Submission

Review of the National Innovation System – Cooperative Research Centres Programme

Submission prepared by
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Declaration of interests and affiliations

The Molecular Plant Breeding CRC (MPBCRC) is made up of participants from government research bodies, universities, R&D corporations and private industry. The commercial and industry partners provide cash and in-kind funding to CRC research projects.

The core participants of MPBCRC are:

Department of Primary Industries, Victoria (DPI Vic)

The University of Adelaide

South Australian Research and Development Institute (SARDI)

Department of Agriculture and Food, Western Australia (DAFWA)

Murdoch University

International Maize and Wheat Improvement Centre, Mexico (CIMMYT)

The commercial and industry partners are:

BASF Plant Science

PGG Wrightson Pty Ltd

New Zealand Agriseeds

Heritage Seeds Pty Ltd

Royal Barenbrug Group

Dairy Australia Ltd

Meat and Livestock Australia Ltd

Geoffrey Gardiner Dairy Foundation

Grains Research and Development Corporation (GRDC)

Australian Centre for Plant Functional Genomics (ACPFG)

The Government Funding Sources are:

Department of Innovation, Industry, Science and Research (DIISR)

Preamble

The CRC programme provides scope and support for innovation.

In this submission to the National Innovation System Review we will respond to the key questions posed by the Review Panel from an industry perspective. We will provide concrete examples from the Molecular Plant Breeding CRC (MPBCRC) experience of what works well within the CRC Programme.

We will also provide insight into how things might be done better.

Three interrelated dimensions will be used as the framework for analysis and discussion of innovation from the perspective of an agricultural CRC, depicted in Figure 1.

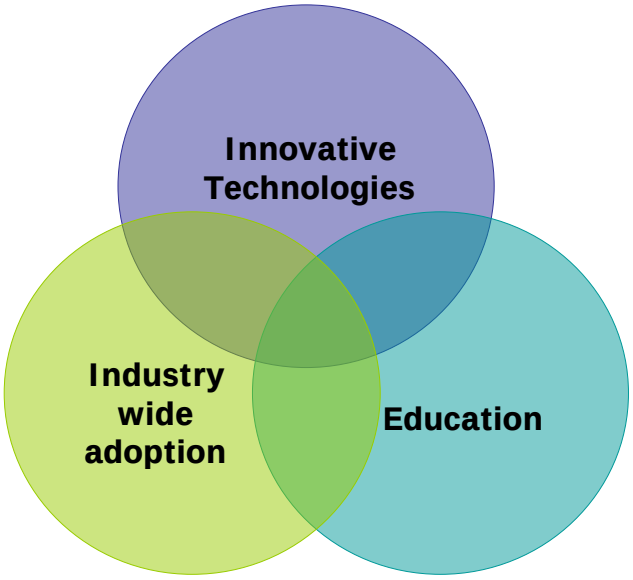

Figure 1. Three interrelated dimensions create a framework for analysis and discussion of innovation

The MPBCRC exists to ensure the competitiveness of Australian crop and pasture industries by developing tools for applying molecular genetics and delivering them through the crop and pasture breeding programs.

The MPBCRC experience has demonstrated that close collaboration between industry and research can deliver fresh ideas and new technologies to industry with substantial benefits for breeders, farmers and ultimately consumers in Australia and overseas.

Competitive, productive partnerships between research and industry provide the platform for innovative and courageous commercialization transactions. Australians must grasp these opportunities if we are to provide sustainable solutions to global challenges such as climate change.

Innovative change requires innovative technologies

Australian agriculture is exposed to a number of significant risks. It is our job as innovative scientists to use the powerful toolbox of biotechnology to help mitigate these risks.

The importance of climate change is recognised in Australia's National Research Priorities. In order to work towards an environmentally sustainable Australia, we must find ways to respond to climate change and variability.

Environmental risks also generate economic challenges for Australian agriculture. It is imperative that we build agricultural productivity and resilience in order to ensure economic viability.

Australia has the innovative capability to meet the challenge of climate change. The challenge is multi-faceted and requires a multi-faceted response.

The development and deployment of molecular technologies by agricultural CRCs can contribute to the solution of a number of the questions posed by the Innovation Review Panel.

Question

"Could we do everyday things better?"

Solution

Long-term, sustainable partnerships with industry and demand-driven, collaborative research. The end-users of transgenic and non-transgenic crop research are primary producers, supply chain partners, consumers and the public in Australia and worldwide.

Example

The use of genetic assays to select breeding progeny for desirable traits. Molecular marker-assisted selection improves the efficiency of breeding programs by reducing from 14 to 7 the number of years required to generate an improved crop variety.

Question

"How do we solve the big challenges we face as a country, an industry or as a community?"

Solution

To remain competitive in agriculture we must do everyday things better by embracing innovation. New tools such as transgenic technologies present opportunities for substantial gains in productivity in the face of environmental challenges such as climate change.

Another of the world's challenges remains that of global food shortage. Food shortage cannot be alleviated by converting more land to agriculture. Yield is more important in this context and transgenic technologies represent one of the essential tools for increasing crop yields.

Example

Transgenic or genetically modified (GM) crops have the potential to provide significant economic, environmental and social benefits to Australian farmers and the Australian public. GM crops offer farmers benefits such as:

- better yields and higher productivity
- more efficient weed control
- better herbicide management to prevent weed resistance
- reduced costs and greater returns

In the future GM crops may also contribute water use efficiency, fertilizer efficiency and enhanced resistance to disease.

GM crops continue to experience enormous growth internationally (see Figure 2). The global area planted to GM crops continues to expand at a rate of around 13% per annum, reaching 114 million hectares in 2007 (James, 2008). Australia's competitors in agricultural trade have not hesitated to embrace GM crops.

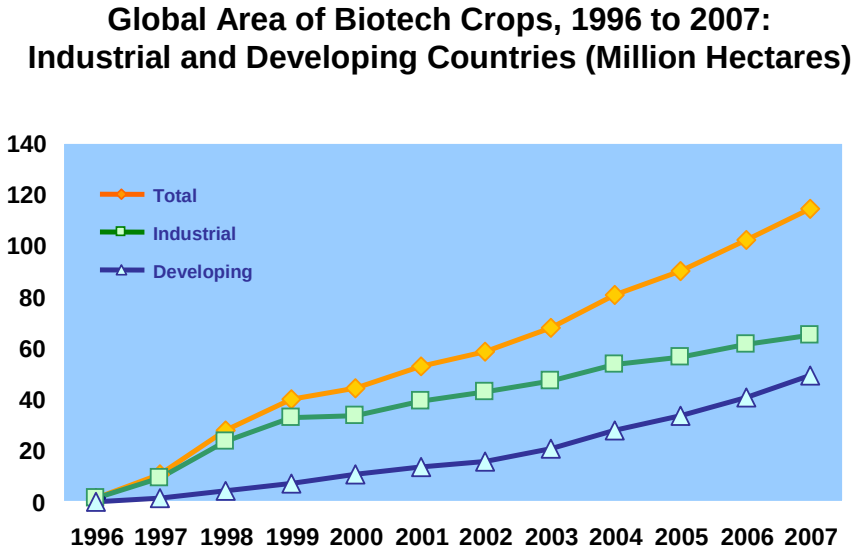

Figure 2. Global area of biotech crops, 1996-2007

Australian farmers have the potential to remain competitive in global markets – even though their competitors are heavily subsidised – because they are at the forefront of scientific research and adoption of new technologies.

Industry-wide adoption of outputs

Industry good, community good and commercialisation are the three integral goals of a productive CRC and MPBCRC aims to achieve a balanced outcome in all three.

CRCs must deliver improved technology to the end user. In the case of MPBCRC the end users or beneficiaries are breeders, primary producers, supply chain partners, consumers and the public in Australia and worldwide.

We believe it is essential for the CRC model to foster and support commercialisation as a means to ensuring the security, efficiency and sustainability of end product delivery and adoption. A CRC model built purely on philanthropic goals and peer-reviewed determination of success would be flawed.

Delivery of outcomes from MPBCRC's research and development activities depends critically on the close involvement of end user organisations. This is partly due to the nature of our Research and Development: development and implementation of new technologies for improving crop breeding must of necessity involve organisations in crop breeding. The breeders at Australian Grain Technologies (AGT) and Department of Agriculture and Food, Western Australia (DAFWA) work closely with the CRC so that as MPBCRC hones in on a genetic marker for a desirable trait, the breeders can incorporate that marker into their breeding programs as soon as the information becomes available. The breeders are now routinely using markers generated by the MPBCRC.

Productive commercial partnerships are a crucial element in the delivery of innovative technologies. In an agricultural context effective distribution of new technologies can only be achieved via established commercial delivery channels.

Only by keeping abreast of industry need can agricultural CRCs ensure both a return on Australia's investment in research and the ongoing competitiveness of Australian crop and pasture industries.

Close engagement with the industry also ensures that the CRC's priorities are aligned with the industry. However this alignment risks putting CRCs and Research and Development Corporations (RDCs) into direct competition. There must be clarification of the role of RDCs and CRCs so that CRCs can utilise RDCs to achieve industry-wide adoption without confusion and conflict between CRC and RDC development agendas.

MPBCRC's contribution to the solution of the questions relating to adoption of innovation is exemplified by two successful collaborative arrangements.

Questions

"How do we make it easy for people to use tools or apply ideas in novel ways?"

"How do we get more firms and organisations to use the best available tools and techniques, from anywhere around the world, in what they do?"

Solution

Collaboration between research and industry, nationally and internationally, is essential with research programs that are focused on the adoption of outputs. These outputs must be tangible products and services that are useful to end users.

Example 1

Collaboration is a key factor in the successful delivery of MPBCRC's target outputs. In 2005-2006, MPBCRC maintained 27 international collaborative arrangements (with 18 organisations) and 25 national collaborations. A range of collaborative frameworks and partnerships were established for effective technology development and commercialisation of MPBCRC research outputs.

An example, in the transgenic pastures area, is the progress Gramina Pty Ltd has made in the commercialisation of GM grasses with enhanced herbage quality. Gramina is an incorporated Australian agricultural biotechnology company jointly owned by PGG Wrightson Ltd and MPBCRC. The partners have agreed to license intellectual property rights developed under the joint venture exclusively to PGG Wrightson to enable the global commercialization of enhanced pasture grasses. The joint venture program is valued at AUD $36 million.

MPBCRC and PGG Wrightson bring complementary capabilities to Gramina. With its strong research background in molecular technologies, MPBCRC has the genetic tools and knowledge needed for the successful development of a new generation of pasture grasses. PGG Wrightson has the global marketing and sales network to secure a route to market for Gramina's technologies.

Example 2

Community good is an important goal of the CRC programme and it too can be realised through supportive international collaborations.

The international impact of MPBCRC is exemplified by its mutually beneficial relationship with the International Maize and Wheat Improvement Centre, Mexico (CIMMYT). CIMMYT is a non-profit research and training centre with direct links to about 100 developing countries through offices in Asia, Africa, and Latin America. One of the main goals of CIMMYT's work is to develop better crop varieties and cropping practices.

The breeding efforts of CIMMYT have an enormous impact on crop development in the developing world and much of its wheat and barley germplasm collection is directly

relevant to Australia. Approximately 90% of all spring bread wheat releases have some CIMMYT ancestry. The work of MPBCRC generates technologies that reduce the costs of germplasm development for CIMMYT, therefore benefiting cereal breeding in the developing world. These outcomes are consistent with the aims of Australian international aid policy.

Question

"As a relatively small country, how does Australia prioritise its innovation efforts to make the most of what it has or can do?"

Solution

Provide support for international partnerships that take risks.

Example

Australians benefit from collaboration between CRCs and multi-national companies. MPBCRC and BASF Plant Science have a strong partnership dedicated to the development of genetically optimised wheat that is more resistant to drought and fungal diseases. The joint program has an overall budget of approximately AUD $28 million and is scheduled for seven years.

BASF Plant Science is one of the top five companies in the world focusing on the discovery and use of agronomically important genetic traits. BASF Plant Science is making available its comprehensive collection of gene candidates for drought tolerance and resistance to fungal diseases. MPBCRC provides expertise and a patented technique for developing highly effective genetic modifications of wheat. Any products developed will be commercialised by MPBCRC in Australia, New Zealand and countries assisted by CIMMYT, while BASF Plant Science will be responsible for commercialisation in the rest of the world. In this way, the interests of Australian and developing world farmers are taken care of at the same time as ensuring that route to market for the technologies in a global context is secured.

The collaboration between BASF Plant Science and MPBCRC is an example of CRC-driven innovation in a global context.

Education

A culture of innovation in Australia requires an educational focus on innovation.

MPBCRC has invested in developing a best-practice education program that supports the development of intellectual capital, an essential driver of long-term prosperity. Education efforts within the MPBCRC are broad, with training provided to post-graduate students, plant breeders, school students, teachers and community groups.

Question

"How do we educate and equip our people to be creative and innovative, life-long?"

Solution

Best-practice community and school outreach programs based on sound educational principles.

Example

Get into Genes, a joint initiative of the MPBCRC and the Australian Centre for Plant Functional Genomics (ACPFG), is an interactive biotechnology education program for secondary school students highlighting the latest technologies used in the development of new cereal crop and pasture varieties. In 2006 Get into Genes was awarded the *Excellence in Innovation in Education and Training and Public Outreach Activities Award* by the CRC Association. By telling the story of plant improvement from farmer-selected seed, through conventional breeding programs to the genetic engineering of food plants, *Get into Genes* connects school students, teachers and the wider community to cutting-edge agricultural research.

A strength of the program has been the involvement of postgraduate students in the delivery of the workshops. These young scientists are positive role models for the school students - they talk candidly about their career pathways and convey a real passion for science. At the same time, the postgraduate students are developing their ability to convey technically complex subject matter to diverse audiences with little knowledge of science.

The innovative quality of *Get into Genes* lies in the ability of the package to meet the needs of several different groups of recipients simultaneously. In addition to the obligation that publicly funded organizations have to engage the community in scientific enterprise, there is a need to raise awareness of agricultural production within our highly urbanised society.

The collaboration between MPBCRC, ACPFG and *Get into Genes* is a good example of synergy. Through collaboration, and specifically through the sharing of staff and resources, all groups have been able to achieve far more than they would have individually. *Get into Genes* highlights the role of gene technology in crop and pasture improvement. It is the vision of the CRC that Australia's crop and pasture industries will be underpinned by innovation in molecular plant breeding. *Get into Genes* supports the CRC's research through its role in ensuring a future where our researchers are inspired, the research is innovative and the community supports them.

Question

"Can we imagine a better world? Are we asking the right questions?"

Solution

Inspire and train excellent students to think creatively and value innovation

Example

Over the lifespan of MBPCRC and its predecessor CRCMPB, 39 postgraduate students have been trained. These students are encouraged to think creatively and develop innovative technologies.

MPBCRC graduates continue to contribute to industry development with graduates working with industry partners within MPBCRC. Postgraduate and Honours Student Retreats are organised every year in conjunction with the Annual Research Conference. This targeted education program includes equipping students with writing and communication skills, effective team work skills and the ability to present to an interview panel.

It is vital that CRCs focus on educating the innovators of tomorrow, in terms of scientific and creative thinking in addition to providing technical training. MPBCRC's training of its post-graduate students focuses on the whole student, developing creative and confident thinkers and innovators.

Recommendations

The innovative outputs of CRCs such as MPBCRC demonstrate Australia's capacity to rise to complex challenges such as climate change and food shortage.

Australia must build on these capacities to remain competitive and productive on the global stage.

CRCs that deal with ground breaking science need more than seven years to bring their work to fruition. For example, in the case of agricultural CRCs breeding cycles and regulatory hurdles may mean that a time frame of 12 to 14 years is more realistic. CRC's that develop drugs and medical devices also require more than 7 years to deliver their technologies due to the onerous regulatory environment that they operate in.

Innovative biotechnologies, industry-wide adoption of research outputs and best-practice community education need to be underpinned by good governance.

Collaboration with multinationals is beneficial to Australian farmers and must be supported. Such collaborations are sometimes perceived as compromising scientific and moral integrity but espousal of this narrow view can stifle innovation. As a corollary, innovative technologies carry high risks and government co-investment through funding of CRC's is a powerful catalyst for private sector investment (e.g. MPBCRC's collaborations with BASF Plant Science and PGG Wrightson Ltd.).

Innovative technologies are usually tightly regulated. While it is appropriate to have a robust regulatory environment for powerful and new technologies, if the public is engaged in the process of technology development, through education programs and informed debate, the regulatory hurdles imposed may not be as high and the benefits of the technology can be delivered more rapidly and at a lower cost.

MPBCRC makes the following recommendations for the CRC programme in the future:

- Continue to provide inducements for collaboration between institutions both in Australia and internationally and insist on high levels of co-operation between institutions.
- Encourage innovative commercialisation transactions including collaboration with multinationals or foreign investors that enhance industry-wide adoption of new technologies.
- Provide support for innovative and powerful technologies such as GM that can bring enormous benefits but must overcome high hurdles of regulatory compliance and public acceptance.

- Recognise the value of innovative educational programs developed by CRCs with funding from the education sector. Link education programs to innovation programs, that is, let the education program engage the public with the innovations being developed by the CRC.

- Increase the time-frame for CRCs to 12-14 years, with appropriate reviews.

- Clarify the role of agricultural CRCs and RDCs so that they are working in concert and not in conflict.

- Good innovation, good education and good adoption must be underpinned by good governance. CRCs therefore need to be structured so that they are governed by the Australian Corporations Act and that key management staff such as the CEO and the Research Director functions are full-time employees of the CRC. In addition, CRC Boards need to have a majority of independent members, who owe their fiduciary duties to the CRC and who are chosen on the basis that they have no conflicts of interest (e.g. associations with competing organisations).

References

James, C. (2008). *2007 ISAAA Report on Global Status of Biotech/GM Crops* (ISAAA Brief No. 37-2008). New York: International Service for the Acquisition of Agri-Biotech Applications.