

from the President of the Australian Council of Engineering Deans

11 November 2014

Mr David Miles
Chair, CRC Review

Dear Mr Miles

Submission from the Australian Council of Engineering Deans

I write on behalf of the Australian Council of Engineering Deans (ACED) to address the review questions and express ACED's support for the continuation and strengthening of the CRC programme. Specific action points suggested by ACED are included in our responses.

Background

The CRC programme and Australia's engineering faculties/schools are well aligned. At least 30 per cent of the CRCs funded over the duration of the programme have undertaken engineering research in ACED member faculties/schools. Several of the 'engineering CRCs' gained funding in more than one round. The proportion of CRCs with engineering focus has declined as the scope of the CRC programme has broadened.

ACED comprises the leaders of the engineering faculties/schools in the 34 Australian universities that operate education and research programmes in engineering. All engineering faculties/schools encourage good relations with engineering industries and employers. The faculties/schools contribute significantly to Australia's research effort in engineering. This has grown rapidly over the period of the CRC programme:

- the faculties/schools collectively graduated 1,113 PhD and 245 Research Masters candidates in 2013. (There were 474 PhDs awarded in engineering in 1996.)
- the faculties/schools employed 1,694 full-time equivalent research-only staff in 2013, compared with 557 in 1996. (These staff are mostly on contract appointments.)

ACED faculties/schools from all university groupings have contributed to the CRC programme. Many of the faculties' research-only staff and the research graduates have contributed directly to CRC programmes and outcomes, while many of the 2,100 permanent engineering faculty/school staff have taken research leadership roles within them. Most of the higher degree research graduates in engineering progress to employment in industry, many to companies associated with CRCs.

The importance of engineering in the CRC programme and in the broader context of Australia's research effort can be seen from the data in Table overleaf. Engineering is the dominant field of research for CRC funding (Category 4), and is strong in Category 3 (Industry and Other). However this Table also shows that the CRC funding reported to the *ERA 2012* exercise was less than 4% of the total funding reported for 2010.

The strong alignments between ACED member faculties/schools and the objectives of the CRC programme are hardly surprising. Over the past two centuries of industrialisation engineers have been the human transformers of scientific and technological ideas into artefacts: the manufactured products, systems, and infrastructure on which modern society depends. Engineers take the leading role in the conceptualisation and delivery of performance improvements, in energy efficiency, materials use, production productivity and maintenance management, using and developing new science, technology and tools. These issues have been at the core of many CRCs.

As previous reviews have reported, the CRCs have delivered engineering outputs in the forms of patents, licences, and spin-offs, as well as direct adoption and research graduate employment.

ACED is incorporated in New South Wales

ACED shares the wide concern about Australia's generally weak position on linkages between research and industry/business. However, any reduction of the nation's major programme that links engineering research with industry/business would be counterproductive. Rather, we hope that this review re-invigorates the CRC programme with an increased emphasis on supporting engineering capacity and enterprise on which Australia's future prosperity, human and environmental health critically depend.

HERDC Category 1, 2, 3 and 4 funding by research field groups, 2010.

Research Field	Cat 1	Cat 2	Cat 3	Cat 4
Physical and Chemical Sciences	8.0%	5.2%	4.1%	4.7%
Earth & Environment Sciences	4.7%	7.3%	6.6%	17.1%
Biological & Agricultural Sciences	19.8%	12.0%	13.6%	22.0%
Mathematics, Information & Computing Sciences	4.4%	3.2%	3.6%	6.3%
Engineering & Technology	10.7%	10.0%	15.8%	32.0%
Medical & Health Sciences	38.2%	40.4%	36.5%	7.7%
Built Environment & Design	0.7%	1.0%	1.4%	0.5%
Commerce, Management, Tourism & Services	0.9%	1.2%	3.2%	3.6%
Other fields	12.6%	19.8%	15.3%	6.0%
Total category funding reported (\$million)	1,339	853	806	121
% of total research funding reported	42.9%	27.3%	25.9%	3.9%

Source: ERA 2012 Report Section 3 National Profiles by Fields of Research Code

Responses to the review questions

A. Is the CRC programme the right vehicle for achieving the Government's priorities for applied science and research? If not, what sort of programme would be more effective?

The CRC programme has proven effective for delivering commercial and commercialisable outcomes for applied science and research in the areas identified as priorities by government.

The core features of the programme have ensured that a critical mass of Australia's best researchers (from multiple universities and eligible research organisations) are deployed to address problems as defined in major multi-company industry sectors and in society at large. The programme has also demonstrated collaboration between disciplines to a greater extent than many others. Whilst the operation of the programme can surely be improved, it is hard to envision that the Government's goals in this area could be fulfilled without a programme that has many of its current features. The role of engineering as a professional discipline in addressing these problems could, however, have a higher profile in the stated objectives of the programme.

ACED's experience is that collaboration between companies and universities comes at a considerable administrative cost. Collaboration must be for mutual benefit, not to fulfil a bureaucratic requirement.

Action points:

- (i) The CRC programme should allow for single industry or single research provider arrangements where these can best deliver the required outcomes.
- (ii) In conveying the objectives of the programme, stronger explicit references should be made to **engineering** as the professional discipline that is centrally concerned with transformation and delivery of innovative and practical outcomes from science and technology within industry.

B. How can the government's investment in the CRC programme better deliver outcomes for industry?

Over the years ACED members have experienced many complexities of CRC governance, IP and related matters, and difficulties in involving small and medium enterprises. Assuming that best-

practice exemplars have emerged, these should be disseminated and deployed within new CRCs. The CRC Secretariat and CRC Association have roles to play in this.

Since the focus of the CRCs should be on undertaking precompetitive research with fairly long time scales, research activities are likely to be negotiated from broad industry settings (with particular constraints) by researchers' more specialised input. Continuing dialogue and collaborative management of the research programmes will ensure industrially relevant outcomes.

It is the governments' privilege to set priority areas. ACED notes that achieving commercial outcomes from each of the five priority areas published recently is underpinned by one or more engineering discipline. However, some of these, specifically agriculture and food, are not currently particularly attractive to undergraduate students, from whom future researchers for CRCs would need to be drawn. Correspondingly there is not necessarily a critical mass of leading academics in the universities to lead the required applied research.

On the other hand, our student-demand led system has the 34 ACED faculties/schools graduating about 11,000 new engineers per year, increasing steadily, but with almost one third in civil engineering. Only about 5% of all Australian engineering graduates progress to higher degree research. Re-invigorating research and innovation-led engineering enterprise through CRCs or related programmes may require new incentives for graduates and industry to study in relevant fields.

Action points:

- (iii) The CRC programme should develop and encourage the use of best-practice exemplars in all areas of CRC administration.
- (iv) New incentives need to be developed by government, industry, and the universities to ensure an adequate flow of first degree students in areas of critical concern to Australia's future, and to encourage adequate numbers of Australian engineering graduates to progress to industry-directed postgraduate research.

C. How can the government's investment in the CRC programme further drive more frequent and more effective collaboration between industry and the research sector?

ACED member faculties/schools have proved their strong support for the CRC programme over its lifetime, by participating in every round, and by operating many CRCs. ACED members are also intensifying their collaboration with industry in areas such as work integrated learning, with approximately 25% of all of the 11,000 capstone design/research projects taken annually by final year student in accredited BEng(Honours) and MEng degrees being linked to industry.

ACED considers that the government could gain more from its investment in engineering education and research (however funded) by expanding the funding to the CRC programme in areas in which engineering input is required (such as the recently published priorities). ACED would support government developing and adopting research impact and industry engagement metrics against which some components of block funding or research training places are distributed.

ACED also suggests that there is scope for systematically improving the research (PhD) training components of CRCs to explicitly include coursework on such topics as commercialisation and advanced project management. The professional doctorate programme that has operated for several years in the United Kingdom could well be trialled in one or more future CRC. There may also be scope for the CRC programme as a whole to more strongly encourage the development of advanced short courses and workshops in technical areas of selected CRCs, through collaboration with their participants.

Action points:

- (v) Expand the CRC programme in areas of critical importance to Australia, such as in the priority areas identified by government.

- (vi) Developing and adopting **research impact** and **industry engagement** metrics against which some components of university block funding or research training places are distributed.
- (vii) Improve research (PhD) training in CRCs through inclusion of relevant coursework, and through exploration of professional doctorate programmes.
- (viii) Increase the outreach component of CRCs with development of advanced short courses and workshops in technical areas of selected CRCs, through collaboration with their participants.

D. How could contractual and administrative requirements of the CRC programme be streamlined?

ACED members have found, in general, that CRC contractual and administrative arrangements are excessive, and should be reduced to the greatest extent possible without compromising the integrity of the programme or reducing the transparency of its outcomes.

A target selection success rate of say 50% would be more acceptable for the investment currently required by both university and industry participants to formulate a bid; increased programme funding or reduced requirements would be needed to at least temporarily redress the investment/success imbalance. This may be achieved with greater focus on priority areas.

Action point:

- (ix) Increase the government funding available to the CRC programme such that a 50% success rate of high quality proposals can be funded, but in fewer and more focussed areas.

E. Is there sufficient demand within the research sector and industry for a programme that builds collaborative structures that facilitate end-user driven research?

There is clear demand from the ACED engineering faculties/schools for such a programme, because of the core desires and focus of engineering schools to see the outcomes of their research (however funded) strongly taken up in Australia.

However, the rapid changes in the balance of engineering industries, particularly in manufacturing, and the many current uncertainties for industry investment in defence and energy, make it hard for some industry sectors to commit and define areas for 'end-user driven research', especially if their businesses are dependent on government policies.

The time scales for investment in new plant and infrastructure, as well as in research, require these uncertainties to be resolved in a politically bipartisan manner. Clearly, the CRC programme itself has had the required bipartisan support over two decades, on the grounds of delivering good outcomes for industry.

We would be pleased to answer any further questions in relation to this response, and look forward to hearing the outcomes of the review.

Yours sincerely

signed

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President Australian Council of Engineering Deans

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