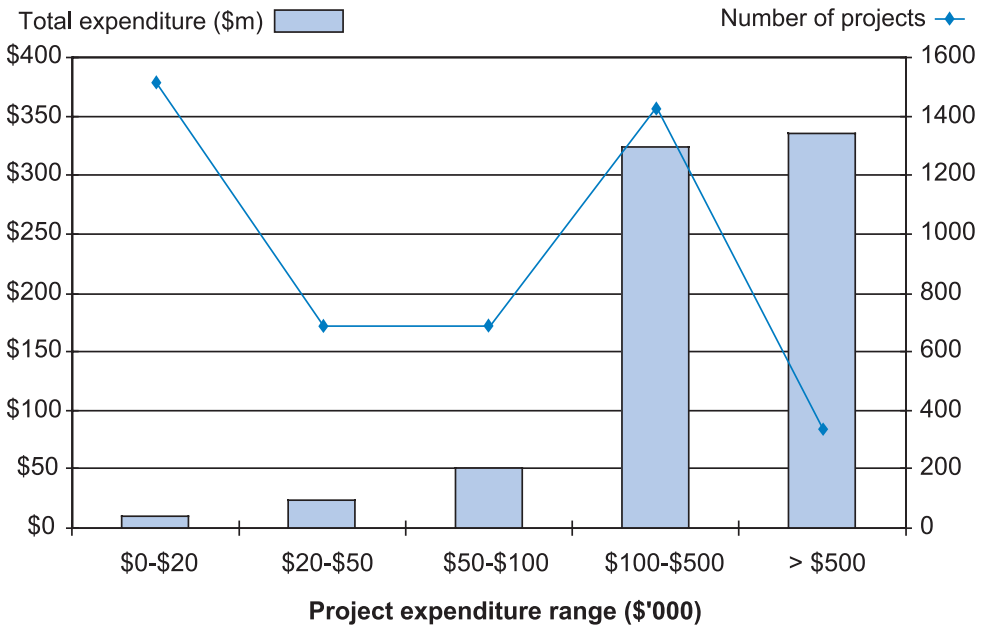
⁹ Excludes revenue allocated to corporate activities, capital use charge or CSIRO Publishing. These account for approximately \$165 million in total. Also excludes the Technology and IP Exploitation category—\$16.7 million—as these are not research 'projects'.

¹⁰ Data to enable comparison of the whole of life budget for projects is not available, accordingly the data in 1.14 and Figure 5 are based on expenditure in 2000–01.

1.15 Smaller projects are more likely to be externally funded, and appropriation projects are typically larger than the other types of projects.

Figure 5

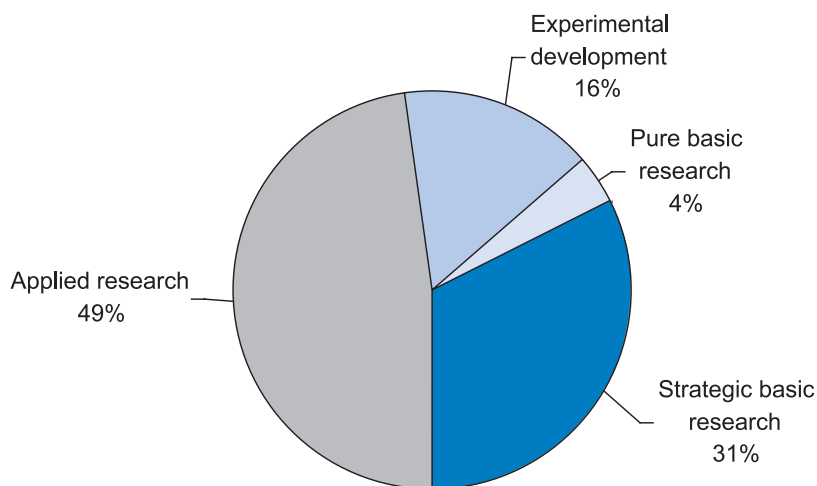
Annual expenditure and number of research projects: 2000–2001



Source: CSIRO

1.16 The Australian Bureau of Statistics (ABS) categorises research across a spectrum from pure basic research, where there is a focus on the advancement of knowledge, to experimental development, which utilises existing knowledge to produce new or improved materials, processes or services.¹¹ Figure 6 shows the distribution of CSIRO’s research effort against the ABS categories; these are expanded upon in Appendix 1. About half of CSIRO’s research is categorised as applied research, that is research undertaken primarily to acquire new knowledge with a specific application in view.

¹¹ See Appendix 1 for the definition of research category types.

Figure 6**Distribution of CSIRO research expenditure by activity type: 1999–2000**

Source: CSIRO

Previous ANAO reviews

1.17 The ANAO tabled an audit report of CSIRO's External Funds Generation in 1991–1992¹² which was followed up by a further audit tabled in 1994–1995.¹³ Although not specifically about project management, these audits identified several aspects of project management that warranted improvement at the time, including:

- inconsistencies in costing, pricing and marketing procedures, which resulted in appropriation funds subsidising externally funded research activities; and
- deficiencies and unevenness in the management of externally funded projects.

1.18 The follow-up audit found that business practices generally, and pricing in particular had improved since the initial audit, but that project costing and possible subsidisation of commercial projects remained issues for management consideration.

1.19 The initiatives subsequently taken by CSIRO to address these findings are addressed in this report.

¹² ANAO, Efficiency Audit, *The Commonwealth Scientific and Industrial Research Organisation—External Funds Generation*. 1991–1992. Audit Report No.8.

¹³ ANAO, *Commonwealth Scientific and Industrial Research Organisation—Follow-up of an Efficiency Audit of External Funds Generation*. 1994–1995. Audit Report No.1.

This audit

Audit objective and scope

1.20 The objective of this audit was to assess the effectiveness of CSIRO in administering research projects to deliver required results. The audit focused on research activities that were either formally designated as projects, or were managed in a similar way, and on relevant supporting administrative and information systems.¹⁴

1.21 The audit did not assess the quality of scientific analysis or outcomes, although it did address CSIRO's assessment of, inter alia, project outcomes.

Audit methodology

1.22 The audit criteria drew on the findings of previous ANAO audits and on agreed competencies of project management developed by the Australian Institute of Project Management.¹⁵ The competencies were adapted, based on the advice of an expert consultant (see paragraph 1.24), to recognise the particular circumstances for management of scientific research projects. The audit methodology comprised:

- reviewing CSIRO corporate and divisional documents;
- interviews with senior corporate and divisional staff and project managers;
- analysis of project management practices in five CSIRO divisions considered representative of the spectrum of project management expertise within CSIRO and of the diversity of project types that CSIRO manages. The divisions were:
 - Atmospheric Research
 - Land and Water
 - Petroleum Resources
 - Plant Industry, and
 - Telecommunications and Industrial Physics;
- reviews of a sample of 76 research projects from the five divisions. These projects were chosen to cover:
 - large and medium sized projects,

¹⁴ Some research activities (such as ongoing monitoring of overseas literature) are not appropriate to be defined as projects. The scale of these activities cannot be quantified from CSIRO systems.

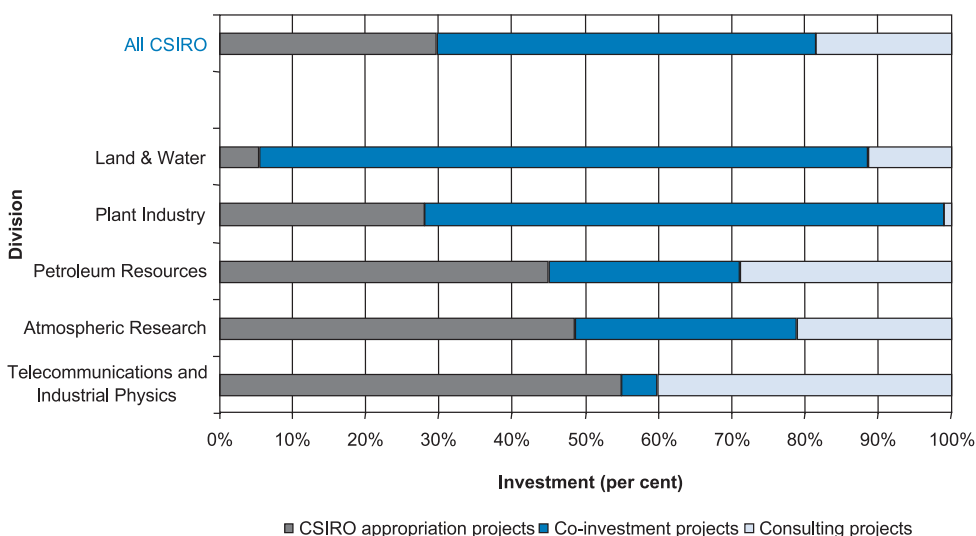
¹⁵ The standards were approved on the recommendation of the Australian National Training Authority Standards and Curriculum Council in June 1996 and ongoing development and management is undertaken the Australian Institute of Project Management.

- open (continuing) and recently closed (finalised) projects, and
- appropriation, co-investment and consulting projects; and
- analysis of information from CSIRO project information systems.

1.23 The choice of divisions and projects to be considered in the audit was agreed with CSIRO. As Figure 7 shows, the divisions have sharply different mixes of projects, with Land and Water for example, having only five per cent of projects fully appropriation funded, while Telecommunications and Industrial Physics has over 50 per cent of its projects of this type. In aggregate, the five divisions broadly reflected the overall distribution of types of project in CSIRO.

Figure 7

Research project expenditure by investment model category: 2000–2001¹⁶



Source: CSIRO

1.24 To assist the ANAO with technical advice on the audit it sought the assistance of project management experts. The firm *Corporate Project Management Group* was chosen on the basis of a selective tender process because of its expertise in the field of project management. Its contribution to the audit included determining relevant test criteria; evaluating audit evidence; and assisting with expert advice on project management to be included in this report.

Audit cost

1.25 The audit was conducted in conformance with ANAO auditing standards and cost \$372 000.

¹⁶ See 1.11 for definition of investment model categories.

CSIRO review of project management

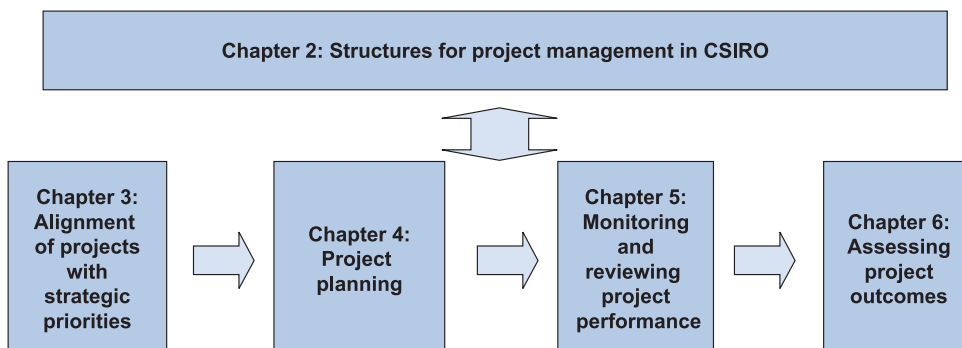
1.26 As discussed in 1.5, CSIRO is currently engaged in a major internal review and subsequent change process through the *Strategic Action Plan*. The Plan included a review of project management that occurred during audit fieldwork. The ANAO communicated its preliminary findings to the internal review team at an early stage to inform the review's proposed actions.

1.27 CSIRO's proposed or actual actions in response to the recommendations of this and other relevant reviews are outlined in the relevant Chapters of this report.

Report structure

1.28 The audit findings are reported in five further Chapters, as illustrated in Figure 8.

Figure 8
Report structure



2. Structures for Project Management in CSIRO

This Chapter examines CSIRO's framework for project management.

2.1 CSIRO faces a complex task in managing a diverse portfolio of research projects. These are spread across many different fields of science; range in size from less than \$10 000 to several million dollars; can be completed in a few weeks or take several years; and can be intense, focused projects for an external client or longer-term more exploratory projects driven by broader community needs.

2.2 With such diversity of tasks there are considerable benefits in a systematic and structured approach to project management. It makes it more likely that project management approaches, risk management and overall effort are appropriate for the task to be managed. These approaches, in turn, reduce the likelihood that a small low-risk task is excessively managed, or that a large, high-risk task is managed with insufficient rigour. Clear guidance also assists managers in determining the appropriate project management approaches for tasks and provides assurance to CSIRO that minimum standards are being met.

2.3 Accordingly, the ANAO examined the extent to which CSIRO had in place project management policies, procedures and supporting structures, including:

- appropriate guidance and standards for project management that reflect the varying risks in projects;
- clarity on identifying what constitutes a project;
- ensuring staff have appropriate skills to implement effective project management and required standards; and
- supporting corporate management information systems for project management; and
- implementation of current corporate policies.

Project management guidance and standards

2.4 Clear guidance contributes to good practice project management, supporting the application of consistent standards of management, and providing the foundation for the cycle of project planning, monitoring and control, and project review. CSIRO does not have a project management manual or guidance, nor articulated standards of project management practice. Various CSIRO policies do, however, address some aspects of project management, particularly for co-investment and consulting projects.

2.5 The most relevant document for co-investment and consulting projects is the Commercial Practices Manual, which is a statement of CSIRO policies on its commercial operations. The Manual has wide application, as 70 per cent of CSIRO's research expenditure on projects include an external client and are therefore subject to its policies. The Manual includes useful policy on:

- project identification and planning, including the need for sound research plans, work plans, decision points, clearly allocated roles and responsibilities and milestones;
- project management, including the role of Steering Committees and communication with clients;
- costing (in particular the need for full costing) and pricing, of projects;
- managing contractual and other relationships; and
- post-project review.

2.6 The Manual, however, is not intended to be a project management guide. Furthermore, some of the policy is understandably at a very broad level, limiting its contribution to the practice of project management. For example, the Manual states that post-project evaluation will be a part of normal divisional business, but does not provide guidance on how such evaluations might be conducted in practice.

2.7 CSIRO does not have corporate guidance on the management of appropriation projects notwithstanding their importance in CSIRO's research portfolio. Reflecting this, the ANAO found that there was far less structured and consistent management of appropriation projects than for projects with an external client. As discussed in subsequent Chapters in this report, appropriation projects tended to lack important elements of structured project management, being less likely than other types of projects to have project plans, be fully budgeted, have a risk assessment conducted or be subject to evaluation.

2.8 The ANAO concluded, therefore, that CSIRO would benefit from guidance, and articulated standards, on project management. Particular areas that warrant attention, and which are addressed later in this report are summarised in Table 2.

Table 2
Strengthening guidance on project management

<i>Element of project management guidance</i>	<i>Extent of current guidance</i>	<i>Desirable enhancement</i>
<i>Definition of project</i>	p	Develop definition(s) to address full range of project types (see 2.10).
<i>Alignment of projects with strategic priorities</i>	p	Build on better practice in some divisions to apply consistent criteria in selecting projects (see 3.6).
<i>Costing</i>	p	Establish costing policy for appropriation projects (see 4.17).
<i>Project risk assessment and management</i>	p	Extend current corporate risk management framework to project-level (see 4.37).
<i>Project monitoring</i>	x	Develop guidance and supporting procedures for monitoring of project scope, costs, timeliness and risks (see 5.49).
<i>Project outcomes evaluation</i>	p	Build on current policy on commercial projects to address appropriation projects and develop minimum procedures to implement policy (see 6.16).

Source: ANAO

Notes:

x – none, or very limited guidance

p – guidance is partial or is in place for some types of projects

✓ - effectively established for all types of projects

2.9 CSIRO has recognised the need to upgrade its approach to project management, and in late 2001 established a *Project Management Improvement Project*. The aim of the Project is to establish minimum standards for project management, based on a risk management approach and it is expected to deliver new standards and other tools progressively during 2002.

Project identification

2.10 Policy and procedures for identification and definition of a project assists managers to decide what activities should be managed as a project, and what should be managed as on-going activities.

2.11 CSIRO's Commercial Practices Manual states that a project is:

...an activity that has a start and an end point, it has customers (internal, external or a combination of both), and contracted deliverables and it is the base level at which resources are managed. The quantum dollar value of an activity is not a material criterion in determining whether it is a project or not.

It usually has a set time frame and cost and can be appropriation funded, externally funded or a mixture of both. If it involves external funding there will be a contract in place with the external funds provider which will contribute to the management of the project.¹⁷

2.12 Notwithstanding this definition, the ANAO found it was inconsistently applied to co-investment and consulting projects (to which the manual applies). There was wide variation in divisions over what constituted a project. Divisions used varying approaches to categorising, recording and creating projects, for example:

- some divisions used 'project', others 'programs' and others 'business opportunities' to describe a project-based task;
- similarly, the term 'project' was used in some divisions to define an individual project while in others it described multiple or groups of projects; and
- there was particularly wide variation in description and definition of appropriation projects.

2.13 This wide variation in practices has several consequences. It leads to inconsistency in project management, as activities that may be managed as a project in one division, or work area, would be managed quite differently in another. It also reduces the quality of information recorded on management information systems and in turn weakens the ability of these systems to support higher level project management and governance.

Project management skills development

2.14 Effective research project management requires those with management responsibilities to have relevant financial, personal and planning skills, as well as the necessary scientific expertise. Structured skills development, usually in

¹⁷ CSIRO Commercial Practices Manual, glossary.

the form of training and development programs, are an important way to facilitate effective project management that is consistent with corporate policies.

2.15 CSIRO recognises the importance of developing staff skills in project management. The major relevant training program is CSIRO's 'Project Leader Program' (PLP), which includes a module on project management. The program is targeted at middle-level to senior staff who are responsible for groups of projects and provides research staff with a variety of information on project planning. The PLP module addresses the structuring and planning of projects, risk management, project work plans, costing and pricing. Recent external reviewers of the program considered that it addressed the major elements of project management, and CSIRO project managers who had attended the program ranked it highly.

2.16 The ANAO also found that the PLP provides a sound overview of project management techniques. However, its effectiveness in supporting a consistent approach to project management is reduced as attendance of relevant staff at the PLP program is not mandatory and so attendance varied widely between divisions. In some divisions it is policy to send all relevant staff on the program; in others participation was voluntary and only some staff attended; while in others no staff attended.

2.17 Some divisions have established their own training for project management to replace the PLP, or are in the process of doing so. However, these courses present different approaches to that in the PLP, making it more difficult to develop common terminology and approaches for project management across CSIRO.

Supporting management information

2.18 CSIRO manages many thousands of projects, and requires sound management information to manage them effectively and provide appropriate accountability to corporate management and external stakeholders.

2.19 The main corporate information system used by CSIRO to support project management is the Project Support System (PSS). The PSS was introduced in 1997 to provide an organisation-wide repository of information about CSIRO projects and thus provide project-related information for project managers, for divisional management and for corporate planning and decision-making. The PSS has its origins in CSIRO's decision to upgrade its financial management capabilities in the late 1990's. Since its introduction it has been regularly upgraded. For example, in mid-2001 CSIRO introduced additional functions such as milestone tracking and recording of risk assessments and project completion reviews into PSS.

2.20 The PSS provides the facility to capture core project and activity information, including finance and staff allocation details. It provides access to budgets and actual transaction figures through a range of reports and enquiries. The components of the PSS are:

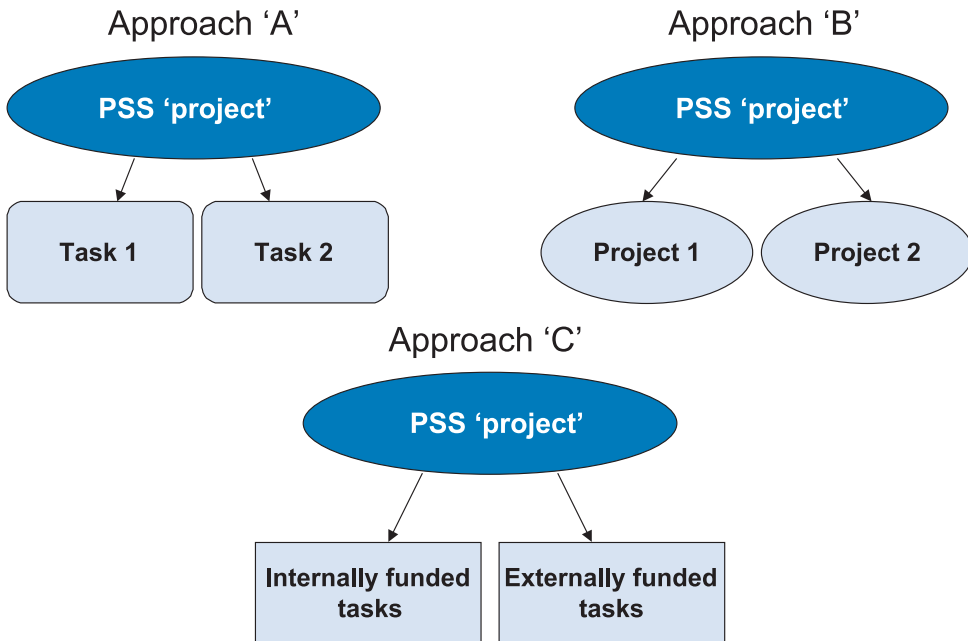
- a data capture module for core information about a project—the project title; project description, objectives and outcomes; project leader; classification (according to the investment model, socio-economic objectives and field of research); and Sector. Divisions can decide to aggregate projects to suit their own needs. Project activities can be defined to sub-divide the work of a project into components as decided by a division;
- project ledger for financial transactions; and
- data warehouse for reporting on project financial information.

2.21 The PSS has robust connections with other systems, such as CSIRO's financial ledger system UNIBIS. This enables it to provide an up-to-date reflection of transactions in the financial systems. Staff are able to identify individual transactions that relate to a particular project (to verify the accurate allocation of expenses) and create individual reports. Staff interviewed by ANAO generally considered that the PSS was a useful tool in assisting them manage projects, particularly project costs.

Definition and recording of projects in PSS

2.22 The ability of the PSS to support corporate reporting on, and monitoring of, projects is, however, markedly reduced by the variation in definition of projects (see paragraph 2.12). Divisions varied in how they created, categorised and recorded projects in PSS.

2.23 The three most common approaches are shown in Figure 9. The approach envisaged (but not prescribed) when PSS was established is shown as 'A'; this breaks down a project into its relevant sub-tasks, which are each listed in PSS and is used by some divisions. Some divisions use approach 'B' whereby separate projects (each possibly with its own contract and client) are listed under the same project code. A further approach is that described at 'C', whereby each project is split into an appropriation-funded task and an externally-funded task.

Figure 9**Three different practices in recording projects and tasks in PSS**

Source: ANAO

2.24 In addition, the PSS includes many activities as 'projects' that are ongoing activities and that are not research projects in the sense envisaged by the existing policy. This practice, and the varying approaches to recording projects in PSS, results in the PSS indicating that there are over 6000 projects currently underway in CSIRO. However, CSIRO considers that there are actually around 3000 to 4000 projects consistent with the definition at 2.11. The ANAO considers that these limitations in defining and recording projects reduce the robustness of CSIRO's corporate governance by limiting its ability to monitor project performance.

2.25 CSIRO acknowledges that the definition of a project in PSS is not clear and as such the quality of the data is not reliable. CSIRO is currently reviewing the categorisation of projects in PSS, to clarify the different types of activities that should be recorded in PSS.

Comprehensiveness of data recorded in PSS

2.26 The ANAO also found that the potential effectiveness of PSS in supporting review and decision-making is further reduced by some fields being optional. These fields include those relating to effort logging, milestones and risks (see Table 3), which are valuable information in monitoring project performance.

Table 3**Requirement to complete major PSS fields**

<i>Field</i>	<i>Mandatory/optional</i>
<i>Project title</i>	Mandatory
<i>Project abstract</i>	Optional
<i>% complete</i>	Optional
<i>Baseline and current budgets</i>	Mandatory
<i>Expenditure</i>	Mandatory
<i>Effort logging</i>	Optional
<i>Identity of project manager, and staff</i>	Mandatory
<i>Client details</i>	Mandatory
<i>Sub-tasks and related projects</i>	Mandatory that at least one sub-task be identified
<i>Milestones</i>	Optional
<i>Risks identified for the project</i>	Optional
<i>Links to relevant contracts</i>	Optional
<i>Post-project evaluation</i>	Optional

Source: ANAO summary of key PSS fields.

2.27 In addition, the ANAO found that data entered into some mandatory fields was of poor quality. For example, the project budget field sometimes contained only a temporary or estimated budget, which was not updated after the project commenced.¹⁸

2.28 Later parts of this report examine in more detail the quality and availability of costing (see paragraph 5.22) and milestone (see paragraph 5.44) data in PSS.

Conclusion

2.29 CSIRO has wide experience in managing research projects, which is reflected in a number of practices outlined in this audit. Its supporting framework for project management has improved in recent years with the introduction and subsequent enhancement of a commercial policy framework and management information systems.

¹⁸ For example, the ANAO found cases where budgets entered for projects in PSS bore little apparent relationship to actual project costs.

2.30 However, CSIRO lacks specific standards, business rules and guidance on project management, and some existing policies are not well implemented. The impacts of this are addressed in later Chapters of this report. They are most notable for appropriation projects but also affect the quality and consistency of project management for co-investment and consulting projects.

2.31 A more structured, corporate approach to project management (supported by management processes to support implementation) would provide greater assurance that sound practices are being appropriately applied, and enable CSIRO to monitor the quality of project management. CSIRO has recently commenced a major initiative to improve project management which has the potential to achieve the improvements recommended below.

Recommendation No. 1

2.32 The ANAO recommends that CSIRO develop and implement a corporate approach to the management of research projects, including:

- business rules incorporating risk based standards and other guidance for the management of projects, including appropriation projects;
- consistent identification of activities that should be managed as research and development projects;
- ensuring key management information systems contain reliable data;
- ensuring relevant staff have project management skills; and
- arrangements to ensure compliance with corporate project management standards and guidance.

CSIRO response

2.33 Agreed.

CSIRO has initiated, among other interrelated activities, a *Project Management Improvement (PMI) Project* to address many of the issues raised in this audit report and identified in its own internal review of project management. A CSIRO guide to project management and accompanying policy documents are currently in draft form. These documents address all projects within CSIRO and establish a corporate standard for project management that includes conception, planning, risk assessment, delivery, monitoring and closing of projects. The PMI project is also charged with ensuring that the appropriate data is captured in the CSIRO Management Information System (MIS), providing training for staff in project management and communicating to all staff these new guidelines, policies and procedures. Other projects dealing with related project management issues are summarised in CSIRO's overall response (see paragraph 20).

3. Alignment of Projects with Strategic Priorities

This Chapter examines alignment of research projects to higher Sectoral priorities.

Setting research priorities

3.1 Every three years CSIRO, in conjunction with Sector Advisory Committees, undertakes a major priority-setting process to guide its research investments for the following triennium. The aim is to identify the mix of research areas that offers the highest return on CSIRO's funds (in financial or public good terms) within each Sector.¹⁹ Each Sector applies uniform assessment criteria and guidelines to develop a set of priorities, expressed in the form of 'Sector Plans' that are approved by the CSIRO Board and subsequently published. The Sector Plans set out broad research priorities that are intended to guide the selection of all projects.

3.2 The most recent Sector Plans were approved in early 2000, covering the period 2000–2001 to 2002–2003.²⁰ These Plans are implemented by relevant divisions through the choice of individual research projects consistent with these Plans. Divisions may be implementing priorities of several Sectors. CSIRO reinforces the need to align projects with Sector Plans through the requirement that, when entered into the Project Support System, it is compulsory that each project must be allocated to a particular Sector, and to a 'component' within that Sector. This allows reporting back to Sector Committees and the CSIRO Board on where CSIRO is investing its research effort.

3.3 The ANAO reviewed the adequacy of *management processes* in achieving and demonstrating this alignment of individual projects with Sector Plans. It was not the purpose of the audit to conduct a *scientific assessment* of whether individual project goals aligned with Sector Plans.

Divisional approaches for aligning projects with Sector Plans

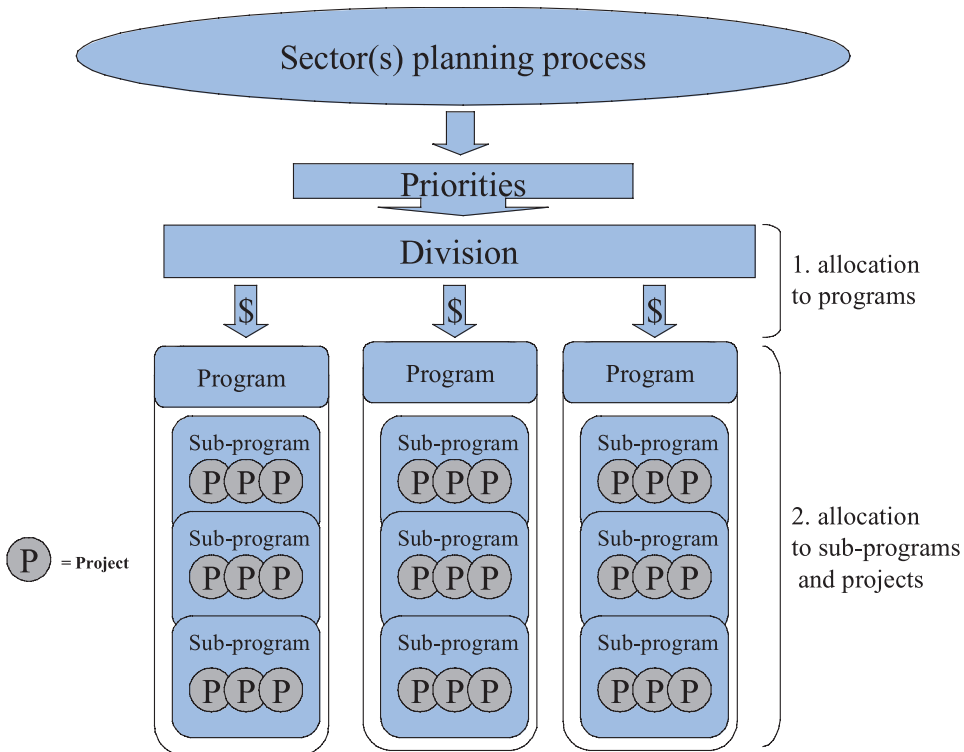
Management processes

3.4 CSIRO divisions reviewed in this audit devote substantial effort to aligning projects with Sector Plans. Broadly, this alignment was achieved in a two-step process as set out in Figure 10.

¹⁹ Priorities *between* Sectors for the current triennium are established when the CSIRO Board reviews the individual CSIRO Sector Plans.

²⁰ *CSIRO Strategic Plan 2000–2001 to 2002–2003* details the Sectoral planned achievements in terms of outputs and outcomes.

Figure 10
Links between Sector priorities and project objectives



Source: ANAO

3.5 Divisions first allocate funds for the coming triennium to broad areas of research (referred to as programs) in line with Sector priorities. This allocation process addresses funding for appropriation, as well as co-investment and consulting projects. To inform these allocations, divisions generally conduct a review of current activities in the light of the Sector Plans. Divisional management then adjusts program budgets to reflect the desired changes to implement the Sector Plans. These processes vary in their formality and quality of documentation. In some divisions there are specific reviews which identify areas of growth and reduction, linked to Sector Plans. In others decisions are made following discussions within the division, and with Sector Committees.

3.6 The second stage is to identify projects to undertake within each program. Each division devotes significant effort to this step, however, approaches vary markedly between the five divisions, and in some cases within divisions. In some cases the processes for identifying projects are structured and systematic. For example:

- a program in one division conducts an annual budget assessment, in which all current and proposed projects (co-investment, consulting and

appropriation) for that part of the division are assessed and numerically scored against the same criteria used in the higher-level Sector planning process; and

- another division employs a similar process in which it usually conducts annual program-level assessments of their research portfolio for all its programs. The assessment criteria are set by the chief of division, and include criteria such as, strategic fit, potential return and ability to capture benefits and R&D potential and capacity.

3.7 However, other divisions, or parts of divisions, use a less structured process, involving discussions between the program manager and more junior staff managers to judge whether the project is appropriate and relevant to the Sector Plan. This approach provides less assurance than clearer, criteria-based ranking processes used elsewhere in CSIRO that the optimal portfolio of projects is chosen.

Project staff understanding of processes

3.8 New research opportunities emerge continually during a three-year planning period, and in order for CSIRO to be able to respond to these opportunities, staff need to be aware of the relevant Sector priorities and apply them in assessing these opportunities.

3.9 As would be expected, more senior managers responsible for programs demonstrated appropriate awareness of the role and importance of the Sector Plan. However, knowledge of and use of Sector Plans by other managers, including some responsible for developing new projects, was more variable. Some staff involved in selecting projects advised that Sector Plans were not considered in the choice of projects, or noted that Sector priorities were often quite broad, and offered little specific guidance at the project level while others made specific reference to the importance of the Sector priorities in guiding the development and approval of their project.

3.10 Given the importance of project staff (such as program and project leaders) understanding how their project contributes to Sector priorities, there would seem merit in CSIRO clearly communicating Sector priorities to such staff.

Reference to Sector Plans in project documentation and systems

3.11 Explicit reference to the relationship between a project and higher-level objectives in project plans and documentation informs decision-makers and other stakeholders of the broader role of a project and allows management review of its relevance. It also supports accountability and review.

3.12 The Commercial Practices Manual requires that the project plan for co-investment and consulting projects ‘must be in line with the Sector Plan’. The Manual also includes a pro-forma research plan as a guide (discussed further in Chapter 4) which includes a section where staff set out the relationship of the project to the division or Sector Plan. However, use of the pro-forma is not mandatory.

3.13 In practice only around 25 per cent of the project plans or approval documentation reviewed by the ANAO mentioned the Sector or Sector Plan relevant to the project. Of these, less than half specifically identified how the project contributed to implementing the relevant Sector Plan, most indicating that a link existed, but did not specify what this was.

3.14 In addition, as appropriation projects are not guided by the Commercial Practices Manual, the ANAO found even less documentary evidence in project plans or approvals of the alignment of the projects with Sector Plans.

Conclusion

3.15 CSIRO places strong emphasis on aligning its research portfolio with Sector Plans, with supporting processes to allocate funds to programs, sub-programs and projects. The prioritisation of individual projects is supported by systematic criteria in some instances, but not in others; the extent of supporting documentation also varied. Addressing this would increase assurance that the optimal portfolio of projects is chosen.

Recommendation No. 2

3.16 The ANAO recommends that, to reinforce the alignment of projects with strategic priorities, CSIRO employ explicit criteria in selecting projects and identify in project planning the contribution of the project to agreed industry Sector or divisional priorities.

CSIRO response

3.17 Agreed.

CSIRO believe that improvements can be made to its existing project planning to document more completely the contributions of projects to specific industry sectors and/or to specific divisional priorities. Given the very broad range and scope of projects it is not considered feasible or desirable to provide a one size fits all set of selection criteria for every activity. For example, CSIRO has recently launched the concept of Flagship Projects which are large scale projects focussing on key national priority areas (e.g. Preventative Health). These are very different in character from small consulting projects.

4. Project Planning

This Chapter examines CSIRO's policies and practices for planning research projects.

4.1 Effective project planning supports the development of project objectives, goals, strategies, implementation, risk management and the commitment of resources. Projects which are well planned have higher chances of success and are better able to be controlled during implementation and finalisation.

Project planning in CSIRO

4.2 The importance of project planning is recognised in policy guidance in the Commercial Practices Manual for co-investment and consulting projects, and supplemented by additional guidance in some divisions. CSIRO's corporate risk management framework also identifies the need to manage risks in projects and corporate and divisional training programs on project management address project planning. Interviews with staff and a review of a sample of projects confirmed that substantial effort is directed to project planning, whether in informal discussions over project scope or the preparation of detailed plans and budgets.

4.3 Accordingly, CSIRO has a basis for sound project planning. However, the effectiveness of some key planning tools varied in the extent and rigour of their application, reducing assurance that an appropriate level of planning effort is being applied. This Chapter assesses the effectiveness of processes for supporting project planning, in particular:

- use of explicit plans;
- costing;
- pricing; and
- risk assessment.

Use of explicit project plans

Project plans for co-investment and consulting projects

4.4 Clearly articulated and documented project plans are an important part of project management. They provide a clear statement of project objectives to guide implementation; give a baseline against which to assess project achievement; and are usually the key document supporting the decision by management to proceed with the project.

4.5 CSIRO policy articulates the need for project plans for co-investment and consulting projects. The Commercial Practices Manual requires co-investment and consulting projects to have project work plans that set out a project's objectives, deliverables and workplan, and allocate roles and responsibilities to relevant staff.

4.6 The key planning document for co-investment and consulting projects is the project proposal submitted to a client or partner. These generally have clear objectives and deliverables, set out the origin and rationale of the project as well as information on project staffing, liaison arrangements and accountabilities, whole-of-life budgets and milestones (where these milestones were linked to payments). The proposals also address the roles of project manager, key project staff, and liaison arrangements with the funder or co-investor of the project. The quality of the information reflected that CSIRO often worked closely with clients in developing the projects, and that external accountabilities create pressure for good planning.

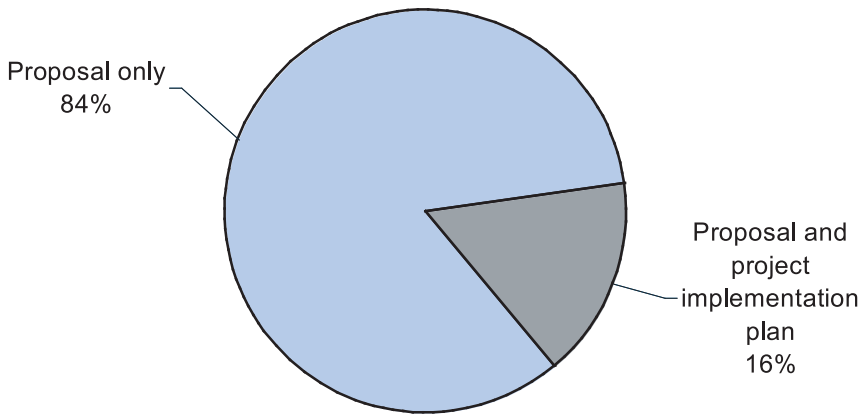
4.7 However, sound project plans seek to include information which would not be appropriate to include in a document for an external audience. Such items which are important for implementing the project, and in facilitating the monitoring and review of the project's progress, include:

- the identification of critical paths and plans for the achievement of *intermediate* milestones that may not be subject of a payment but which are important for project success; and
- an internal assessment of the project delivery risks and plans for the treatment of these risks.

4.8 As shown in Figure 11, all co-investment and consulting projects examined by the ANAO had at least a proposal. These project proposals addressed the issues required by the Manual. In addition, some projects also had more comprehensive project implementation plans that addressed the additional information referred to in 4.7.

Figure 11

Use of project proposals and plans in co-investment and consulting projects²¹



Source: ANAO

4.9 Two divisions are currently implementing an enhanced project plan pro-forma for new projects, to assist internal decision-making and project management. These address the issues listed in 4.7 to a greater degree than previously.²²

4.10 The ANAO also notes that policy requires that co-investment and consulting projects also have plans for commercialisation of project findings or for further application of findings in research if the findings are not immediately able to be commercialised. However, the ANAO found that only three of the five divisions examined in detail consistently implemented this policy.

Project plans for appropriation projects

4.11 In contrast to co-investment and consulting projects, CSIRO does not have a corporate requirement for appropriation projects to have a plan. Furthermore, appropriation projects are often managed as part of a wider 'program' of activity and therefore are not separately identified as projects.²³ As a result, the use of project plans for appropriation projects was less frequent than for co-investment and consulting projects. Only some 30 per cent of such projects in the ANAO sample have a documented project plan.

²¹ Sample of 61 projects.

²² As these new pro-formas are being progressively introduced, their impact are generally not be reflected in the ANAO's sample of projects.

²³ Most programs did have annual plans that identified the activities to be undertaken for the coming year, but these were usually not separately costed or identified in the PSS.

4.12 Given their significance in CSIRO's research portfolio, and that such projects are often longer-term and more complex, the absence of a corporate requirement for plans in appropriation projects is a significant weakness in CSIRO's approach to project management. In recent years, some divisions have independently introduced requirements that appropriation projects have plans in recognition of the benefits of such plans. Extending this practice to all divisions would enhance corporate governance.

Recommendation No. 3

4.13 The ANAO recommends that, in order to facilitate a more robust approach to project management, CSIRO develop guidance and supporting practices to ensure that projects have appropriate, documented and readily accessible implementation plans.

CSIRO response

4.14 Agreed.

Compliance and accessibility issues will be addressed through the *Project Management Improvement Project* and through enhancements to the functionality and reporting capabilities of CSIRO's key project Management Information System, the Project Support System (PSS).

Project costing

4.15 Accurate estimating of a project's full costs over its life (whole of life budget) is needed by management to:

- determine whether the investment return is justified by the project (either monetary, intellectual or public good);
- assist in setting the price to be charged to any external party; and
- justify CSIRO's entitlement to intellectual property in co-investment projects.

4.16 CSIRO has introduced several corporate initiatives over a number of years to improve project costing. These include the introduction of the Project Support System in 1997 and setting out some policies for costing co-investment and consulting projects in the Commercial Practices Manual.²⁴ The Manual states 'it is necessary to estimate as accurately as possible the full cost of conducting the work' and requires staff to identify the full costs of projects, including all direct costs, indirect costs and divisional and CSIRO corporate overheads. The ANAO found the divisions audited had all put in place procedures for costing

²⁴ The Commercial Practices Manual was first introduced in 1994. The most recent edition (5th) was released in 2001.

co-investment and consulting projects, consistent with this requirement. These procedures often include the use of standardised costing templates which incorporate fields for salary costs, travel expenses, equipment or service costs, indirect costs and pricing information. As a result, all the co-investment and consulting projects examined by the ANAO had a whole of life budget that met the requirements of the Commercial Practices Manual.

4.17 In contrast to co-investment and consulting projects, CSIRO has no formal policy on costing appropriation projects, despite these projects accounting for 30 per cent of research expenditure. Furthermore, as discussed at 2.12, appropriation projects are not always separately identified and budgeted. Accordingly, appropriation projects are less frequently and less comprehensively costed than co-investment and consulting projects. Only around half of appropriation projects in the ANAO sample had a project cost budget.

Treatment of corporate overheads

4.18 Indirect corporate overheads are items such as corporate management costs (Executive Team, corporate Human Resources and Risk Assessment and Audit Unit) and corporate support areas (the Information Technology and Property Groups). In 2000–2001 indirect corporate costs across CSIRO amounted to some \$45.6 million or around seven per cent of CSIRO project costs.

4.19 The Commercial Practices Manual requires that these indirect overheads be included in each project's cost. However, the ANAO found that these costs are not presently passed to the divisions; instead they are funded directly out of appropriation allocations by CSIRO corporate headquarters.

4.20 This practice amounts to an additional contribution, or unplanned subsidy, to consulting and co-investment projects.

4.21 CSIRO has acknowledged that this practice should be examined, and in 2002 agreed to the recommendation of an internal working group that a review of the treatment of corporate overheads be performed.²⁵

Recommendation No. 4

4.22 The ANAO recommends that CSIRO enhance its costing policies to provide clear policy and guidance on:

- costing of appropriation projects; and
- the distribution of corporate overheads to research projects.

²⁵ Financial Discipline Group, *Subsidy Elimination from Contract R&D, Consulting and Technical Services Provision*, Recommendation 5.

CSIRO response

4.23 Agreed.

The cost of appropriation projects needs to be identified, recorded and regularly updated in the Management Information System. It should be recognised that appropriation funded projects by their very nature are likely to have somewhat less predictable outcomes and therefore cost structures than, for example, consulting projects where the outputs are much more clearly defined. The development of a process to distribute Corporate overhead costs back to research projects is well underway and will be completed by 1 July 2002.

Project pricing

4.24 CSIRO's pricing policy differentiates between co-investment projects where there is a contribution from CSIRO and consulting projects (which are generally expected to be wholly funded by clients).

4.25 For consulting projects the policy requires the price to cover the estimated full costs.²⁶ At the time of audit fieldwork the pricing policy was very broad and divisions implemented the policy in different ways with each division seeking to achieve full recovery of the projects costs. In some divisions, a multiple of salary costs was used to guide pricing and in others a minimum percentage mark-up on costs was used. Divisions also varied in the level of percentage mark-up.

4.26 A further weakness is that as corporate overheads are not allocated to research projects (see paragraph 4.19). Consulting projects are effectively under priced to the extent to which corporate overheads are absent from costings.

4.27 For co-investment projects divisions negotiate the price (or CSIRO contribution) on a case by case basis depending, on for example, how much intellectual property (IP) would be retained by CSIRO. Generally, most divisions tended to charge a higher price when CSIRO retained less IP, reflecting an important aspect of the project's value to CSIRO, but there were no clear guidelines on how to set the price in relation to IP leading to diversity of pricing practices.

4.28 A further complexity for pricing some projects is that CSIRO historically has had difficulty in negotiating full-cost recovery with rural research and development organisations. CSIRO advised that such bodies have a policy of not funding the costs of lead researchers and only contribute to research support or other operating costs. Because of CSIRO's commitment to similar research

²⁶ The estimated full costs must also include the commercial pre-tax rate of return and tax equivalent regime components. These on-cost factors are set corporately by CSIRO on industry benchmarks and approved by its Minister.

aims to those of the granting bodies, it often contributed the costs of the lead researcher itself. This often resulted in what might have been a full-cost-recovered project becoming a 'partnership' or co-investment project which might only recover direct divisional costs (such as salaries), but not divisional or corporate overheads for CSIRO thus resulting in CSIRO making a greater than planned contribution to the project.

4.29 In recognition of the risks from such diverse practices in pricing projects, CSIRO is implementing, and training staff in, a new approach of "value based" pricing. It is intended to move CSIRO away from a cost-plus pricing approach to one that is based on the perceived value of the project to the client, and to standardise this across the organisation. This approach aligns the pricing policy with CSIRO's investment model (described at paragraph 1.11) and seeks to address the pricing issues identified in this report.²⁷

Project risk planning

4.30 CSIRO has a standard risk assessment methodology which seeks to identify all risks. For reporting purposes it categorises risks into the following types: political; commercial practice; financial; program/project management; natural disasters; operational management; personnel; and program/project outcomes.

4.31 Since 1996 CSIRO has employed a top-down approach to the management of risk, focusing on organisation wide reviews, divisional risk assessments and other reviews. These assessments/reviews are conducted on a systematic basis by the CSIRO Risk Assessment and Audit Unit and are reported to the CSIRO Executive Team and the Audit Committee. Organisational reviews are undertaken every six months and divisional risk assessments occur on a three year rotational basis.

4.32 CSIRO's approach to risk management in operational areas was recently benchmarked by COMCOVER. CSIRO was rated as above average for all key performance indicators assessed.²⁸

4.33 CSIRO has a corporate risk management policy and manual, which is complemented by a training module on risk management in the Project Leaders' Program. These policies are intended to cover all activities in CSIRO and are

²⁷ The Productivity Commission considered such an approach was appropriate for agencies where commercial operations were a major component of overall activity. See Productivity Commission, 2001, *Cost Recovery by Government Agencies*.

²⁸ COMCOVER assessed organisations against 10 risk management key performance indicators of best practice. They were: integrated risk management approach; committed and led; positive and proactive focus; process driven; planned for continuous improvement; audited and documented; active communication; resourced; trained and educated; and value-based decisions.

implemented in a devolved manner. Project risk assessments are primarily the responsibility of project leaders, who are expected to apply the corporate framework to their project. According to CSIRO policy:

all staff, project leaders, program managers are responsible for identifying potential project risk exposures, developing risk mitigation plans and implementing risk mitigation plans for all high and significant risks.

4.34 Broad areas of project risk are, to some extent, addressed in divisional risk assessments. For example, the risk assessment in one division identified the risk of accidental release of genetically modified material as a division-wide risk that should be addressed in all projects. However, to be fully effective in managing risks, project-level risks need to be addressed appropriately.

Conduct of project risk assessments

4.35 CSIRO policy considers that risk assessment is a key part of research project management and should address both contractual risks (such as the nature of the client or legal risks) and project risks (such as the nature of the project or techniques used).

4.36 The Commercial Practices Manual requires that all projects with a contract have a *contract* risk assessment performed on it prior to being approved by the division chief. This policy was developed in response to perceived under-management of contractual risks. It requires project leaders to assess risks such as the type of customer, type of contract and legal exposure. The ANAO found that the Manual's requirement for contract risk assessment was mostly being implemented. However, some 15 per cent of relevant projects sampled did not have the required contract risk assessment. It would seem appropriate for CSIRO to ensure that all projects comply with the Manual's requirement.

4.37 The conduct of *project* risk assessments is not mandatory. As a result, formal project-level risk assessments are rarely conducted. One of the five divisions examined by the ANAO identified project risks as part of its planning for groups of projects. These risk assessments included consideration of the likelihood and impact of risks, and set out proposed mitigation strategies. However, none of the projects in the ANAO's sample had a project risk assessment consistent with that suggested by CSIRO policy. Project risks were often identified and discussed amongst staff as part of the decision on whether or not to proceed with projects. However, these processes are not the project risk assessments envisaged by CSIRO policy and are rarely conducted in a systematic, structured and documented way which result in risk assessments or plans.

4.38 CSIRO accepts that there is a need to better manage risks at the project level. At the time of audit fieldwork, it was seeking to upgrade its risk assessment procedures through the development of software to standardise the conduct and recording of risk assessments for all projects.

Recommendation No. 5

4.39 The ANAO recommends that project planning address project risk assessments and management to an agreed standard, including project delivery risks.

CSIRO response

4.40 Agreed.

CSIRO has developed a project risk assessment process based on its corporate approach that will be used as a standard for all projects in CSIRO. We have piloted our approach across Divisions and commenced a series of risk assessment training workshops for project leaders. The importance of project delivery risks is recognised and is addressed in this framework.

5. Monitoring and Reviewing Project Performance

This Chapter examines CSIRO's policies and practices in monitoring and reviewing active research projects.

5.1 Monitoring project progress is essential to maximising project performance. Effective project monitoring structures enable project managers to assess a project's progress; identify and address any problems; provide an opportunity to reassess the project; and also assist senior management to identify broad trends in project progress. Robust monitoring structures require sound management processes to ensure all projects are appropriately monitored, and that reliable information on project costs, timeliness and risk is collected.

Project monitoring policy and practices

5.2 As set out at 2.4, there is limited guidance currently available on project management. This is particularly the case with respect to monitoring and reviewing project performance, where guidance applies only to co-investment and consulting projects and is limited to the role of steering committees and monitoring project scope. There is no corporate guidance on the monitoring of project timeliness, costs or risks.

5.3 CSIRO is currently developing new guidance on project management as part of its *Project Management Improvement Project* (see paragraph 26) which, it has advised, will address these limitations.

Divisional practices on project monitoring

5.4 Notwithstanding the lack of guidance, the five divisions examined by the ANAO have each established structures to monitor projects. These vary, but generally include:

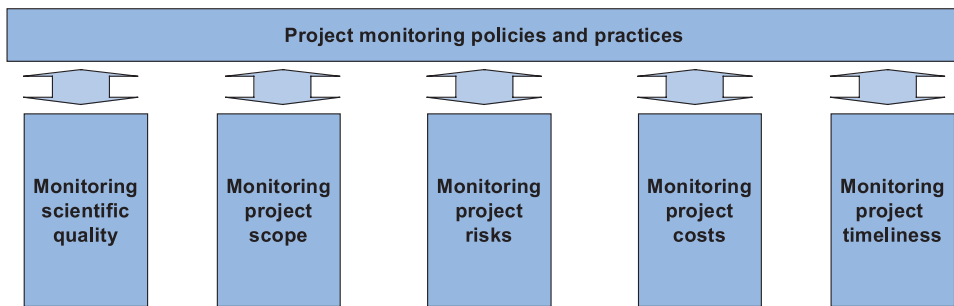
- regular (for example, fortnightly) meetings of the project team;
- meetings (at three- or six-monthly intervals), where senior research managers review the progress of projects under their control;
- annual program reviews, which examine the progress of individual projects within a program and their relevance to the broader research goals of the division and Sector;
- divisional-level meetings to review the overall research portfolio in the division, considering major projects in detail as well as reports on progress

on smaller projects. The focus of these reviews is on scientific outcomes, staffing issues, and scientific achievement of the divisional programs and sub-programs. These occurred at six- or twelve-monthly intervals; and

- reports to Sector Advisory Committees on implementation of Sector Plans. These usually occur at least annually, and focus on the technical achievements of the projects.

5.5 This Chapter assesses the effectiveness of the monitoring mechanisms discussed above in addressing the key aspects of project progress described at Figure 12.

Figure 12
Monitoring of projects



Source: ANAO

Monitoring scientific quality

5.6 The quality of CSIRO's scientific research is central to its effectiveness. All divisions had rigorous processes in place, typically including compulsory review of scientific reports and results by supervisors (and usually several other scientists). Internal quality assurance of scientific material produced by projects was a particular feature of project management practice. Some divisions also commissioned regular review of important programs by external scientists of international standing to ensure that its scientific resources are appropriate and consistent with world better practice.

5.7 Staff had a notable commitment to delivering the best possible scientific outcome to clients, and the ANAO observed that this is a strength of CSIRO. The ANAO found that senior staff were closely involved in monitoring scientific developments in individual projects and applied high scientific standards. The various levels of review also provided accountability and transparency to the discussion of scientific issues. The impact of these mechanisms is discussed further in Chapter 6 in generating a positive reputation for CSIRO scientific capacities with clients and international peers.

Monitoring project scope

5.8 One of the major challenges in project management is to control scope change in projects and thus ensure that projects remain relevant to client or organisational needs. This is particularly the case in CSIRO's environment, where many projects face high scientific uncertainty. Projects may lose relevance by not adhering to agreed scope, or by not responding to changes in the environment that would justify changes.

5.9 The importance of addressing this is reflected in the Commercial Practices Manual, which states (for co-investment and consulting projects):

any changes to the [project] workplan should be very carefully considered and the advice of those involved in negotiating the original workplan, or other advice as needed, should be sought. In any event the implications for project pricing and costing will need to be considered before embarking on the change.

5.10 Systematic processes for dealing with scope change, such as explicit processes for agreeing to and documenting such changes, are therefore an important part of sound project management practice.

5.11 CSIRO advised that project scope change is managed as part of the project review arrangements discussed at 5.4. However, there is limited structure in the way in which these arrangements address project scope change, increasing the risk of inconsistencies in the rigour of scope change management and control and supporting management information. For example, the ANAO found that there was appropriate approval of scope changes requiring contract variation, where a client seeks to vary the agreed project. However, in contrast, where the scope change does not impact on contractual obligations (for example, for appropriation projects, or the CSIRO component of co-investment projects), the ANAO was often unable to establish because of inadequate documentation, whether these had appropriate approval of scope change and adequate consideration of the implications, consequences and reasons for the change.

5.12 Some of the potential consequences of weaknesses in processes to manage scope change are illustrated in the following examples:

- there was a change in project direction following a take-over of the client company. However, there was no structured or documented reconsideration of the revised project's relevance to Sector Plans, nor of the need for reassessment or change to the project budget;
- changes to scope and budget of a project were appropriately approved by a program manager but not reflected in PSS. The inaccuracy of the budget in PSS reduces assurance that the key management system consistently reflects approved budgets for project management and review purposes; and

- a project was terminated. However, costs from other projects were being charged to the terminated project's code in PSS. This gives a misleading impression both of 'loss' for the terminated project and inflates any surplus for the other projects, distorting management cost out turn information.

5.13 Overall, the ANAO found that scope changes were poorly documented, making it more difficult to assess current project progress and conduct project completion review (see paragraph 6.10).

Recommendation No. 6

5.14 The ANAO recommends that CSIRO articulate standards and procedures for approving, managing and documenting scope change for projects.

CSIRO response

5.15 Agreed.

CSIRO will articulate recommendations on scope changes for projects appropriate to their nature as part of the project management guidelines referred to in its response to Recommendation 1.

Monitoring project risks

5.16 Effective processes to assess and manage identified risks and unforeseen issues facilitate prompt and appropriate corrective action. Current standards on risk management reinforce the value of management systems capturing information on risks, and ensure that it is reviewed regularly both to ensure currency and to enable lessons to be learned and disseminated to other staff.²⁹

5.17 The importance of risk review is recognised in the CSIRO Risk Management Policy which states that 'regular monitoring and review of risk exposures, and effectiveness of risk management strategies is essential.' At the project level this is a responsibility of project leaders, although policy does not provide specific guidance on how to do this.³⁰

5.18 This policy is complemented by the Project Leadership Program (PLP) and other training, which address risk monitoring and identify the management of unforeseen project problems ('issues') as a 'critical success factor' in project management. The PLP manual states that the 'issues log is one of the key control tools for the project manager'.³¹ Such logs should record issues that may affect

²⁹ Standards Australia, *AS/NZS 4360, Risk Management* (1999).

³⁰ CSIRO Risk Assessment and Audit Branch, *Guidance Notes for Implementing CSIRO's Risk Management Policy*.

³¹ The PLP documentation states that 'monitoring of risks during the life of the project is an important aspect for a project manager', and provides guidance on how to monitor project risks, and to review and update the risk management plan.

the progress of the project and allow managers to track the status of the issues until they are resolved.

5.19 The ANAO found that project leaders and more senior management do consider project risks as part of the general divisional project review processes. These reviews deal mainly with scientific or methodological issues but in some cases identified risks in the context of ‘concerns and progress’ about a particular project. Staff do also consider other factors that might affect project success, such as changes in the environment or actions by other agencies and stakeholders.

5.20 As discussed at 4.37, however, CSIRO research projects do not have the individual project risk assessments which are necessary for a structured review of risks. As a result, risk review was informal and unstructured. None of the projects reviewed by the ANAO maintained an issues log as recommended by the PLP manual. Nor was there any other mechanism to systematically capture information on unforeseen problems with the project. The ANAO also found that there was no structured process for reviewing, through the life of a project, the risks and mitigation strategies identified in the contract risk assessment.

5.21 CSIRO is developing a computer-based risk management system which, inter alia, will be able to support project risk monitoring and review. The tool will be a valuable aid to monitoring project risks. The ANAO considers that its impact will be enhanced by supporting policies and procedures to establish the desired level of project risk management, consistent with Recommendation 5.

Monitoring project costs

5.22 Reliable and accurate information on project costs is necessary to monitor project progress and to support prompt decision making and corrective action.

5.23 CSIRO has no policies or standards for the tracking of project costs. However, the ANAO found that project leaders and their supervisors are generally focused on the need to deliver results within available budgets, particularly for external clients.

5.24 The Project Support System (PSS) is intended as the key tool for monitoring expenditure on projects and comparing this with the project budget (see paragraph 2.20). The ANAO found that divisional managers and project leaders made extensive use of PSS in monitoring overall research expenditure at the divisional level. However, the ANAO found that inadequate data or inconsistent approaches between divisions affected the capacity of CSIRO to monitor individual project costs effectively, particularly at the corporate level. This is discussed below.

Categorisation of projects in PSS

5.25 As previously discussed (see paragraph 2.23), divisions take varying approaches to entering projects into PSS. For example, in some divisions multiple projects are included in a single project ‘code’ in PSS. This is particularly the case for appropriation projects. This practice limits CSIRO’s ability to accurately track and control the costs of such projects, and reduces the assurance that the costs of such projects are effectively controlled.³² The practice limited the extent to which the ANAO could conduct analysis of trends in project costs below, and in analysing final project cost outcomes in Chapter 6.

Recording of labour costs

5.26 Labour costs are often the major cost in research projects. They therefore merit close monitoring to ensure that CSIRO is aware of the true costs of a project and to identify any patterns over or under-expenditure. The actual costs charged to a project depend both on the elapsed time of the project, and the amount of effort devoted to the project over time.

5.27 At the start of a project the labour likely to be involved (in terms of an attribution of a percentage of each researcher’s time) is estimated and entered into PSS. For effective monitoring, the actual labour time devoted to the project would be periodically reviewed against these estimates. However in practice, the frequency of such review varies widely, with differences due more to divisional practices than to characteristics of projects. One division examined requires all staff to record each fortnight the actual time they spend on projects, using an existing function within PSS—a practice known as ‘effort logging’. This division’s recording of the time spent on project activities represents better practice and provides greater assurance of the actual costs of a project than the practices observed elsewhere.³³

5.28 Other divisions examined did not implement effort logging. Instead they aim to review staff attributions at least annually but, in practice, the attributions are rarely, reviewed or revised. Furthermore the basis of any reviews undertaken are subjective, as there is no system for recording time or effort in these divisions. Consequently, some project leaders advised that the staffing attributions in PSS, which determine project costs (and therefore fees charged to customers) are often not accurate after the first year of the project.

³² The use of such codes may be appropriate in some circumstances, for example where the activity is a series of repeated tasks, such as a testing or analytical process and would not justify a separate project code.

³³ The CSIRO Financial Discipline Group, *Subsidy Elimination from Contract R&D, Consulting and Technical Services Provision*, also recommended the introduction of agency-wide effort logging (Recommendation 2).

5.29 The ANAO concludes that these practices have not achieved accurate information on the labour costs of a project. CSIRO has now decided to introduce effort logging across the organisation progressively during 2002. This has the potential to markedly improve the reliability of project costing data observed during this audit.

Categorisation of expenditure and revenue

5.30 CSIRO guidance envisages that the tasks recorded in PSS as making up a project should be based on the actual structure of the project.³⁴ As discussed at 2.23 some divisions split every project into two sub-tasks, one appropriation funded and one externally funded, in order to streamline accounting to funders. Other divisions split projects along functional lines, based on the work needing to be done for the project. A further variation is that some divisions record appropriation funding as income to a project, while others record it as a deficit item.

5.31 These variations markedly reduce the capacity of CSIRO to monitor trends in expenditure across its research portfolio, and identify, for example, areas or projects that are worthy of more detailed examination. CSIRO has recognised these difficulties, and is planning to introduce a new, standardised, method of accounting for project costs.

Appropriation budgets and expenditure

5.32 A precondition for effective monitoring of project cost is for relevant systems to record project budgets. However, the extent to which this occurred varied widely for appropriation projects, and for the appropriation funded component of co-investment projects. Some divisions recorded budgets for all individual appropriation projects, whereas others did not record project-level budgets.

5.33 Until recently one of the five divisions examined did not record budgets on PSS for both appropriation projects and for the appropriation component of co-investment projects. This prevented the division from readily comparing expenditure of appropriation funded research with a baseline budget. This practice has now changed and it now enters budgets for new projects.

5.34 More broadly, the deficiencies in the recording of budgets limits CSIRO's ability to monitor, identify and assess for action cost overruns. This creates the risk that other appropriation activities and goals may not be met in order to

³⁴ Guidance for entering projects into PSS states that 'Activities are the physical tasks which make up a project. The completion of a project depends on one or more activities being carried out, staff and resources allocated to undertake the activities and sufficient support for the activities is provided.'

fund overruns, or that appropriation funds may be used to inappropriately support co-investment and consulting projects. Such outcomes and impacts may remain undetected because of the data limitations.

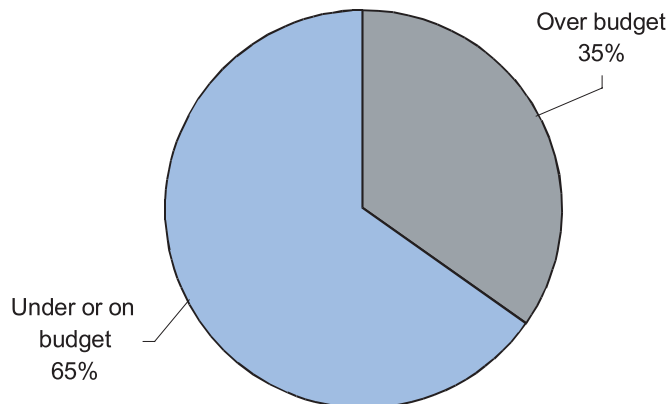
Analysis of project cost trends for consulting projects

5.35 The above practices in recording project costs and budgets made the analysis of actual costs for current ‘active’ appropriation and co-investment projects problematic. Data on active consulting projects had fewer limitations (as they should not have any appropriation funding) and the ANAO sought, with CSIRO assistance, to obtain indicative information of the current costs for all such projects against the indicated final project revenue shown in PSS. As consulting projects are intended to recover all costs, the costs of projects still incomplete should be less than the contracted price for the completed project—i.e. should be showing a profit.

5.36 According to PSS, the costs of over a third of active (i.e. incomplete) consulting projects had already exceeded their contracted revenue as illustrated in Figure 13. The overruns shown in PSS may be caused by a variety of causes including categorising projects as ‘consulting’ when in fact they are co-investment projects.³⁵ However, the level of over-runs suggests that cost control at the individual project level requires management investigation, and raises the risk of unplanned taxpayer subsidy/revenue for projects as such overruns are occasionally met from appropriation sources, rather than commercial reserves.

Figure 13

Percentage of active consulting project expenditure over/under-runs



Source: ANAO analysis of CSIRO data

³⁵ The costs are also subject to the same caveat at 5.28 that although staff time continues to be charged to projects while the project continues, the extent to which the attribution reflects actual effort is uncertain.

Funding of overruns for co-investment and consulting projects

5.37 However well projects are managed, some will exceed their planned budget. Sound financial management seeks to ensure that there are reserves available from previous profits to cover any such overruns, so that appropriation funds are not used more than intended to support projects with an external client. Divisions do generally hold such reserves. However the ANAO found that in at least one division, appropriation funds had been used to cover shortfalls in co-investment and consulting projects. In that division, of the total shortfall of \$0.41m, around half was funded from appropriation funds and the remainder from program commercial reserves. This practice was identified as a broader problem by an external review of financial capability in CSIRO in 2001 which stated that:

Appropriation revenues are seen in those divisions as paying for salaries, overheads and capital items. External revenues are seen as paying the direct, variable costs incurred in science work. The tendency is for the appropriation expenditure activities to be more flexible and hence available for covering shortfalls in external revenues.³⁶

5.38 Given the acknowledged importance of sound management of appropriation funds, developing guidance on the tracking and handling of such overruns would seem desirable to ensure that they are not met from appropriation sources.

Recommendation No. 7

5.39 The ANAO recommends that CSIRO record on PSS budgets and the actual effort expended on projects, including for appropriation projects, and develop procedures on the monitoring and funding of project cost over-runs.

CSIRO response

5.40 Agreed.

This process is already underway. For example effort logging will be progressively introduced in divisions where it is not currently utilised from 1 July 2002.

³⁶ KPMG Consulting, *Review of Financial Management Capability Across Divisions of CSIRO* (February 2001), p. 16.

Monitoring project timeliness

Management information on project timeliness

5.41 CSIRO does not have guidance or policy on the tracking of project progress. As a result, divisions vary in the means and extent to which timeliness data is collected and analysed for management review.

5.42 One of the five divisions examined is progressively entering into the PSS all milestones data for co-investment and consulting projects.³⁷ Two other divisions use offline systems to monitor the achievement of financial milestones for co-investment and consulting projects; this is primarily driven by the need to invoice appropriately. Two divisions do not record milestone achievement in any divisional system.

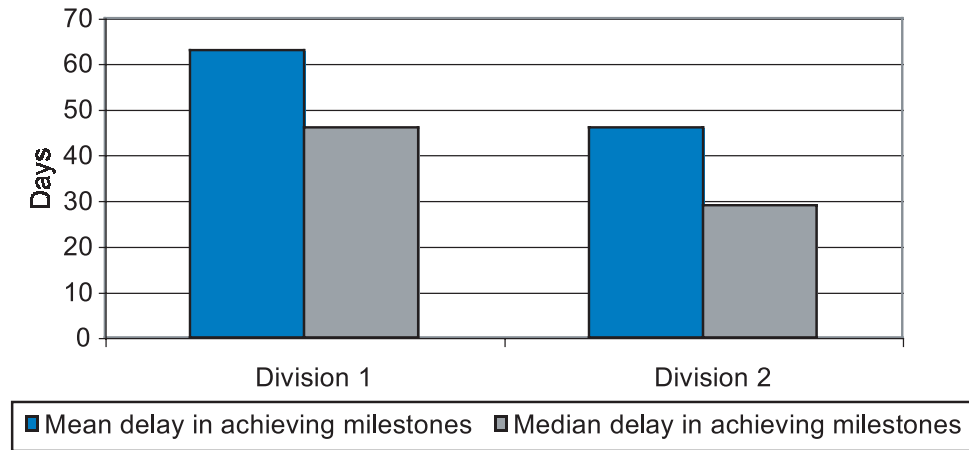
5.43 Recording of milestones for appropriation projects was particularly weak. None of the five divisions had systems in place to monitor achievement of milestones in appropriation projects. This makes it likely that delays in appropriation projects will be detected far less promptly than for equivalent co-investment or consulting projects.

5.44 At the time of audit fieldwork, some divisions were reviewing and improving the collection of timeliness data. In particular, divisions were investigating the use of the PSS to track milestones. The ANAO noted, however, that the PSS was only able to track milestones for co-investment and consulting projects, and that there was no corporate facility for appropriation projects. The ability to track milestones in PSS was also limited by the way projects were identified in PSS, discussed earlier in this report at 5.25.

ANAO analysis of project timeliness

5.45 Limitations in reliability of data recorded on PSS means that there were insufficient data to draw general conclusions about the timeliness of CSIRO's research projects. However, two divisions had comparable data available on the timeliness with which financial milestones were met (for co-investment and consulting projects). These are set out below in Figure 14. The data show that the divisions had a median delay in meeting milestones of 42 and 28 days respectively.

³⁷ This capacity was introduced in 2000.

Figure 14**Delays in meeting financial milestones for 2 divisions: 2000–2001**

Source: ANAO analysis of CSIRO data

5.46 The data are insufficient to draw general conclusions about the timeliness of CSIRO’s research projects, but suggest that some projects are significantly delayed. A more systematic collection and analysis of such data would provide greater insight into the effectiveness of an important element of project management.

Recommendation No. 8

5.47 The ANAO recommends that achievement of milestones is recorded in relevant information systems.

CSIRO Response

5.48 Agreed.

It needs to be recognised that there is a significant difference in the nature of the milestones used to track a ‘commercial’ project and those used to measure progress of appropriation funded research projects. CSIRO is making a significant investment in enhancing the project management capability of our information systems through the e-CSIRO initiative. These enhancements will allow capture of milestone information appropriate to the project context.

Conclusion on project monitoring

5.49 CSIRO has implemented a range of processes to regularly monitor and review project progress. These processes have a particular focus on maintaining scientific quality, and are robust in this regard. Processes to monitor changes to

project scope and risks were less systematic and transparent, particularly for appropriation projects. Furthermore, CSIRO’s ability to monitor and review project costs and timeliness was significantly reduced by inadequate or inconsistent data in key management information systems. CSIRO is considering relevant enhancements to policy and systems which, if implemented well, should markedly improve its corporate governance in these areas. Relative strengths and weaknesses of the monitoring processes are summarised below in Table 4.

Table 4
Current CSIRO monitoring processes

Extent to which CSIRO project monitoring:				
<i>Dimension of project performance</i>	includes management review	is supported by clear standards and guidance	supports accountability and transparency	uses reliable, management information
Science	✓	n/a	✓	n/a
Scope	✓	x	p	✓
Risks	✓	p	x	x
Costs	✓	p	p	p
Timeliness	✓	p	p	p

Source: ANAO analysis

Notes:

x - none or limited

p - partially effective

✓ - largely effective

n/a – not applicable

6. Assessing Project Outcomes

This Chapter examines CSIRO's policies and practices for assessing project outcomes.

6.1 Sound project management approaches assess and analyse the extent to which projects achieve their outcomes. This provides assurance that projects are succeeding; identifies any problems that can be addressed by management; and suggests lessons learned to improve future project management.

6.2 This Chapter examines:

- CSIRO's methods for assessing project outcomes; and
- the available data on project outcomes achieved in terms of their scientific outcomes, timeliness and costs.

Methods for assessing project outcomes

CSIRO scientific benchmarking

6.3 As a research organisation the quality of the science applied to CSIRO's projects is fundamental to achieving its goals. The recent *Strategic Action Plan* stressed the importance of CSIRO's science base to its future strategies.

6.4 CSIRO regularly monitors its scientific performance, in terms of its contribution to scientific research and knowledge through international scientific literature benchmarking. The results of this are discussed below at 6.20. CSIRO is also planning, as part of the implementation of the *Strategic Action Plan*, to conduct detailed assessment of its performance in scientific publications.

Customer satisfaction surveys

6.5 CSIRO is an increasingly client-oriented organisation, with over 70 per cent of projects having some external funding (i.e. other than appropriation funding). Regular assessment of customer satisfaction enables organisations to gauge the extent to which they are meeting client needs and satisfying expectations. CSIRO's policy reflects this, requiring divisions to collect data on customer satisfaction on both completed and in-progress co-investment and consulting projects.

6.6 However, at the time of audit fieldwork the ANAO found that the requirement for customer satisfaction measurement was not consistently implemented, with two of the five divisions examined not following this policy. One of these two divisions had not conducted a recent survey; the other division surveyed stakeholders rather than customers.

6.7 The ANAO also found that there was a wide variation in the design and conduct of surveys in the three divisions that did conduct surveys. The divisions used differing means (mail or telephone), questions, rating scales and topics, and focused on different types of customer. As a result the findings were not comparable across divisions. Furthermore, only two divisions sought to survey customers of *both* current and completed projects, as is required by the Commercial Practices Manual.

6.8 CSIRO has recognised the shortcomings of these approaches to customer satisfaction measurement and has identified the need for improved customer satisfaction measurement as a part of its *Strategic Action Plan*. During the latter part of audit fieldwork it developed a new common customer satisfaction measurement instrument, known as the 'Customer Value Survey' (CVS). This survey will be run centrally across a sample of CSIRO clients and replace the existing division-based customer survey instruments for reporting on customer value/satisfaction. The findings of the first survey became available at the conclusion of this audit, and are discussed at 6.23.

6.9 The above surveys, including the CVS, address co-investment and consulting projects only. As appropriation projects do not have a 'customer', CSIRO has no similar means of gathering views on the conduct and value of such projects. Such projects do, however, often have significant external stakeholders who might be surveyed. CSIRO is currently considering formalising processes for seeking feedback on the achievements of appropriation projects.

Project completion reviews

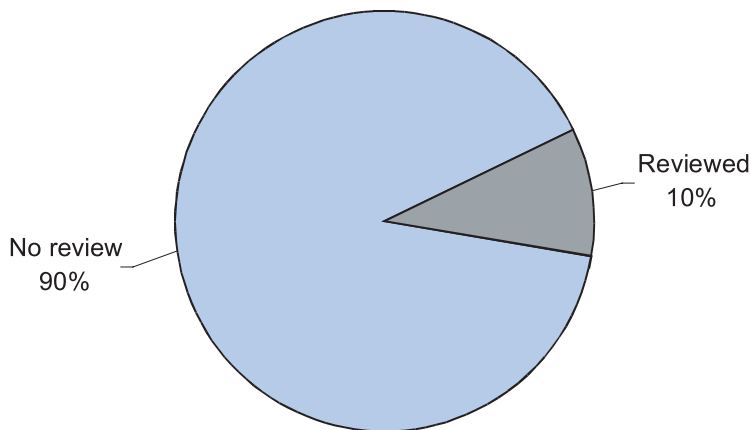
6.10 Project management standards indicate that an internal evaluation of the conduct and impact of a project after it is completed is valuable. It provides a means of identifying areas of better practice; aids planning and estimating future projects; and generally improves the level of project management in an organisation.

6.11 CSIRO has a two-tiered policy on project completion review for co-investment and consulting projects. Firstly, each division is required to develop an annual plan for the evaluation of completed projects and contracts. The ANAO found that none of the divisions under review had such a plan. In most cases relevant staff were unaware of the requirement for such a plan.

6.12 Secondly, CSIRO requires that 'significant' co-investment and consulting projects should be subject to a 'Project Completion Review'. The reviews are expected to address the quality of science process, identification of factors affecting project success and whether the project was completed within original or amended cost and time estimates.

6.13 In practice, such reviews are rarely conducted in the divisions reviewed. CSIRO and relevant staff advised that this was due to competing resource demands and budgetary requirements to start the next project. As shown in Figure 15 only 10 per cent of completed co-investment and consulting projects assessed by the ANAO had been subject of a Project Completion Review.³⁸ Those that were conducted tended to focus on scientific outcomes and lacked quantitative data on time and cost outcomes.

Figure 15
Frequency of Project Completion Reviews



Source: ANAO analysis of CSIRO data

6.14 CSIRO does, however, conduct reviews of some aspects of a project where this is required by a client. Typically, such reviews focus on scientific results. There is little or no consideration of project management issues such as are required to meet the CSIRO policy for project completion reviews.

6.15 There is no requirement for appropriation projects to have a project completion review. Reflecting this, none of the closed appropriation projects examined by the ANAO had such a review.

6.16 CSIRO acknowledged that there is a lack of formal project completion review but explained that there is continual assessment of project progress. However, these reviews are a policy requirement and are a valuable source of insight on the effectiveness and efficiency of project management arrangements. Sound governance arrangements would seek to ensure that the project plans and budgets addressed the need for such reviews, and that they are given appropriate priority by management.

³⁸ Although the Commercial Practices Manual does not define 'significant' the projects in the ANAO's sample were generally medium to larger projects and therefore likely to have been subject to the policy.

Recommendation No. 9

6.17 The ANAO recommends that, in order to maximise organisational learning from project management experience, CSIRO implement a systematic approach to project completion review that addresses the key aspects of project performance.

CSIRO response

6.18 Agreed.

Post-project reviews will be mandated in the new standards for project management. CSIRO is developing an organisational-wide Learning and Development matrix that will facilitate the dissemination of organisational learning from project management experience.

Project outcomes achieved

Scientific outcomes

6.19 CSIRO devotes extensive effort to monitoring the quality of the science in its projects (see paragraph 5.6).

6.20 This audit did not directly assess the quality of scientific analysis by CSIRO or the scientific outcomes of its research projects. However, CSIRO advised that there had been recent external reviews and benchmarking of CSIRO's scientific performance. Broadly, these indicate that CSIRO ranks highly on international comparisons for the quality of its research. For example, a recent international analysis of publications citations by *ScienceWatch* magazine found that:

- CSIRO ranked 3rd internationally in environmental science/ecology. Over the decade CSIRO published 1523 scientific papers in this field, which were cited 14 385 times by other researchers;³⁹
- CSIRO was ranked fourth internationally in agricultural science. It produced 1461 papers which were cited 9049 times;⁴⁰ and
- overall, CSIRO ranked in the top one per cent of scientific institutions in the world in 12 out of 22 scientific disciplines.⁴¹

³⁹ King C. (Ed) (2001). Heavy Hitters, Outsized Influence. *Science Watch*. 12 (4). p 1-2.

⁴⁰ *ibid.*

⁴¹ ISI Essential Science Indicators, March 2002.

6.21 In addition, recent studies, which included benchmarking of CSIRO against other similar agencies in other countries and the conduct of cost-benefit studies of major projects, commissioned by CSIRO for the purposes of a pricing review found:⁴²

- CSIRO is a world-class research organisation. It exhibits a robust citation performance in world terms with a citations per publication rate at least 30 per cent higher than the world average; and
- the benefits of CSIRO research are substantially greater than the cost of undertaking the science. These returns include lower unit production costs, new products, reduced business risk, improved human health, reduced pollution and improved environmental health. An assessment by the Centre for International Economics (CIE) for the pricing review indicates the return on some successful CSIRO projects is high. Detailed benefit cost analysis of four major CSIRO projects shows their likely long-term benefits range from \$5.7 billion to \$7.8 billion.

6.22 The ANAO also found that stakeholders, such as members of Sector Advisory Committees, considered CSIRO provided high quality scientific advice.

6.23 Findings from the initial CSIRO Customer Value Survey (see paragraph 6.8) also indicated that CSIRO was rated most highly by clients for using a rigorous scientific approach.

6.24 Research organisations also need to monitor the quality of research outputs delivered in projects at the individual project level, as is envisaged by the CSIRO policy on Project Completion Reviews.

6.25 The lack of such reviews, however, limits the ability of CSIRO management to assess this important aspect of project performance. This also prevented the ANAO from forming an opinion on the quality of scientific outcomes in individual projects. However, where reviews were available, these generally showed positive of feedback from clients on the quality of research. Examples of feedback include:

- ‘the report is very comprehensive and shows that there is great scope for producing antennas with improved coverage’; and
- ‘...the team demonstrated...scientific excellence’.

⁴² At the time of the audit the output pricing review was still in draft form and under embargo.

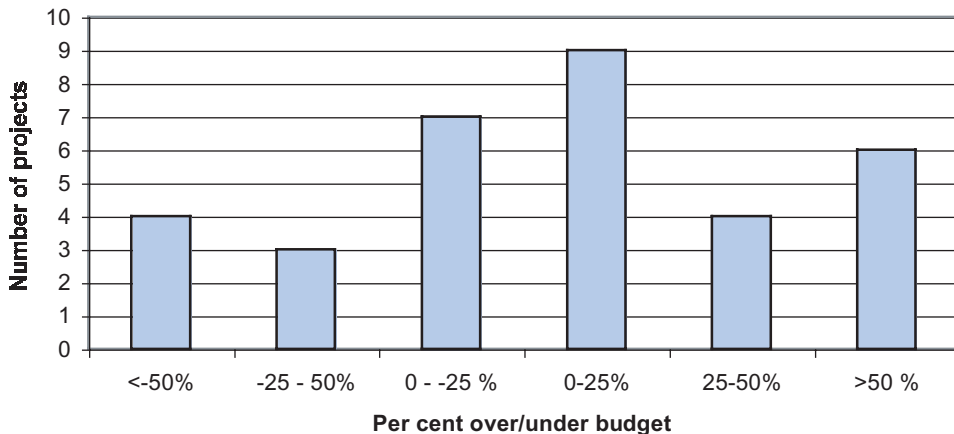
Cost outcomes

6.26 As discussed at 5.30, the data available from the main system used to monitor project costs (the Project Support System) is entered in different ways across CSIRO, and with varying degrees of completeness. This greatly limited CSIRO's ability to assess cost outcomes for finished projects, as does the lack of data in project completion reviews.

6.27 However, the ANAO was able to conduct two analyses of project cost data for such projects. The first was of a small sample of closed co-investment and consulting projects where PSS data could be supplemented by individual file reviews. Figure 16 shows the extent to which projects met or exceeded their budget. Fourteen of the sample of 33 exceeded their planned costs, in some cases by over 50 per cent.

Figure 16

Achievement of budgeted outcomes on a sample of 33 closed consulting, co-investment and appropriation projects



Source: ANAO analysis of CSIRO data

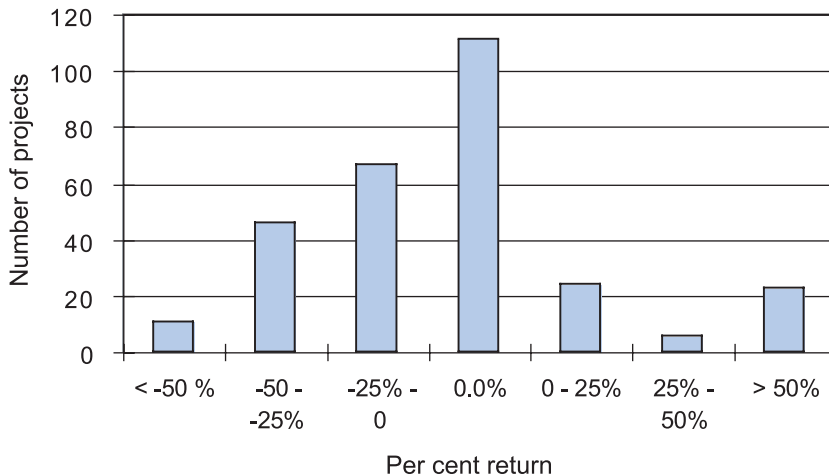
6.28 The second analysis by the ANAO was of all recently closed consulting projects in CSIRO. As set out at 5.35 data on these types of projects is more reliable than that for other types of projects.⁴³ To improve the reliability of the analysis projects were chosen in consultation with divisions, and a specific PSS report was developed in consultation with CSIRO.

⁴³ Due to the lack of budgets for appropriation components for co-investment projects and other data limitations, these projects could not be analysed.

6.29 Total revenue for 288 completed consulting projects was \$17.5 million, and total costs \$19.6 million, resulting in a net loss of \$2.0 million, or a negative return of some 10 per cent overall.⁴⁴ The distribution of the returns is shown at Figure 17. Of the projects, around 40 per cent showed negative returns. This pattern of cost over-runs is similar to that found in the analysis of active projects at 5.36.

Figure 17

Distribution of 288 closed consulting projects by rate of return



Source: ANAO analysis of CSIRO data.

6.30 It may be that projects showing exceptionally high or low returns were inaccurately recorded in PSS, although this could not be established on information available. The ANAO also found a large number of projects (48 or nearly 20 per cent) where costs exactly equalled revenues (to the nearest dollar), suggesting that amounts recorded in PSS may have been the product of internal accounting policies. Overall, the negative return on consulting projects is of concern given that such projects in general seek to generate surpluses.

6.31 Project costs can exceed budgets for several reasons. The ANAO found several co-investment and consulting projects within its sample of closed projects that had exceeded their budget. Examples included:

- a tender for air pollution research in a South East Asian country. CSIRO submitted an incorrect budget which underestimated costs by \$40500. Rather than seek to re-negotiate the budget, CSIRO agreed to conduct the research at the original, lower budget and subsidise the project;

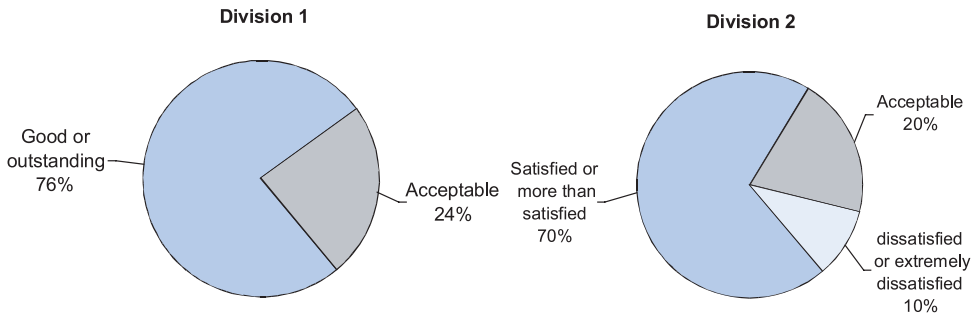
⁴⁴ PSS Report run 15 October 2001. *Consultancy Costing (2)*. Report parameters were developed in consultation with CSIRO Corporate Finance.

- a small air quality project. This project had been intended to be fully cost-recovered, however its costs had grown to a level twice that of the contracted revenue of \$27 000. The overrun had not been drawn to the attention of management;
- a project had an approved budget of around \$300 000 but was aborted shortly (two weeks) after it commenced; however, some \$60 000 costs has been charged to the project. The ANAO was advised that most of these costs did not in fact relate to the project but were costs incurred in preparatory work for other projects;
- a telecommunications project to supply advanced devices. It was intended that this project would make a surplus of around 21 per cent. However, actual costs exceeded the contracted revenue by more than 80 per cent (\$495 000) without management approval. The cost-overrun subsequently received management approval as a 'loss leader' in a promising area of commercial research.

6.32 CSIRO data discussed at 1.13 indicates that currently around 40 per cent of expenditure (or \$50 million) on consulting projects is currently drawn from appropriation funding. The appropriation contribution to such projects is due to a range of factors, including inaccurate categorisation of projects as 'consulting' when in fact they may be co-investment or appropriation projects, inadequate cost control and inaccurate allocation of costs within PSS (see the examples at paragraph 6.31). Such a significant contribution of taxpayer funds suggests that the funding of consulting projects merits close management review. This has been recognised by CSIRO, which is intending to introduce new standardised accounting procedures for all projects and other measures to reduce any cross-subsidisation.

Customer views on cost outcomes

6.33 There is limited information available on customer views of CSIRO's project management performance in cost outcomes. What data is available for two divisions is summarised in Figure 18, suggesting that customers are generally satisfied in relation to cost outcomes. This data was based on surveys conducted prior to the introduction of the new Customer Value Survey (CVS) in late 2001. In the survey CSIRO gained a relatively low score for price competitiveness and was seen as 'expensive but mostly of value'.

Figure 18**Customer satisfaction with cost of project delivery in two divisions: 2001**

Source: ANAO analysis of CSIRO data

Project timeliness

Milestone achievement

6.34 In Chapter 5 the ANAO used divisional data to indicate CSIRO's timeliness in meeting milestones for currently active projects. In the absence of data from project completion reviews that identified the extent to which projects were delivered within estimated time, or of reliable quantitative data on the timeliness of project completion, the ANAO conducted an analysis of completed projects where data was available from individual file reviews. Of these:

- five were completed before or on time;
- the remaining eleven projects were late by between one month and eight months.

6.35 This sample, combined with the trends identified in analysis of active projects in Chapter 5, and customer views discussed below suggest the timeliness of project completion merits attention by CSIRO management.

Customer views on project timeliness

6.36 There is limited available information on customer views of CSIRO project management performance in delivering timely results. Earlier, division-specific surveys also identified that project timeliness was a concern, with one division's survey finding that 17 per cent of clients were dissatisfied or extremely dissatisfied with the timeliness of project delivery. The more recent (November 2001) CVS identified that timeliness of project delivery was sometimes an issue of concern to clients.

Canberra ACT
23 May 2002



P. J. Barrett
Auditor-General

Appendix

Appendix 1

The Australian Bureau of Statistics research categories

In general, research can occur across a spectrum from pure basic research to experimental development. The Australian Bureau of Statistics uses the following categories:

- **pure basic research** is experimental and theoretical work undertaken to acquire new knowledge, without looking for long-term benefits other than the advancement of knowledge;
- **strategic basic research** is experimental and theoretical work undertaken to acquire new knowledge, directed into specified broad areas in the expectation of useful discoveries. It provides the broad base of knowledge necessary for the solution of recognised practical problems;
- **applied research** is original work undertaken primarily to acquire new knowledge with a specific application in view, either to determine possible uses for the findings of basic research or to determine new ways of achieving some specific and predetermined objectives; and
- **experimental development** is systematic work, using existing knowledge gained from research or practical experience, that is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.

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