Collaborating to a purpose

1. Executive summary

Introduction

The Cooperative Research Centres Program was established by the fourth Hawke Government in 1990, having been designed by Professor Ralph Slatyer, the then Chief Scientist, primarily to encourage collaboration in research and development between the private sector and the public sector research bodies but also to address research concentration for world-class teams and preparing PhD graduates for non-academic careers.

To date there have been 10 selection rounds resulting in 168 CRCs over the life of the Program (102 if renewals and new-from-existing are not counted separately). In 2007-08 there were 58 CRCs. Of these, 25 were in their 1st term, 16 in their 2nd term and 17 in their 3rd term. Nine CRCs reached the end of their funding term in June 2008, hence there are 49 CRCs receiving funding in 2008-09. The first selection round resulted in 20 CRCs; the last round in 2006 resulted in 3 new CRCs, 7 new-from-existing CRCs and 4 extensions.

The total investment by the Commonwealth is of the order of $3 billion, with almost $9 billion (in kind and in cash – tied and untied) leveraged from participants - including approximately $2.9 billion from universities; $2.3 billion from industry; $1.6 billion from government endusers; and $1.1 billion from CSIRO.

Since its inception, the Program has delivered significant, identifiable economic and social benefits, particularly through end-user application of research.

As a discrete part of the broader review of the National Innovation System (NIS), the Minister for Innovation, Industry, Science and Research, Senator the Hon Kim Carr, announced a Review of the Cooperative Research Centres Program on 22 January 2008. The Chair of the Review was Professor Mary O'Kane; she was supported by the Collaboration Working Group (CWG) of the National Innovation System (NIS) Review.

The Review looked at the general issue of collaboration and its place within the NIS; and at how the CRC Program fits with other programs in the NIS in contributing to national productivity and social good through collaboration. The Review took note of some consistent themes coming through the consultations and submissions and sought to understand these in the light of the CRC Program's evolution, as reflected in data on the Program and changes to the selection criteria. It also considered how changes in funding and incentive systems for CRC participants, especially the public-sector research providers, have affected the way these participants have interacted with the Program. In line with its terms of reference, the CWG also drew on the Productivity Commission's Research Report of 9 March 2007, *Public Support for Science and Innovation*.

Why collaborate?

There are many benefits to be had from bringing groups of researchers and end-users together. These include the achievement of critical mass; overcoming fragmentation

caused by distance and a smaller resource base; bringing together different perspectives, experience, skills and knowledge; breaking down specialist silos and restrictive organisational boundaries and fostering cross-disciplinary interactions; encouraging skills and knowledge transfer; promoting mutual understandings; and managing risks.

These benefits of collaboration underpin the CRC Program. However, the Review emphasises that collaboration should not be an end in itself but a means to generate productive and innovative outcomes for both the collaborators and the taxpayers whose funds are invested in the Program.

Governments at all levels have been active in encouraging collaboration in the NIS. From the 1980s onwards there has been an increasing understanding of the need for Commonwealth Government support for collaboration to tackle high-risk projects, and a variety of programs has been introduced, including CSIRO National Research Flagships, ARC Centres of Excellence, ARC Linkage Grants, and, very recently, NHMRC Partnership for Better Health Grants. These have been complemented by a range of State government programs.

A recent ABS study found that innovative firms show a strong tendency to collaborate – but with other firms. Of those firms which collaborate, only about 3% do so with government organisations and about 2% with higher education research organisations[1]. Australia still needs programs such as the CRC Program to bridge the gap between our strong public-sector research capacity and its potential use by innovative Australian firms.

While about 570 Australian firms have participated in CRCs, funding even in a large program such as this is limited, and consequently the firms participating represent only a small fraction of all Australian firms. However the CRC Program has had a whole-industry impact in CRCs where there is strong drive from a strong industry intermediary. For example, large numbers of agricultural businesses have benefited from rural Research and Development Corporations' involvement in CRCs; and mining businesses have benefited from the broker role AMIRA International has played in mining CRCs. The Review suggests that in future the Program encourage more CRCs with impact across broad groupings of end-users.

The CRC Program has changed focus over time

Analysis of the Program's objectives, selection criteria and guidelines reveals that the CRC Program has changed considerably since its inception. While cooperative research is still the underlying raison d'être for the Program, the early ideals of enhancing and expanding the nation's overall scientific and technological research capability to support broadly stated national objectives have been replaced by a heavy emphasis on supporting end-user driven research and research capable of producing commercial return. While the early guidelines looked for a balance between strategic pre-competitive research and shorter-term research leading directly to application or commercialisation, the later guidelines placed an absolute focus on commercialisation/utilisation of outcomes. This has been emphasised by more

[1] ABS 8158.0 Innovation in Australian Business 2005

stringent requirements to demonstrate their IP management and commercialisation 'vehicles', with clear milestones and 'paths to adoption'.

The early rounds required that the research itself be of high quality, but this has been less prominent in later rounds. While graduate education and training was a specified objective for the first years, specific reference to this was dropped from the objectives and the selection criteria in 2004 (though CRCs were still required to have a PhD program). The early rounds recognised the cooperative aspect of CRCs, but the later rounds emphasised end-users over research providers, to the point of requiring that research providers not be in the majority on governing boards. Early CRCs were permitted considerable flexibility about their management and governance arrangements, so long as there were clear lines of responsibility and accountability linking the participants, but there has been a steadily increasing specification of requirements, and CRCs in the last two rounds have been required to be incorporated with independent chairs and the full governance strictures of corporate entities.

These trends are consistent with the drive over the last 20 years to derive financial returns from commercialisation of intellectual property arising from publicly supported research – the current program objective and guidelines provide a framework for commercialisation of research from CRCs. However the Review notes the findings of two economic-impact studies[2] of the CRC Program which have argued that the while the economic impact of the Program has been considerable, it has been primarily through end-user application of research rather than direct commercialisation.

The Productivity Commission argued that the emphasis on commercial outcomes was less defensible from an economic efficiency perspective and more likely to result in research collaborations of a type that a firm or industry collective would undertake anyway. In any event, CRCs typically appear not to have the know-how and resources to be particularly good at commercialisation (with singular exceptions).

The Productivity Commission recommended, and this Review agrees, that a greater emphasis be placed on translating research outputs into not just economic, but also social and environmental, benefits. The latter two objectives can be achieved by re-instating public good as a CRC objective, a commitment made in the current Government's election promises and which the Review supports.

Concerns about the CRC Program

Through most of its life the CRC Program has been popular with participants. However the consultations and submissions to this Review and submissions to the 2007 Productivity Commission Report indicated that the Program is less attractive than formerly to some important participant groups, most notably CSIRO and the research-intensive universities, but also some significant end-users. The concept of end-users and research providers working together on research to produce productive outcomes still draws strong support – the problems seem to centre on the

[2] Allen Consulting Group, *The Economic Impact of Cooperative Research Centres in Australia — Delivering Benefits for Australia,* A report for the Cooperative Research Centres Association Inc, December 2005; and Insight Economics 2006, *Economic Impact Study of the CRC Programme*, Prepared for the Department of Education, Science and Training, Insight Economics, Melbourne.

collaboration vehicle itself, and what is allowed and encouraged explicitly and implicitly in the Program.

The need for a more flexible Program, and the complexity and cost of CRC governance arrangements, were frequently raised in submissions and consultations about the CRC Program by end-users and research providers alike. Indeed, it was consistently raised as one of the 'dark matters' of the current innovation system during the consultations. The high costs of bidding for CRCs, the transaction costs of involvement with them, the lack of flexibility in suiting governance and management to the needs of the partners, and the lack of an adequate return on investment for partners, especially when the CRC is incorporated, also drew comment.

Intellectual property (IP) arrangements drew a lot of comment. Despite detailed coverage of this matter in the legal agreements for CRCs, early clarity seems to be lacking. Continuing unrealistic expectations by universities and government research bodies that the IP within a CRC will generate a major financial flow to their institutions underlies many of the cited difficulties in reaching agreement on IP arrangements. This is exacerbated by the belief – encouraged by the application process – that the CRC itself will be the commercialiser of the IP resident in the CRC. Agreements would be easier to negotiate if it were accepted that the industrial/end-user partners are the logical developers of the IP, with the question of fair and reasonable returns from the industrial partner to the research providers and their institutions a matter to be negotiated, in general terms, at the commencement of the CRC.

The Review agrees that

> *collaborative innovation and the transfer of ideas are often impeded and curtailed by problems and delays arising out of the negotiation and formalisation of agreements for collaborative research.*[3]

Comments against evaluation principles

The Review was specifically asked to evaluate the CRC Program against principles used for new policy proposals and reviews. The first goes to *Appropriateness*. The Review finds the Program primarily addresses a gap left by the market directly, and also indirectly, through the influence it has had on the design of other programs. In the past, when public good was one of the Program's objectives, it has also sponsored some innovative collaborations addressing social inequity. The Review also finds that the CRC Program is appropriate as a national program, pulling together research expertise from across the country often with active assistance from State Governments.

On the *effectiveness* of the Program – whether it represents value for taxpayer funds, and whether it has achieved its stated objectives – the Review has taken note of two recent studies[4] and also the Productivity Commission's report. While the Review is

[3] Fitzgerald and Austin, law academics who work with the Open Access to Knowledge (OAK) Law Project at Queensland University of Technology, in submission to NIS Review, 428A-Fitzgerald & Austin, p.13.

[4] Allen Consulting Group, *The Economic Impact of Cooperative Research Centres in Australia —*

cautious about placing too much credence on the precise figures produced by the economic models used, these studies give confidence that the CRC Program does provide a positive return on taxpayers' funds invested.

The current CRC Program objective is:

> *to enhance Australia's industrial, commercial and economic growth through the development of sustained, user-driven, cooperative public-private research centres that achieve high levels of outcomes in adoption and commercialisation.*

It is hard to produce a precise quantitative estimate of how much the CRCs have enhanced Australia's growth, especially net economic growth. High levels of *commercialisation* have not occurred but there is evidence that benefits have come from industry *application* of CRC research. Like the Productivity Commission, but for additional reasons, this Review does not consider the current Program objective to be appropriate. This issue is addressed at Recommendation 2.

In looking at the *efficiency* of delivery of the CRC Program, the Review was cognisant of the oftstated complaints about the high costs associated with planning, bidding for and establishing new CRCs, and the ongoing governance and transaction costs. The Program requires more flexibility; and improved efficiency in the selection and review process (see Recommendations 3 and 7).

On *integration* – whether government agencies are working together to deliver on measure objectives within clearly defined lines of responsibility – greater integration with agencies offering related programs would benefit the Program, in both program-design quality and operating efficiencies, and would provide better articulation between programs that form a 'spectrum' in the NIS.

The CRC Program has a formidable *performance assessment* system of reporting and reviewing including annual reports; a major third-year review; and a requirement to lodge a Commercialisation and Utilisation Plan. The Review suggests that the system might be excessive rather than robust, and that its selection procedures are inappropriately risk averse. This issue is addressed in Recommendation 7.

The Review finds that the CRC Program does *strategically align* with the government's long-term policy priorities for innovation driving economic growth.

The future

The CRC Program needs to work for all those funding it and participating in it. It needs to be an appropriate, efficient and effective investment of government funds. It needs to produce research for end-users that allows rapid breakthrough business transformation. For research providers, it needs to attract and stimulate their very best researchers. For all parties the organisational and funding arrangements need to work smoothly while consistent with prudential requirements.

Delivering Benefits for Australia, A report for the Cooperative Research Centres Association Inc, December 2005; and Insight Economics 2006, *Economic Impact Study of the CRC Programme*, Prepared for the Department of Education, Science and Training, Insight Economics, Melbourne.

The feedback from consultations, workshops and submissions was overall remarkably consistent about current concerns with the CRC Program. No one suggested that the Commonwealth should stop providing incentives for research collaborations between researchers from the universities and publicly funded research agencies on the one hand and industry and public and community sector users on the other. The biggest issue was on the degree of change required.

Continue the CRC Program with additional funding

The Review finds there is still a need for a program supporting big, end-user-inspired and driven, risk-addressing research projects directed at significant national issues (and outcomes) across Australia's innovation system. The benefits of the CRC Program warrant continued investment in it, provided its objectives are re-focused, the problematic aspects raised in submissions and consultations addressed, and its success in meeting the new objectives regularly reviewed.

Unless some extra funding is injected into the Program, the next round will be able to fund only a small number of centres. This could exacerbate the unease with aspects of the Program. In particular the next round could see a 'spike' in applications as many existing CRCs are likely to apply to be new CRCs.

If CRC funding is to be linked directly and specifically to solving major problems of market failure/creation and public good, more frequent opportunities to submit applications for CRCs are desirable, and an annual round is proposed.

Recommendation 1

1.1: That

i. a re-focused and modified CRC Program continue, and

ii. the next evaluation recommend whether the Program continue in light of the modifications and the impact of changes arising from the Innovation White Paper.

1.2: That

i. funding be injected into the Program to allow for annual rounds to take place over the next five years;

ii. there be a selection round at least once a year so that emerging market failure/creation and urgent public good issues can be addressed quickly; and

iii. the Program encourage CRCs of varying lifespan (typically 4-7 years but up to a maximum of 10 years where appropriate), with funding up to a maximum of $45M over the life of the Centre.

Change the Program objectives - collaborating to a purpose; end-user take up of CRC research

The emphasis of CRC research must be directed to end-user uptake rather than commercialisation by the CRC itself. This requires changing the objectives to focus very specifically on research collaborations aimed at ameliorating a clearly-identified risk, such as

- a significant challenge in creation of a new industry area; or
- a significant challenge in an existing industry sector where the risk involved in solving the challenge is too great for a single firm to tackle alone; or
- a significant challenge in the provision of public goods and services; or

- a significant challenge in an area of community or social benefit (and not restricted to an area represented by government portfolios).

The solution to the challenge would provide a significant advantage – not necessarily commercial – for CRC end-users, preferably with significant spillovers. Without an exact challenge to be met, it is difficult to decide whether the research is potentially valuable: either to end-users, or to the national benefit.

CRCs would be put together to carry out research to address the CRC's core challenge, pass the findings on to end-users as efficiently as possible (including through provision of PhD graduates who have been trained through the CRC), then wind up (either winding up the research program for which funding was received or wind up altogether). The focus of the research should be at the pre-competitive or, in the case of public-good CRCs, pre-applicative stage.

This emphasis on a single purpose will also help avoid the tendency by CRCs to become an end in themselves.

Recommendation 2: That

i. the prime objective of the CRC Program be to provide support for pre-competitive or pre-applicative research ventures between end-users and researchers which tackle a clearly-articulated, major challenge for the end users addressing identified risk gaps such as:
   - a significant challenge in creation of a new industry area; or
   - a significant challenge in an existing industry sector where the risk involved in solving the challenge is too great for a single firm to tackle alone; or
   - a significant challenge in the provision of public goods and services; or
   - a significant challenge in an area of community or social benefit (and not restricted to an area represented by government portfolios).

   The solution to the challenge should be innovative and of high impact and capable of being deployed rapidly by the end-users to good effect. Each CRC should be of high national benefit with significant spillovers.

ii. a secondary aim of the Program be to encourage closer working ties between Australia's public-sector research organisations (universities and PFRAs) and end-user groups and to encourage end-user-focused education, especially at the PhD level.

CRC organisational arrangements need to be fit for purpose

Solving big challenges requires organisational arrangements fit for purpose. The joint venturers in a CRC need to be very clear on what they are attempting to do; how they intend to go about doing it, and what governance, management, reporting and end-user take up arrangements for CRC outputs are most likely to work for them. And to attract funding, they need to be able to justify their proposals. The Program needs to be flexible enough to accommodate this.

CRCs do not need to be incorporated to be successful. Of course, issues of leadership and management, accountability and responsibility, must be addressed early in the collaboration; but there are many different models for what are fundamentally joint ventures, and the collaborators should be free to choose a model which is most likely to ensure the aims and purpose of the collaboration are achieved. This extends to

representation on the Board (if there is one), which should be linked to the input of resources into the CRC and the participants' wishes, rather than the present arbitrary requirement that end-users and/or independents hold a majority of Board positions.

Flexibility of lifespan and membership arrangements were frequently raised as problems even though they are technically allowed under the guidelines. The general period should be 4-7 years, with occasional opportunities for shorter and longer terms if the situation warrants; and membership arrangements should permit partners to join late and exit early.

Allowing more flexible arrangements means that the initial case has to be well made. Applicants must demonstrate how the proposed research and education program will address the identified challenge and then how the end-user partners will deploy the research findings and gain advantage from the Commonwealth investment with spillovers.

The Legal Agreement between the Commonwealth and the CRC needs to be as simple as possible, with one party (the CRC itself or an agreed agent) signing on behalf of the CRC. The Agreement also needs to formally require compliance with both research ethics and research integrity codes and guidelines.

Recommendation 3

3.1: That the CRC Program guidelines be modified:

i. to permit much greater flexibility than at present including in organisational structures, governance models, lifespan (typically 4-7 years but up to a maximum of 10 years where appropriate), membership arrangements, intellectual property arrangements and size of Commonwealth grant (up to a maximum of $45M over the life of the Centre) but

ii. that there be even higher requirements than at present on applicants to demonstrate why their proposed structure, membership arrangements, research plan, end-user absorptive capacity, leadership, key research people, outputs, likely impacts, performance metrics, governance, management, intellectual property arrangements, Centre lifespan and funding are appropriate to deliver a solution to the identified challenge and the fast and effective uptake of results by end-users.

3.2: That the legal agreement between the Commonwealth and the CRC be as simple as possible, with the recent practice continued of one party (the CRC itself or an agreed agent) signing on behalf of the CRC.

3.3: That the legal agreement include provisions requiring the CRC to be fully compliant with all relevant Commonwealth and State research integrity and ethics codes and guidelines and with all international treaties dealing with these matters. Records of all ethics applications and their current status must be kept up to date and be available at all times for inspection.

Helping potential participants work out what they need to do - an auxiliary program

Public-sector partners are experienced at submitting big grant applications but industry (especially service industries and those sectors populated by SMEs) and

community groups often find it harder. And they find it hard to locate the most appropriate research partners.

The introduction of an auxiliary program to assist such groups to explore shared problems, formulate shared approaches to solving them and establish the details of collaborations – collaborations that might in time be the basis for a CRC bid – would address this issue. Under the program, potential applicant groups would:

- have an opportunity to explore, frame and experiment with ideas, challenges, problems and opportunities affecting their sectors
- get the definition of their problems right and work how to go about solving them
- identify appropriate research partners and end-users work out the formal arrangements for working together including IP, management and governance arrangements
- find out who is doing similar work around the world and decide whether to seek them out as international partners, or direct their own focus into other areas
- work out the skilled labour force requirements.

The auxiliary program would complement the proposed Industry Innovation Councils which are to be introduced by the Commonwealth Government later in 2008 and will operate in 'key sectors' to support the Enterprise Connect network.[5]

Recommendation 4

That a new program be established to assist industry and other end-user groups to undertake strategic analysis or innovation mapping projects and to establish collaborative ventures between end-users and researchers, including publicly funded research institutions. The priority is to support new collaborations in areas with little history of collaborative activity or a low research and development base, particularly service industries and those sectors populated by SMEs.

Promote to the right participants

A wider diversity of participants needs to be encouraged into CRCs. This includes SMEs, which have long been identified as a vital part of the Australian economy; services industries, which underpin Australia's domestic economy; and the humanities and social sciences, which are particularly important to the services industries, but also have an increasing role in the multidisciplinary approach which is required to solve most pressing real-world problems.

Because education – especially research training – is essential to developing Australia's innovation capacity, and because universities are significant research providers, it is important that every CRC application continue to secure a commitment in the bid from at least one Australian university. The university must guarantee to provide supervision for PhD students associated with the Centre, in return for CRC funding of the supervision if needed; and be continually vigilant in ensuring the research training experience for students is comprehensive and in line with industry and educational needs.

Involvement on the international stage is also vital if Australia's innovation system is to develop to its full capacity. Strong engagement with international research groups

[5] http://www.ato.gov.au/budget/2008-09/content/bp2/html/expense-20.htm

working on similar challenges to those of an Australian CRC must be encouraged including, where appropriate, joint projects.

Recommendation 5

That participation in the CRC Program be encouraged, allowed or required as follows:

i. SME and service industry involvement in CRCs be specifically encouraged;
ii. CRCs addressing challenges across several service industries be encouraged
iii. strong engagement with international research groups working on similar challenges be encouraged including, where appropriate, joint projects; and that funding of research undertaken overseas be allowed;
iv. CRC applications in Humanities and Social Sciences fields be allowed and encouraged; and
v. CRCs continue to be required to have at least one Australian university as a partner.

Re-design the funding arrangements

The funding arrangements for CRCs need to work in a way that ensures that the Commonwealth's investment in a CRC is appropriate, and that the funding rules encourage participation in the Program by both end-users (especially from SMEs and the services sector) and research providers.

Contributions to CRCs can be made in different ways, but in the past the balance between the Commonwealth, research-providers and end-users has not been the most effective. Requiring end-users to provide substantially higher cash funding to maximise the value of the Commonwealth's contribution would be in line with international best practice for major centres. However, for SMEs, which are typically less cashed up to support the quality of research required, a continued ability to commit through in-kind contributions is warranted.

Universities (and, to a lesser extent, other research providers) face a continual challenge in finding the funding required to undertake their research activities. This, plus the changes to CRC governance which restricted their representation on CRC boards, has led to a perverse situation. Some research providers have resorted to side deals with potential CRCs, making their contributions conditional on being guaranteed a return in research funding several times greater than their contributions. In other words, for many research providers CRCs have ceased being eagerly sought-after collaborations and become rather circumscribed research granting bodies. The complexities and ill-will surrounding these deals are, in turn, resulting in leading researchers abandoning the CRC Program. The Review recommends that the CRC Program not insist on research provider contributions but encourage such contributions and, in line with this, adopt the system currently used in the ARC Linkage Grants for universities (and other research providers) to specify what they are contributing to each CRC.

For public good CRCs, it is important that applications provide evidence that relevant Government agencies and portfolios, whether State or Commonwealth, strongly support the CRC application.

Recommendation 6

That the approach to funding of CRCs be redesigned in accord with the following:

i. the share of public funding of any CRC be aligned to the level of likely induced social benefits;
ii. CRC end-user applicants normally be expected to provide more than half the cash contribution towards the CRC;
iii. in-kind contributions not be rated the same as cash during the selection and reporting processes, but treated as an important secondary factor. In turn, tied in-kind contributions (which should be declared at the time of application and in annual reporting) should not rate as highly as untied in-kind contributions;
iv. there be scope to modify the application of recommendations ii and iii to the advantage of end-user applicants where they are predominantly SMEs or from the community sector;
v. universities and PFRAs be encouraged but not explicitly required to make cash or inkind commitments to a CRC bid – but that, where they do make contributions, they be described in the same way as for other university/end-user collaborations (e.g. ARC
Linkage Grants) and that they include details of program leaders and key researchers and their time commitments;
vi. predominantly public good applications be scrutinised to see that they do indeed have the funding support of the 'home' Commonwealth and State portfolios or authorities; or, where this is not the case, that the reasons why are addressed as part of the application; and
vii. there be no upper limit on postgraduate stipends offered within CRCs.

Encouraging fleet and flexible CRCs requires top quality program design and management

The Review recommendations are aimed at ensuring a much greater diversity of CRCs with organisational arrangements designed to maximise the chances for each particular CRC to be as effective as possible. Encouraging this diversity and instituting the increased flexibility needed will require program managers who are experienced in end-use-focused research, research management, and program design and management. The Review recommends such expertise be co-opted into the Program from across the NIS.

Rigorous assessment against criteria aligned to the Program objectives is essential. Under the modified CRC Program proposed, changes to the current selection criteria are required and selection should be fundamentally based, in line with best practice for grants as large as this, on layered peer review.

Successful review mechanisms are one of the keys to running a successful research funding program. They help maintain rigour and focus, and ensure accountability. Hard-nosed review using a core of common measures across all CRCs (and across other collaboration programs) should be encouraged. However, review mechanisms are not useful if they have no consequences. A level of failure should be expected and accepted as the CRC Program will cover areas where there are risk gaps. There should be an expectation that a proportion of CRCs will lose funding at each review round.

Recommendation 7

7.1: That

i. the CRC Program be administered at senior levels by secondees from across the NIS who have experience with similar programs as successful research end-users, researchers and research administrators.
ii. CRC Committee members be chosen to ensure the committee has expertise in program design, delivery and review, and significant experience in successful joint ventures deploying research results.

7.2: That the selection process involve layered peer review against detailed selection criteria which include the following:

- the risk being addressed (how significant is the problem? What is the current state-of-the-art worldwide in addressing this problem?)
- the quality of the research approach and plan and how it will address the identified risk
- the capabilities of the participants (how well do the proposed end-users connect with the identified problem, and how highly regarded in their field are the proposed researchers?)
- the quality of the leadership and the research and management teams
- the quality of the education program
- the proposed success/progress metrics
- how the end-user partners will deploy the research findings and gain advantage from the Commonwealth investment
- the expected wider spillover benefits and how these will be taken up by parties outside the collaboration
- the genuineness of the joint venture and alignment of interests (i.e. checking that it is not 'hollow collaboration'), and
- the suitability of the proposed accountability and governance arrangements including the management of the joint venture.

7.3: That

i. CRC applications be submitted using a two-stage process. Applicants would initially make the case in a written application(s) and, if shortlisted, following peer review, would be given the chance to augment this at interview;
ii. the CRC Committee establish disciplinary-based standing committees drawing on expertise in the ARC and NHMRC to manage the peer-review processes associated with the first-stage culling, and second-stage ranking. These committees should use a common formal process which should include giving the applicant CRC the chance to comment on assessors' comments in writing;
iii. the CRC Committee consult with the ARC and NHMRC to develop a joint database of assessors to do the rigorous assessing of CRC applications for consideration by the standing committees;
iv. the standing committees rank proposals assigned to them on all criteria after obtaining sufficient peer assessments, and then overall, and make recommendations to the CRC Committee; and
v. the CRC Committee consider all the input and recommend a final list to the Minister.

7.4: That a common core of evaluation metrics be developed that would apply across all CRCs and would allow for cross-comparison between them. These should include, at minimum, metrics on research quality, end-user uptake, international connections

for national benefit, and researcher education. As well as reporting on the core evaluation metrics, it is recommended that CRCs, in their annual report, report on measures specific to their CRC and agreed at the time the CRC is awarded.

7.5: That annual reports be examined closely for early warning signs of difficulty.

7.6: That a major hard-nosed review of each CRC using a common evaluation framework take place at the end of each 3 years – or more frequently if there are early warning signs of failure – of the life of a CRC, with a final review as it is finishing; and that it be an explicit condition of funding that termination be an option if the review's findings are adverse.

7.7: That the CRC Committee establish a Review Sub-committee to

i. oversee the review process;
ii. propose the composition of the initial and subsequent review panels to the CRC Committee for approval. The same review panel should be used for all CRCs in a field of application in order to ensure cross comparison. Each review panel to be chaired by a Sub-committee member;
iii. consider feedback from the review panels;
iv. prepare a report for the CRC Committee on each review round including a list of CRCs reviewed, ranked by success to date; and
v. propose which CRCs continue to receive Commonwealth funding under the Program and which should no longer be funded.

Improve articulation with other programs in the NIS

The Review recommends ongoing and effective articulation and cooperation between the CRC Program and other funding programs in the NIS, especially with CSIRO Flagships, ARC Linkage Grants and NHMRC Partnership for Better Health Grants.

Recommendation 8

8.1: That the CRC Program build close policy and operational links with other collaborative research programs in the National Innovation System and that it articulate well with the CSIRO National Research Flagships Program, ARC Linkage Program and the NHMRC Partnerships for Better Health Program. While the CRC Program should focus more on funding large end-userdriven collaborative pre-competitive research, the Linkage Program should continue to fund simpler end-user/university partnerships. In line with the move to larger Linkage grants, these programs should complement the CRC Program by supporting long term-basic/strategic research with smaller, shorter and more flexible arrangements between groups of firms either independently or in conjunction with universities and public sector research agencies. The administrators of these programs (and related State programs) should meet regularly to discuss applications that might be eligible to either scheme.

8.2: That

i. a common core of broad evaluation measures be developed that would apply across all

Government innovation funding programs (especially programs involving collaboration) and their projects;

ii. common application and review forms/processes be used as far as possible across all innovation funding schemes, especially schemes involving collaboration (including Federal & State schemes); and
iii. a much improved capacity to review innovation funding programs (especially schemes involving collaboration) be developed along with a robust capacity to cease funding weaker projects. Sometimes international review mechanisms are needed.

8.3: That the ARC Centre of Excellence Program be enlarged and become annual and that it encourage applications from innovative research concentrations that have proved themselves producers of high quality and high impact research through programs such as the CRC Program (but also through multi-partner, collaborative ARC Discovery and Linkage grants).

Conclusion

The Review expects implementation of its recommendations to result in many more end-user industries and service providers being involved in CRCs. End-users will come from a wider range of industries and services than have so far participated in CRCs. More of them will be SMEs. Universities and PFRAs will be excited about the opportunities for quality research with potential national and international impact and will be enthusiastic participants. They will partner with end-users as joint venturers in CRCs to tackle big problems that affect a whole industry or sector or community. The solutions will be rapidly deployed by end-users to the benefit of end-users and, through spillovers, the wider community.

CRCs will be diverse in structure, size and longevity. Some will be quite small; others large. Some will be short term; others for a longer term of up to 10 years. Some will incorporate; others will choose different management and governance structures that suit their purpose. Most will have international connections so that Australia can be informed by, and inform, the rest of the world. Employers will compete for researchers and PhD graduates from CRCs. There will be growth in related programs, including ARC Linkages, to develop and nurture collaborative activity. When the problem is solved, participants will move on to other forms of collaboration to solve other problems. Success on all these fronts will be a measure of the relevance and importance of the CRC Program to Australia’s innovation system. Success will also guarantee a sound return on the Commonwealth’s investment. And success will contribute to a sustainable, community-oriented, productive, creative and prosperous Australia.

2. Recommendations

Recommendation 1

1.1: That

i. a re-focused and modified CRC Program continue, and

ii. the next evaluation recommend whether the Program continue in light of the
modifications and the impact of changes arising from the Innovation White Paper.

1.2: That

i. funding be injected into the Program to allow for annual rounds to take place over the next five years;

ii. there be a selection round at least once a year so that emerging market failure/creation and urgent public good issues can be addressed quickly; and

iii. the Program encourage CRCs of varying lifespan (typically 4-7 years but up to a maximum of 10 years where appropriate), with funding up to a maximum of $45M over the life of the Centre.

Recommendation 2

That:

i. the prime objective of the CRC Program be to provide support for pre-competitive or pre-applicative research ventures between end-users and researchers which tackle a clearly-articulated, major challenge for the end users addressing identified risk gaps such as:

- a significant challenge in creation of a new industry area; or
- a significant challenge in an existing industry sector where the risk involved in
- solving the challenge is too great for a single firm to tackle alone; or
- a significant challenge in the provision of public goods and services; or
- a significant challenge in an area of community or social benefit (and not
- restricted to an area represented by government portfolios).

The solution to the challenge should be innovative and of high impact and capable of being deployed rapidly by the end-users to good effect. Each CRC should be of high national benefit with significant spillovers.

ii. a secondary aim of the Program be to encourage closer working ties between Australia's public-sector research organisations (universities and PFRAs) and end-user groups and to encourage end-user-focused education, especially at the PhD level.

Recommendation 3

3.1: That the CRC Program guidelines be modified:

i. to permit much greater flexibility than at present including in organisational structures, governance models, lifespan (typically 4-7 years but up to a maximum of 10 years where appropriate), membership arrangements, intellectual property arrangements and size

of Commonwealth grant (up to a maximum of $45M over the life of the Centre)

but

ii. that there be even higher requirements than at present on applicants to demonstrate why their proposed structure, membership arrangements, research plan, end-user absorptive capacity, leadership, key research people, outputs, likely impacts, performance metrics, governance, management, intellectual property arrangements, Centre lifespan and funding are appropriate to deliver a solution to the identified challenge and the fast and effective uptake of results by end-users.

3.2: That the legal agreement between the Commonwealth and the CRC be as simple as possible, with the recent practice continued of one party (the CRC itself or an agreed agent) signing on behalf of the CRC.

3.3: That the legal agreement include provisions requiring the CRC to be fully compliant with all relevant Commonwealth and State research integrity and ethics codes and guidelines and with all international treaties dealing with these matters. Records of all ethics applications and their current status must be kept up to date and be available at all times for inspection.

Recommendation 4

That a new program be established to assist industry and other end-user groups to undertake strategic analysis or innovation mapping projects and to establish collaborative ventures between end-users and researchers, including publicly funded research institutions. The priority is to support new collaborations in areas with little history of collaborative activity or a low research and development base, particularly service industries and those sectors populated by SMEs.

Recommendation 5

That participation in the CRC Program be encouraged, allowed or required as follows:

i. SME and service industry involvement in CRCs be specifically encouraged;

ii. CRCs addressing challenges across several service industries be encouraged

iii. strong engagement with international research groups working on similar challenges be encouraged including, where appropriate, joint projects; and that funding of research undertaken overseas be allowed;

iii. CRC applications in Humanities and Social Sciences fields be allowed and encouraged; and

iv. CRCs continue to be required to have at least one Australian university as a partner.

Recommendation 6

That the approach to funding of CRCs be redesigned in accord with the following:

i. the share of public funding of any CRC be aligned to the level of likely induced social benefits;

ii. CRC end-user applicants normally be expected to provide more than half the cash contribution towards the CRC;
iii. in-kind contributions not be rated the same as cash during the selection and reporting processes, but treated as an important secondary factor. In turn, tied in-kind contributions (which should be declared at the time of application and in annual reporting) should not be rated as highly as untied in-kind contributions;
iv. there be scope to modify the application of recommendations ii and iii to the advantage of end-user applicants where they are predominantly SMEs or from the community sector;
v. universities and PFRAs be encouraged but not explicitly required to make cash or inkind commitments to a CRC bid – but that, where they do make contributions, they be described in the same way as for other university/end-user collaborations (e.g. ARC Linkage Grants) and that they include details of program leaders and key researchers and their time commitments;
vi. predominantly public good applications be scrutinised to see that they do indeed have the funding support of the 'home' Commonwealth and State portfolios or authorities; or,
v. where this is not the case, that the reasons why are addressed as part of the application; and
vii. there be no upper limit on postgraduate stipends offered within CRCs.

Recommendation 7

7.1 That
i. the CRC Program be administered at senior levels by secondees from across the NIS who have experience with similar programs as successful research end-users, researchers and research administrators.
ii. CRC Committee members be chosen to ensure the committee has expertise in program design, delivery and review, and significant experience in successful joint ventures deploying research results.

7.2 That the selection process involve layered peer review against detailed selection criteria which include the following:
- the risk being addressed (how significant is the problem? What is the current state-of the-art worldwide in addressing this problem?)
- the quality of the research approach and plan and how it will address the identified risk
- the capabilities of the participants (how well do the proposed end-users connect with the identified problem, and how highly regarded in their field are the proposed researchers?)
- the quality of the leadership and the research and management teams
- the quality of the education program
- the proposed success/progress metrics
- how the end-user partners will deploy the research findings and gain advantage from the Commonwealth investment
- the expected wider spillover benefits and how these will be taken up by parties outside the collaboration

- the genuineness of the joint venture and alignment of interests (i.e. checking that it is not 'hollow collaboration'), and
- the suitability of the proposed accountability and governance arrangements including the management of the joint venture.

7.3 That

i. CRC applications be submitted using a two-stage process. Applicants would initially make the case in a written application(s) and, if shortlisted, following peer review, would be given the chance to augment this at interview;

iii. the CRC Committee establish disciplinary-based standing committees drawing on expertise in the ARC and NHMRC to manage the peer-review processes associated with the first-stage culling, and second-stage ranking. These committees should use a common formal process which should include giving the applicant CRC the chance to comment on assessors' comments in writing;

iv. the CRC Committee consult with the ARC and NHMRC to develop a joint database of assessors to do the rigorous assessing of CRC applications for consideration by the standing committees;

v. the standing committees rank proposals assigned to them on all criteria after obtaining sufficient peer assessments, and then overall, and make recommendations to the CRC Committee; and

vi. the CRC Committee consider all the input and recommend a final list to the Minister.

7.4: That a common core of evaluation metrics be developed that would apply across all CRCs and would allow for cross-comparison between them. These should include, at minimum, metrics on research quality, end-user uptake, international connections for national benefit, and researcher education. As well as reporting on the core evaluation metrics, it is recommended that CRCs, in their annual report, report on measures specific to their CRC and agreed at the time the CRC is awarded.

7.5: That annual reports be examined closely for early warning signs of difficulty.

7.6: That a major hard-nosed review of each CRC using a common evaluation framework take place at the end of each 3 years – or more frequently if there are early warning signs of failure – of the life of a CRC, with a final review as it is finishing; and that it be an explicit condition of funding that termination be an option if the review's findings are adverse.

7.7: That the CRC Committee establish a Review Sub-committee to

i. oversee the review process;

ii. propose the composition of the initial and subsequent review panels to the CRC Committee for approval. The same review panel should be used for all CRCs in a field of application in order to ensure cross comparison. Each review panel to be chaired by a Sub-committee member;

iii. consider feedback from the review panels;

iv. prepare a report for the CRC Committee on each review round including a list of CRCs reviewed, ranked by success to date; and

v. propose which CRCs continue to receive Commonwealth funding under the Program and which should no longer be funded.

Recommendation 8

8.1: That the CRC Program build close policy and operational links with other collaborative research programs in the National Innovation System and that it articulate well with the CSIRO National Research Flagships Program, ARC Linkage Program and the NHMRC Partnerships for Better Health Program. While the CRC Program should focus more on funding large end-user driven collaborative pre-competitive research, the Linkage Program should continue to fund simpler end-user/university partnerships. In line with the move to larger Linkage grants, these programs should complement the CRC Program by supporting long term-basic/strategic research with smaller, shorter and more flexible arrangements between groups of firms either independently or in conjunction with universities and public sector research agencies. The administrators of these programs (and related State programs) should meet regularly to discuss applications that might be eligible to either scheme.

8.2: That

i. a common core of broad evaluation measures be developed that would apply across all Government innovation funding programs (especially programs involving collaboration)and their projects;
ii. common application and review forms/processes be used as far as possible across all innovation funding schemes, especially schemes involving collaboration (including Federal & State schemes); and
iii. a much improved capacity to review innovation funding programs (especially schemes involving collaboration) be developed along with a robust capacity to cease funding weaker projects. Sometimes international review mechanisms are needed.

8.3: That the ARC Centre of Excellence Program be enlarged and become annual and that it encourage applications from innovative research concentrations that have proved themselves producers of high quality and high impact research through programs such as the CRC Program (but also through multi-partner, collaborative ARC Discovery and Linkage grants).