



Australian Institute
for Commercialisation

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DEFINING AND OPTIMISING VALUE FROM CRC KNOWLEDGE

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1. Executive Summary

The AIC has been tasked by a number of governments to provide advice on how Cooperative Research Centres (CRCs) create value, and to identify the challenges experienced by CRCs in optimising the value from the knowledge they generate through their collaborative research activities.

To provide this advice, the AIC has studied its background IP, reviewed its consultancies on behalf of CRCs, and held discussions with over twenty CRCs and their industry partners. Although these discussions reached into only a subset of the total CRC population, and were certainly not inclusive of all successful CRCs, the sample size and background IP together were comprehensive enough for common characteristics and key drivers of success to emerge. The project proposed a model framework to test both internal and external conditions to determine a CRC's ability to realise its value, and this model was then tested against these observations.

The definition of 'value' can clearly be contentious, particularly in the current environment where there is a popular strand of thought that value can derive from either public benefit, or commercial outcome, as if the two are mutually exclusive. The AIC believes this is false logic, and has proposed a definition of value as “the **application of knowledge generated by the CRC**, including internal diffusion between partners, and transfer into industry and the wider community of users”. We have also proposed a framework of **dual benefit**, in which the demand to show spillover effects is forcing 'commercially focused' CRCs to consider public benefit, and the call for commercialisation is forcing 'public benefit' CRCs to consider partnerships with industry partners. The end result is that both public and commercial benefits are being demonstrated by leading practice CRCs.

The purpose of this paper is to present the AIC's conclusions of a model for a 'Great CRC' on the basis of its studies; and to present factors considered by leading edge CRCs to be critical to their success.

2. Introduction

2.1 Objective

The purpose of this project is to identify how CRCs extract value from the knowledge they generate, and more specifically how knowledge is transferred into industry and the wider community. Utilising a sample of CRCs and industry partners identified by each CRC, a survey instrument was developed to determine the prevailing challenges and the methods used to extract value from the knowledge generated by each CRC.

2.2 Overview

The consensus view is that the CRC program has been successful overall in realising its broad objectives; however it can be argued that there are opportunities to further improve the program's impact and strengthen some of its outcomes. For additional information on the Commonwealth CRC Program refer to Appendix A.

The AIC's approach to this project was to apply a framework designed to test both internal and external conditions that are thought to determine a CRC's ability to realise its value. Because the measurement of 'value' can be broadly defined – and is frequently contentious – the AIC has used qualitative outputs from the CRCs during the course of each survey, as well as surveys from the intended end-users of CRC collaborative research, primarily the nominated industry partners.

Capturing the impact of conditions internal to the CRC will be critical to understanding the link to performance. These include methods, processes and procedural dynamics such as:

- ❑ Intellectual property (IP) management
- ❑ Operating structure
- ❑ Governance arrangements
- ❑ Commercialisation structures
- ❑ Communication programs
- ❑ Recognition of intellectual capital

- ❑ Stage within the CRC lifecycle
- ❑ Exit Strategies and Planning
- ❑ Managing customer relationships
- ❑ Internal Resourcing
- ❑ Skills and Capability

A CRC's interaction with, and response to, its external environment will also impact the CRC's ability to diffuse its generated knowledge throughout industry and the broader community of users. Therefore, understanding the impacts of external conditions, such as those below, and their relevance to the value metric, will further test the understanding of a CRC's ability to derive value from its knowledge:

- ❑ Degree of market pull
- ❑ Strength of collaborations
- ❑ Relationships between CRC partners
- ❑ Depth of industry relationships
- ❑ Evolution of CRC partners

The CRCs that participated in this project were selected to ensure the survey results were representative of a cross section of industries and stages of the CRC lifecycle. This approach ensures the project team successfully identified most of the challenges in maximising value; had a wide cross-section of value creation activities; and could identify common features and characteristics in a CRC that extracts greater value from the knowledge it generates.

3. Methodology

3.1 Process Summary

The AIC project team performed and completed a number of essential tasks to complete this study. The tasks included a literature review, including both public and internal AIC consultancy documentation, a survey of selected CRCs, and the development and validation of a model containing the key factors that impact on knowledge creation and IP transfer.

3.2 Description

The AIC project team commenced with a broad scan and analysis of various CRC program information and commentary that identifies and discusses the objectives of the CRC program, its policy underpinnings, as well as some evaluations of the program's success and progress since inception.

The project team's next objective focussed on scanning and reviewing the relevant literature on intellectual property and knowledge transfer from the research sector. This included analysis of key publications such as the *Metrics for Commercialisation*¹ and the *Emerging Business of Knowledge Transfer*² reports. This process also included engagement with relevant stakeholders such as the CRC Association, the Commonwealth Department of Education, Science and Training, and State Government representatives.

The literature review enabled the AIC to identify several key factors of success in commercialisation, knowledge transfer and value creation. These factors contributed to the development of the project team's survey instruments used to capture the essential factors and issues for deriving value from CRC knowledge, as well as the AIC's experience in working with CRCs in a variety of sectors and lifecycles.

Thirteen CRCs were engaged and formally surveyed as participants in the project. Others were canvassed through internal consultancies and ongoing discussions. Face to face surveys were undertaken with the CEOs or senior executive staff of each CRC. The CRCs were representative from across the three classes of National

¹ *Metrics for Research Commercialisation*, A Report to the Co-ordination Committee on Science and Technology, 15 April 2005,

² Howard Partners, *The Emerging Business of Knowledge Transfer: Creating Value for Intellectual Products and Services*, March 2005, p21

Economic, Environmental and Social Benefit; Industrial Research; and Business Development. The survey included closing or closed CRCs as elements in the survey constituency, to determine the extent to which knowledge generated by the CRC may not have been fully utilised at the time the CRC was, or was expected to be, wound up. Lastly, the inclusion of CRCs funded once or more, and the differences, if any, in the extraction of value derived from the created knowledge in their second or third rounds were also included.

A second survey constituency comprising industry partners was also engaged and interviewed, in an attempt to capture and rate the extent to which knowledge generated by the CRC was, in fact, utilised by the intended end-user. This second survey was also used to understand any commercial perspective in the process of knowledge transfer from the collaborative research endeavour at the core of the CRC program.

Lastly, the project team evaluated the input to identify common critical success factors, to identify leading practice in extracting value from knowledge created and commercialising or transferring IP within the Australian industry. The validated the AIC's model which identifies the common features, characteristics and factors that comprise a "Great CRC" that creates optimum value.

The project concludes, on the basis of the survey responses, with the presentation of this model; the presentation of some factors considered by the thirteen CRCs to be critical to their success; and some general conclusions about the project.

3.3 Survey Definition

The project survey process consisted of two qualitative survey instruments for CRCs and their nominated industry partner.

3.3.1 Project Hypothesis

The project hypothesis tested was: The value derived from the knowledge generated by a CRC is a measure of sound internal procedures and processes, in addition to the strength of its external relationships.

3.3.2 CRC Qualitative Question Set

The aim of the CRC survey instrument was to extract the key features, characteristics and factors of success in knowledge creation, commercialisation and knowledge transfer. The questions within the survey revolved around five broad topics including:

- *CRC Details and Structure*

These questions related to the industry, CRC type and CRC structure

- *Accounting for Value*

Value was defined as the creation, capture, storage, and usage of knowledge and its subsequent internal diffusion between partners and into industry and the wider community. These questions attempted to capture how the CRC generated its value.

- *Knowledge Diffusion*

Refers to the processes and procedures by which knowledge generated within the CRC was transferred to participants, industry and the wider community. These questions attempted to capture how the CRC diffused its knowledge.

- *Internal Conditions*

The internal processes and procedures that determine: research undertaken by the CRC; intellectual property generation, identification, management, valuation and ownership; management of relationships with research customers and end users.

- *External Conditions*

The way in which the CRC interacts with external parties and the market, including the CRC's knowledge of its market; how the CRC engages with industry partners; how partners assist the CRC to identify research; the extent to which industry partners participate on a project level; and the strength of the relationships with research customers and end users of the CRC's research.

3.3.3 Industry Qualitative Question Set

The aim of the industry partner survey instrument was to capture and rate the extent to which knowledge generated by the CRC was, in fact, valued and utilised by the intended end-user; and to understand any commercial perspective on the process of knowledge transfer from the collaborative research endeavour at the core of the CRC program. These points would further test and validate the key CRC features,

characteristics and factors of success identified in the CRC survey. The questions within the survey revolved around three broad topics including:

▣ *Relationship to the CRC*

These questions related to the nature of the firm's involvement with the CRC, including history, relationship, expectations, among others.

▣ *Accounting for Value*

Value was defined as the creation, capture and storage of knowledge and subsequent transfer to industry. Specific questions related to the level of involvement in research projects, access to IP, absorption of value and benefits.

▣ *Knowledge Diffusion*

This section referred to the level of resources, method types, depth of collaboration and procedures by which knowledge was transferred to end-users.

3.4 Participating CRCs

Thirteen participating CRCs were selected on the basis of their exhibiting characteristics representative of a variety of industries currently participating in the program, and encompassing the National Economic, Environmental and Social Benefit; Industrial Research; and Business Development classification of CRCs. Cooperative Research Centres were also selected based on the stage within their lifecycle, including new CRCs in early phase, CRCs that have operated for multiple rounds, and discontinued CRCs.

CRCs or past CRCs that participated in the project are listed below:

- ▣ CRC for Construction Innovation
- ▣ Polymers CRC
- ▣ Vision CRC
- ▣ CRC for Spatial Information
- ▣ Invasive Animals CRC
- ▣ CRC for Micro technology
- ▣ Antarctic Climate and Ecosystems CRC
- ▣ CRC for Mining
- ▣ Distributed Systems Technology Centre
- ▣ CRC for Sugar

- ❑ Sustainable Tourism CRC
- ❑ CRC for Advanced Composite Structures
- ❑ CAST CRC

3.5 Project Limitations

Survey bias and limitations exist within some areas of the survey process. The primary source of bias is the small sample of CRCs that were interviewed. Only thirteen CRCs were surveyed and this sample, and the corresponding results and analysis, will not be representative of all CRCs in the Australian CRC community. This project does not intend to propose national best practice in the field of value created from CRC research collaboration, and any results should not be interpreted in that context.

The CRCs that participated in this survey were instead selected to ensure the results of the survey were representative of a cross section of industries and stages of the CRC lifecycle. The industry partners, however, were nominated by their corresponding CRC, and this will result in selection bias in the industry component of the overall survey.

Although it was necessary to collect qualitative data from the CRCs during the course of the survey due to the lack of a clearly defined method to measure 'value', this has allowed for some bias to exist in responses from CRCs. The written qualitative responses are also open to interpretation from the project team during the analysis of results, and this may also lead to some variability in the results.

The findings from the industry survey describe how each of the participating CRCs interact with their nominated industry partner, while the survey established the research user's perspective of knowledge diffusion from their CRC. It is important to recall that each CRC volunteered an industry participant nominee to survey and the results must be interpreted in that context. Limitations also exist in the analysis of these results due to the distribution of participants across a range of industries. CRCs in different industries have different external factors that would affect the CRC and the creation of value, making comparative analysis difficult.

Despite these limitations, the findings and subsequent conclusions can fulfill a useful role as an additional source of program guidance. The intent of this paper is to enable current and proposed CRCs to better respond to the challenges of

maximising their value creation activities and to raise awareness of some of the critical success factors, features and characteristics for optimising CRC value.

3.5.1 Comparison of CRC Outputs using the MDQ

The participating CRCs were asked to supply copies of their completed Management Data Questionnaires (MDQ) for previous financial reporting periods, with the reported measures used as the basis for a comparison of the outputs of the CRCs. The MDQ was used to compare CRCs because they represent the only available source of independent data on CRC performance.

The data captured in the MDQ reflects the Department of Education Science and Training definition of commercialisation, where for statistical and data collection purposes 'research commercialisation' is defined as 'the processes that generate commercial returns via income and capital gains, income from licences and revenue from sales of new products and processes from research conducted.'³

3.5.2 Limitations of the MDQ

The MDQ is the only available method to quantitatively compare CRC value creation outcomes, and a number of limitations associated with its interpretation are apparent. First and foremost, as discussed below, the overwhelming majority of the surveyed CRCs argued that the MDQ did not adequately capture the value creating activities of their CRC, failing to capture such indicators as:

- ❑ Work in progress
- ❑ Environmental, economic, and social benefits
- ❑ Intellectual capital
- ❑ Know how.

Furthermore, owing to the limited number of MDQ reporting years supplied by some CRCs, and their varying life spans, no impartial comparison of the CRCs could be completed on the basis of the information supplied.

One report by Allen Consulting Group also noted that there exists substantial 'time-lags involved in the translation of research outputs into final economic impacts for society'⁴. Thus it is reasonable to assert that CRCs operating early in their lifecycle would not have research outputs of the kind found in those later in their CRC cycle.

³ DEST, *Definitions and Methodological Notes—Statistics on Science and Innovation*, p. 28. 2004

⁴ Allen Consulting Group, *The Economic Impact of Cooperative Research Centres*, p.12. 2005

Given the AIC was unable to obtain a complete set of MDQ data covering the surveyed CRCs across their entire lifecycle, and because the MDQ data itself reported only a small subset of CRC value creation activity, this data was used sparingly to form the conclusions on which this report is based.

4. Results

4.1 Qualitative Results of the CRC Survey

4.1.1 CRC Details and Structure

Thirteen participants were asked in which industry or sector the CRC operates; which category of *Trajectory in the Evolution of the CRC System*⁵ identified in the Howard Partners Evaluation of the Cooperative Research Centres Programme applies to their CRC; the duration of their operations; and the legal/tax structure of the CRC vehicle. The results are summarised below. Several respondents noted that their CRC satisfied the definition of one or more of the CRC classifications.

Table 1: Summarised results of the CRC Survey

CRC	Industry/Sector	Life Cycle	CRC Structure	CRC Classification
CRC for Construction Innovation	Construction, design and facility management	Round 1 Year 6	Unincorporated Joint Venture	National Economic, Environmental and Social Benefit;
CRC for Polymers	Emerging new materials/Engineering	Round 3 Year 2	Taxable company	Industrial Research Collaboration; business development
Vision CRC	Health/Eye care	Round 3 Year 2	Taxable company	Industrial Research Collaboration; Business Development;
CRC for Spatial Information	ICT	Round 1 Year 3	Unincorporated Joint Venture	Industrial Research Collaboration
Invasive Animals CRC	Agriculture	Round 2 Year 1	Tax exempt "not for profit" scientific institution	National Economic, Environmental and Social Benefit
CRC for Micro Technology	Micro-electronics and materials	Ceased operation Round 1	Unincorporated Joint Venture	Industrial Research Collaboration

⁵ Howard Partners, *Evaluation of the Cooperative Research Centres Programme*, p133. July 2003

CRC	Industry/Sector	Life Cycle	CRC Structure	CRC Classification
Antarctic Climate and Ecosystems CRC		Round 3 Year 4	Unincorporated Joint Venture	National Economic, Environmental and Social Benefit
CRC for Mining	Natural resources/Mining	Round 3 Year 2	Tax exempt "not for profit" scientific institution	Industrial Research Collaboration
Distributed Systems Technology Centre	ICT	Ceased operation Round 2	Incorporated Joint Venture	Industrial Research Collaboration; Business Development
CRC for Sugar	Agriculture	Round 1 Year 4	Incorporated Joint Venture	Industrial Research Collaboration;
Sustainable Tourism CRC	Tourism	Round 3 Year 2	Taxable company	National Economic, Environmental and Social Benefit; Industrial Research Collaboration; Business Development
CRC for Advanced Composite Structures	Advanced materials and technologies	Round 3 Year 2	Tax exempt "not for profit" scientific institution	Industrial Research Collaboration.
CAST CRC	Manufacturing technology	Round 3 Year 2	Tax exempt "not for profit" scientific institution	National Economic, Environmental and Social Benefit; Industrial Research Collaboration; Business Development

4.1.2 Accounting for Value

For the purposes of this survey the project team defined value as the application of knowledge generated by the CRC, including internal diffusion between partners and transfer into industry and the wider community of users.

This is consistent with the AIC's broad definition of commercialisation, where it is the process of transforming knowledge and technology into marketable products, services, or processes, and does not limit commercialisation to solely economic factors. Of course, marketable products, services, or processes can create outcomes that are economic, social, or environmental in scope...

4.1.2.1 MDQ Reporting Process

Participants were asked if the MDQ reporting process, a DEST mandated reporting requirement of CRC program participation, adequately captures the value that the CRC generates. Of the thirteen CRCs, only two responded that they believed the MDQ process was adequate for their CRC; however the remaining eleven replied that the MDQ process did not adequately capture the CRC's generated value, as described by the following survey extracts:

"The MDQ doesn't capture work in progress, for example one patent has been filed but three are pending [as well as] a number of deals that are pending and that cannot be counted"

"The MDQ is based on cash accounting, first order measures. CRCs are complex and produce both information and money"

"The CRC is aimed at building intellectual capital; this is not captured in the MDQ"

"The MDQ doesn't account for cost-benefit to an industry or community"

"The environmental impact is hard to capture in the MDQ"

Although the overall response to the adequacy of the MDQ capturing complete CRC value was overwhelmingly negative, partial MDQ results from the CRCs were nevertheless reviewed since they presently represent the only available source of independent data.

4.1.2.2 Human Resourcing

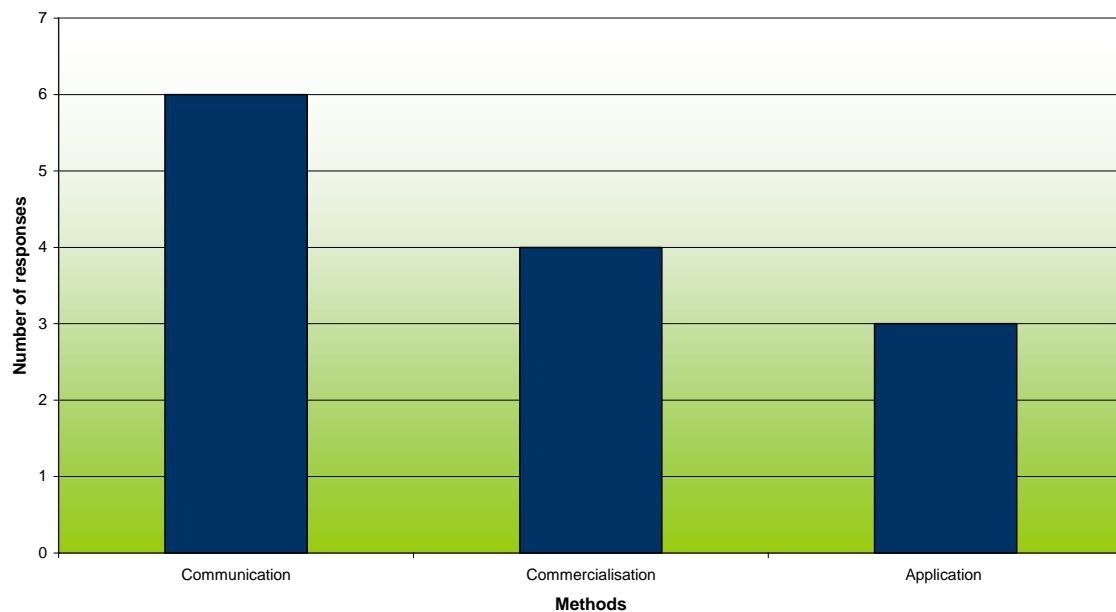
When asked if the CRC's human resources were adequate to realise the user needs and expectations, all thirteen participating CRCs responded that their human resource commitment to, and responsibility for, knowledge diffusion within their CRC was adequate.

4.1.3 Knowledge Diffusion

4.1.3.1 Methods of Knowledge Diffusion

The thirteen CRCs were asked to list their preferred methods of knowledge diffusion from a list which covered the following four areas: research training and education; communication; application; and commercialisation. The preferred method of knowledge diffusion was through communication followed by commercialisation and application.

Figure 1: Preferred Methods of Knowledge Diffusion



Some of the thirteen CRCs elaborated their responses, with examples listed below:

- ❑ Open source [of communication] with public programs and publication
- ❑ Developing partnerships with industry to establish industrial processes that have a clear path to market
- ❑ Need to combine communication and application
- ❑ Achieve a balance of workshops and seminars as awareness activities, as well as industrial process and new technology businesses

4.1.3.2 Translation of Research into a Tangible Form

The thirteen respondents were asked to describe the processes and procedures they have in place to translate research from the CRC into knowledge, such as industrial processes and public programs. Successful practices included:

- ❑ Deep involvement of industry partners in the research program
- ❑ Use of a defined structure and reporting for research management
- ❑ Use of an innovation register
- ❑ Policy initiatives open to the community –some knowledge made freely available
- ❑ Sharing of equipment or infrastructure for prototyping or demonstration
- ❑ Appointment of an industry development officer

Multiple respondents within the thirteen participants surveyed indicated that they used research participation with an industry partner to identify and translate research. One CRC indicated that industry participants are encouraged to pursue intellectual property protection since the partner holds part ownership of the generated IP.

Another CRC had in place a research committee reporting to the board. The role of the committee was to evaluate and re-align research projects to market needs. Another method of research translation was to have a clearly defined research structure and matrix reporting to executive officers. It was found that many CRCs utilise innovation or intellectual property registers to identify, capture and evaluate IP.

One CRC identified the inability to rapidly create products as a barrier to research translation, and instead developed the appropriate infrastructure to enable the development and rapid prototyping of products. To ensure research is effectively translated into policy initiatives one CRC allows the community to engage and drive the research it undertakes. Some CRCs have dedicated officers whose job it is to identify and translate research.

4.1.3.3 Research Communication

Respondents were asked to describe the processes and procedures they utilised to communicate research to target markets. The most successful processes identified by the thirteen participants were the use of:

- ❑ Strategies to broadly communicate non-confidential knowledge
- ❑ Education managers
- ❑ Alignment of research and communication
- ❑ Seminars, Workshops and Conferences
- ❑ E-bookshop
- ❑ Publications
- ❑ Public relations
- ❑ Monthly reporting

While some of the thirteen participants used non-confidential communication strategies such as a weekly e-newsletter to communicate with partners, others employed education managers to act as a resource responsible for research communication. Other CRCs strategically planned communications by aligning workshops and seminars with their research programs. Workshops seminars and conferences were a widely used method of CRC research communication; CRCs held workshops directly for industry participants as well as for the wider industry. One CRC had an online bookshop and E-library that was open to the community. Another used an aggressive public relations strategy to ensure broad communication of research using the media.

4.1.3.4 Research Commercialisation

One of the broader objectives of the CRC program is to encourage interaction with industry partners to accelerate the commercialisation of research. The thirteen CRCs were asked to describe the processes they used to transfer technology and research from the CRC into commercial application and use. Methods identified included the use of:

- ❑ requesting expressions of Interest
- ❑ a commercialisation manager
- ❑ partnering with another organisation
- ❑ appointing a commercialisation committee

- ❑ a product development group
- ❑ an IP management process
- ❑ a separate commercialisation company
- ❑ a licensing strategy
- ❑ pre-licensing to further develop and beta test IP
- ❑ a predefined commercialisation strategy at research conceptualisation

Processes and procedures used by CRCs for the commercialisation of generated knowledge were varied across all the participating CRCs, with some CRCs adopting certain methods exclusively.

Expressions of Interest

One of the CRCs interviewed submitted all their IP to the market for expressions of interest from industry, allowing industry to outline how they planned to commercialise the IP and the likely return. The most beneficial offer submitted to the CRC was then selected; preferential consideration was given to those organisations who had participated in the development of the IP.

Commercialisation Manager

A number of the participating CRCs had appointed full-time commercialisation managers who were responsible for commercialising the CRC's IP.

Partnering

Some CRCs would look for industry partners to assist in the commercialisation of the CRC's IP; another further developed IP by trialling it with an industry partner.

Commercialisation Steering Committee

Multiple CRCs had appointed commercialisation steering committees charged with the responsibility for making commercial decisions relating to the CRC's IP.

IP Management Process

A rigorous IP management process was implemented in some of the CRCs which governed how all IP within the CRC was recognised and documented. One CRC would conduct regular IP audits to identify intellectual property with commercial potential.

Separate Commercialisation Company

One of the participating CRCs had a separate for-profit commercialisation company that acted as a vehicle for the transfer of IP and technology into the

commercial arena. This organisation would start new technology companies, license IP or create joint ventures with other organisations.

Product Development Group

One of the CRCs had a product development group that was focused on the generation of commercial products from the CRC's IP.

Licensing Strategy

An articulated licensing strategy was the main commercialisation strategy used by one CRC.

Pre-Licensing

One CRC would pre-license IP that was yet to be developed.

Predefined Commercialisation Strategy

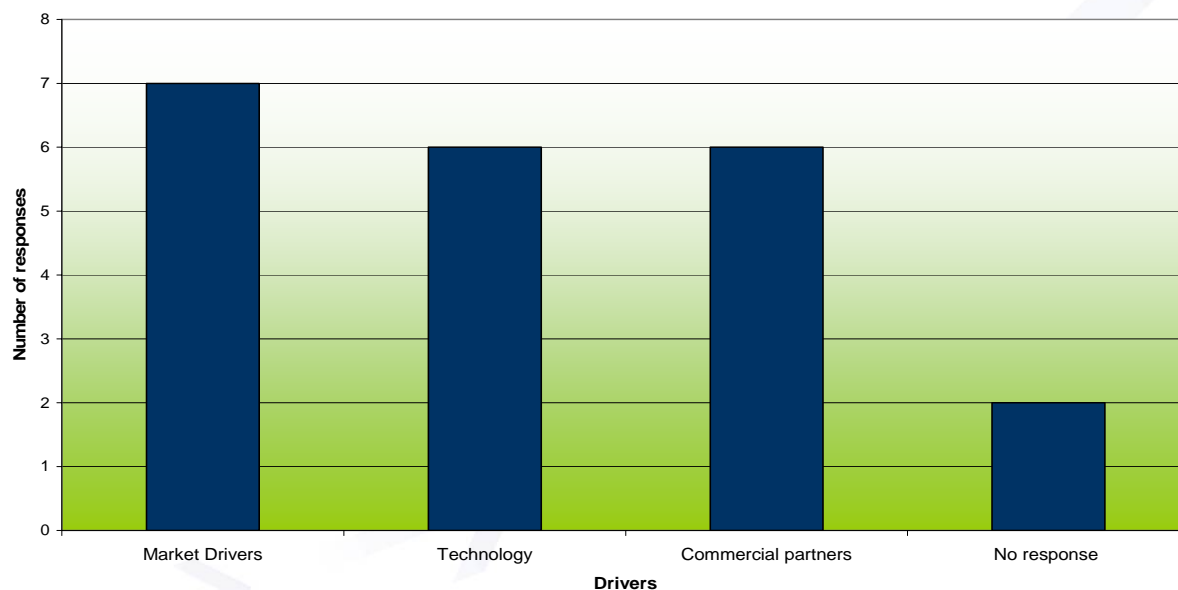
Another CRC determined the commercialisation strategy at the research planning stage.

4.1.4 Internal Conditions

4.1.4.1 Research Drivers

The thirteen participants were asked if their CRC research was driven by technology, commercial partners and/or market need. The results indicate that the market was the most common driving force behind the thirteen CRCs research objectives. This was closely followed by technology and the demand from commercial partners. Overall it would seem that the drivers that impact research programs are of equal value in terms of influence.

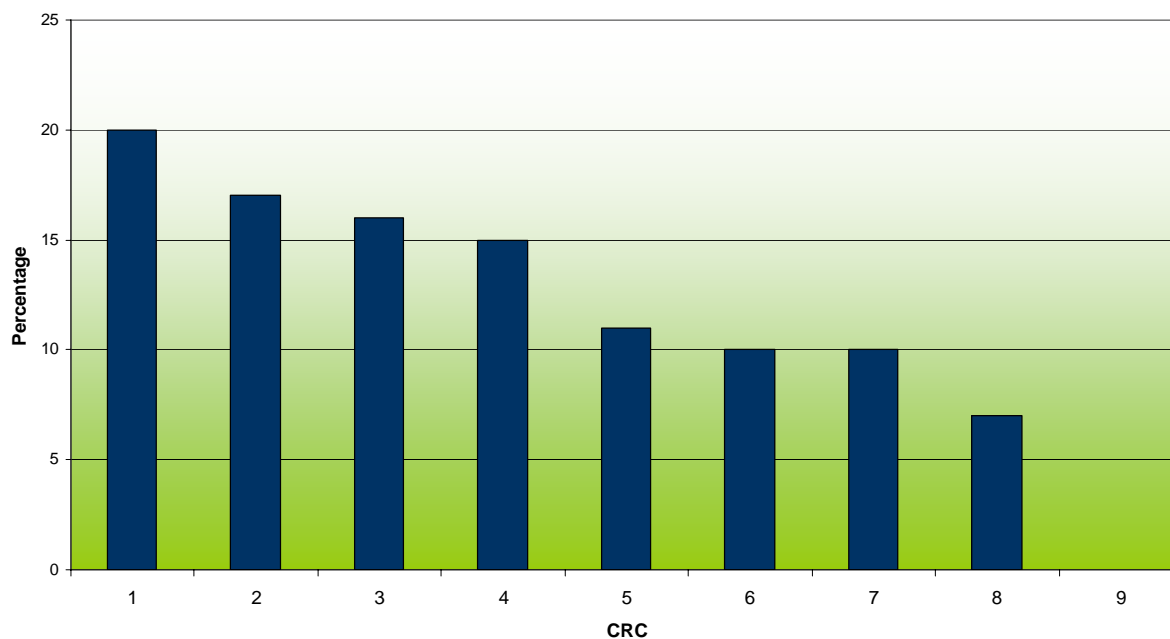
Figure 2: Research Drivers



4.1.4.2 Discontinued projects

The thirteen CRCs were asked to disclose the percentage of projects that had been discontinued and the evaluation criteria used to determine the termination process. Only nine of the thirteen participants disclosed the cessation rate of CRC projects. The percentage of CRC projects discontinued ranged from 0% to 20%.

Figure 3: Percentage of total CRC Projects that are discontinued or abandoned



The evaluation methods that were used to determine the viability of the CRC projects were also mentioned. Important evaluation criteria were identified from all nine respondents. These are as follows:

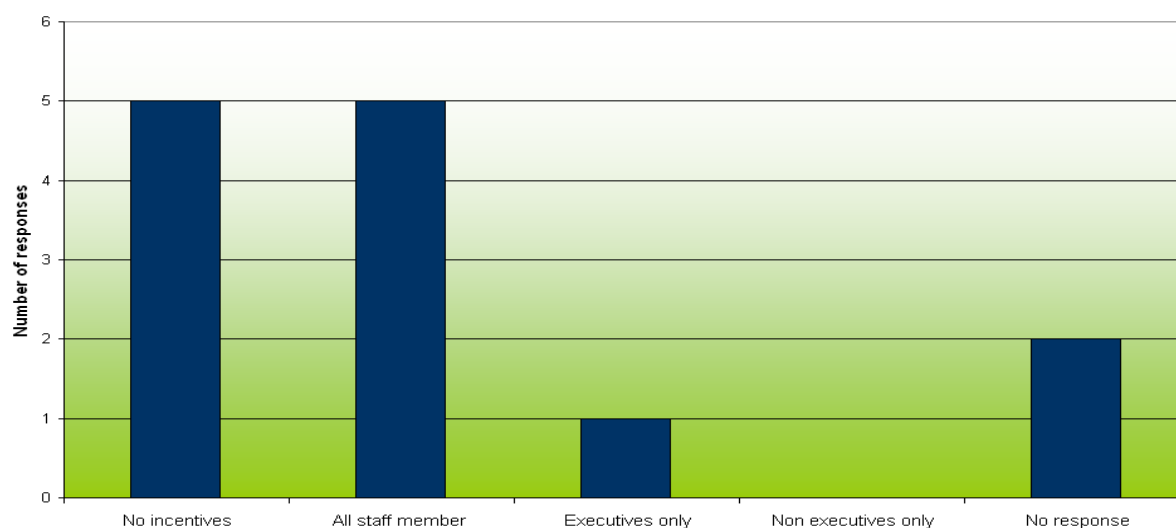
- ❑ Review meetings to check if projects were meeting milestones;
- ❑ Project benefits have to outweigh project costs;
- ❑ Must have recognition and acceptance by industry partners as industry influence can change decisions;
- ❑ Review meetings to check the technical feasibility of a project;
- ❑ Must have a defined path to commercialisation.

4.1.4.3 Incentives

The thirteen participating CRCs were asked if they provided incentives for both managers and researchers to create knowledge and IP for end-use adoption. The results below show a polarity between the CRCs with either all staff members receiving incentives or none.

The most common incentive program utilised a bonus scheme, based upon staff key performance indicator results.

Figure 4: Staff Incentive Distribution

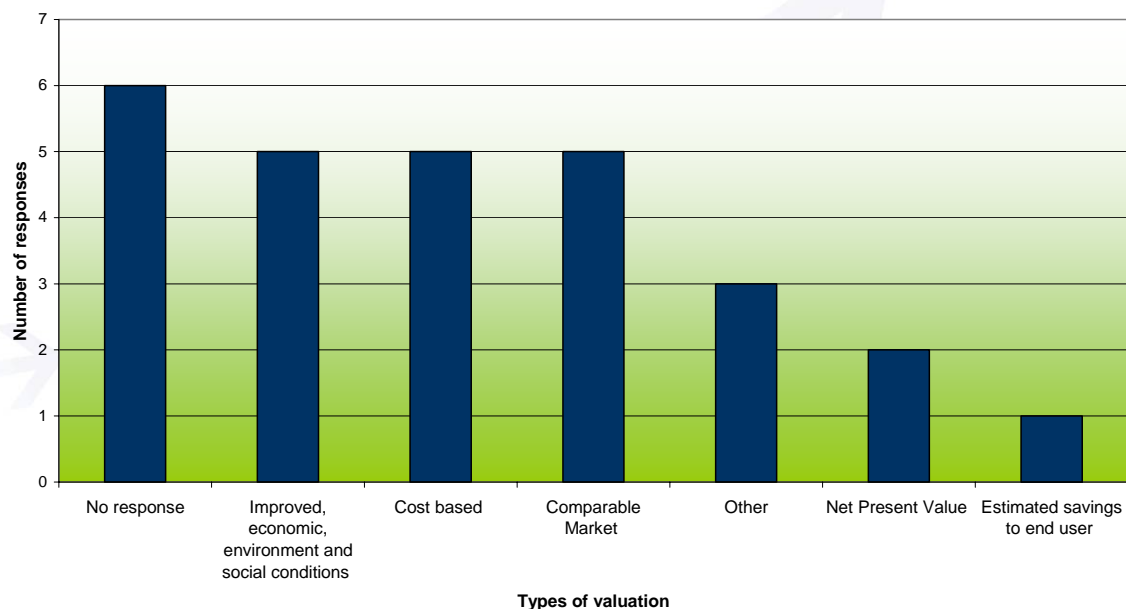


4.1.4.4 Valuation of Intellectual Property

When asked about how the CRC values the IP it generates, six of the thirteen participants did not respond to this question. The results of the remaining seven are not mutually exclusive as some CRCs had more than one method for valuing IP.

Improved economic, environment and social conditions, cost-based, and the comparable market approach were the most common methods employed by the CRCs to value IP. One other response provided by a CRC participant was that their IP was valued at “whatever anyone would pay for it”, which is a comparable market approach and possibly implying that no valuation would be completed.

Figure 5: Valuation of IP



4.1.4.5 Relationship Management

Participants were asked to describe what internal structures were in place within each of their CRCs to manage relationships with research customers and end users. Respondents identified a number of methods and characteristics of their relationship management, including:

- *Executive Committee*
A committee composed of executive members of staff is responsible for managing the relationship of the CRC with its participants.
- *Relationship Manager*
The CRC has a staff resource responsible for managing the relationships of the CRC and its participants, which may be a communications director, or business development officer.
- *Treating Partners Equally*
The CRC treats all partners equally regardless of their contribution to the CRC.
- *Through the Centre Agreement*

The CRC's relationship management is governed by the centre agreement.

- ▣ *Quarterly User or Project Reviews*

Each quarter a review is conducted with industry participants to ensure the project is meeting the needs and expectations of all parties.

- ▣ *Screening Partners*

The CRC uses a screening process when selecting partners to ensure that they can manage the relationship and meet the expectations of the partners

- ▣ *Framework Agreement*

The CRC has a framework agreement which governs the relationship management of its partners.

- ▣ *CRM*

The CRC has customer relationship management process or software to manage contact with partners. The software stores partner details and interactions.

4.1.4.6 CRC Program Exit Planning

Of the participating thirteen CRCs, 46% had already commenced strategic business planning for exiting the current program, while 31% had not commenced any formal planning. The remaining 23% included two CRCs that had ceased operations and one that had 'no response'.

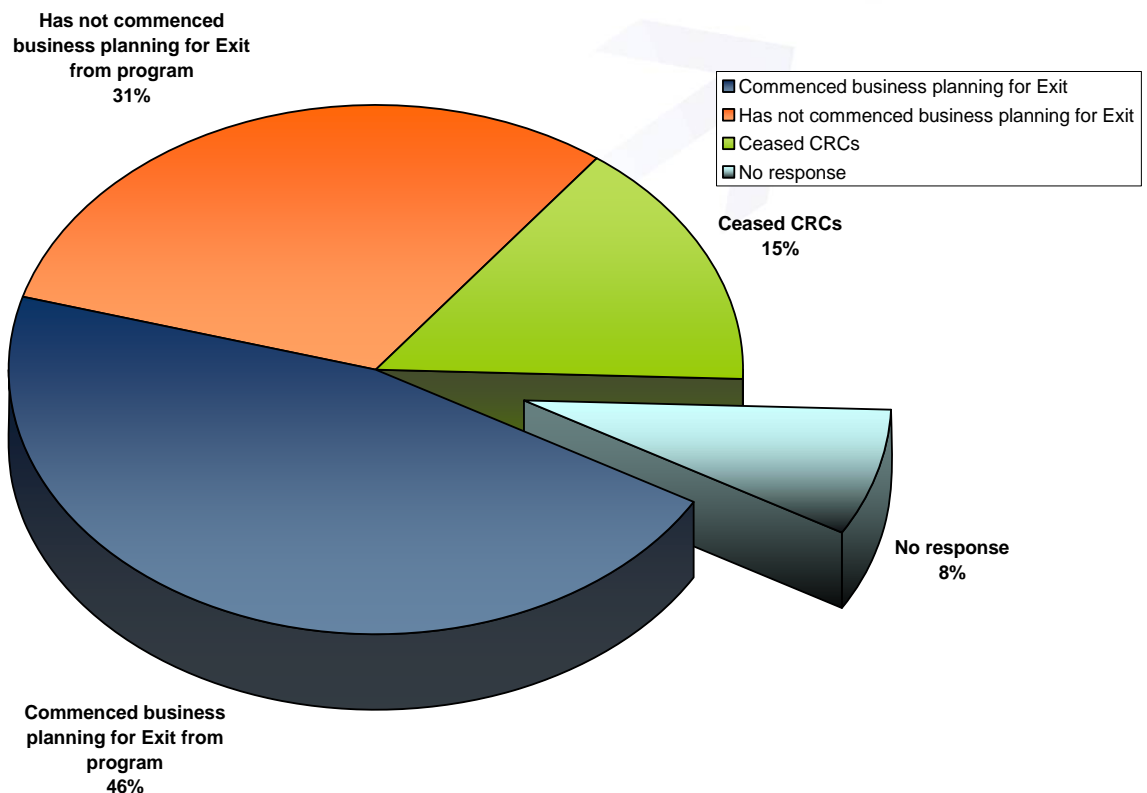
Of the CRCs that had commenced planning for exit, all were considering a re-bid as their preferred option. Several CRCs suggested that without the government investment as leverage, their partners, particularly the universities, would not continue to support them. Exit planning also included:

- ▣ Developing the CRC into a national centre for excellence
- ▣ Transferring some of the CRC activities to another entity and re-bid part of the CRC
- ▣ Continuing to operate with reduced scope
- ▣ An extension of the CRC without funding until the next round of funding

Of the 31% of CRCs that were yet to commence exit planning, half indicated that a re-bid would be their preferred exit. The remaining 15% had ceased operations, and had implemented two different approaches to exit. One packaged its IP assets which were sold, transferred or gifted to other organisations; and placed its staff in new

employment, while the other licensed its IP to spin-off companies that remain in operation today.

Figure 6: Exit Planning



4.1.4.7 Critical success factors

The thirteen CRCs were asked to identify what they considered to be the critical success factors for their CRC. All responses had similar themes in this regard, some of which are included here:

- Having a good management team supported by high-quality staff members, dedicated towards the work of the CRC.
- Having strong patenting skills
- Having excellent internal and external communication ability
- Encompassing simplicity within all processes and the organisation structure allowing for decisions to be made better and quicker for the best interest of the company
- Being able to leave a legacy behind after the CRC has closed to justify everyone's overall involvement and investment.
- Having a flexible approach to projects

- Having an effective and efficient governing board
- Having the skills to blend the need and obligations to Commonwealth with the needs of partners and board members.

4.1.5 External Conditions

4.1.5.1 Informing the Research Program

When asked if the CRC research program was driven by market need, 54% of the thirteen CRCs indicated that this was a major consideration, while 31% responded that they did not consider market need to be a determinant of their research program. 70% of the respondents indicated that they conducted market research to influence the direction of their research, while 15% indicated that they did not utilise market research.

Figure 7: Are end-users the driving force to the CRCs Research Agenda?

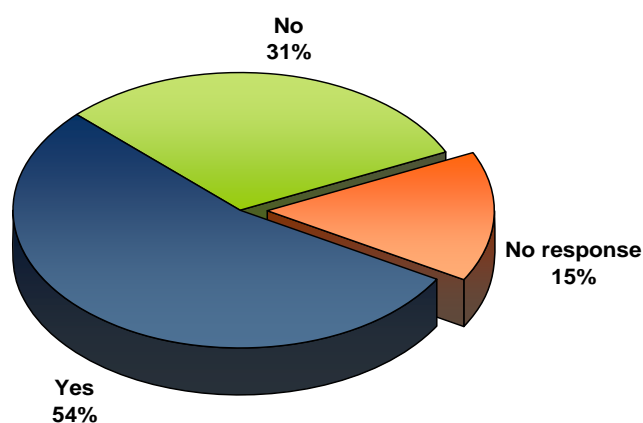
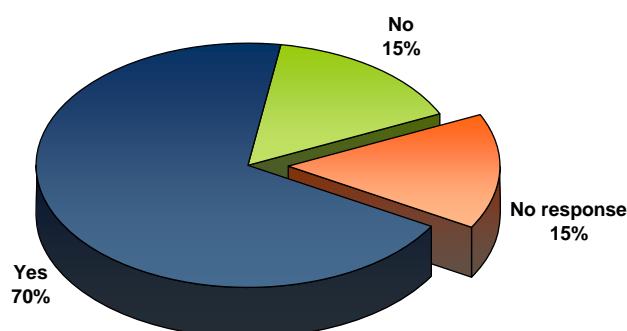


Figure 8: Utilisation of Market Research

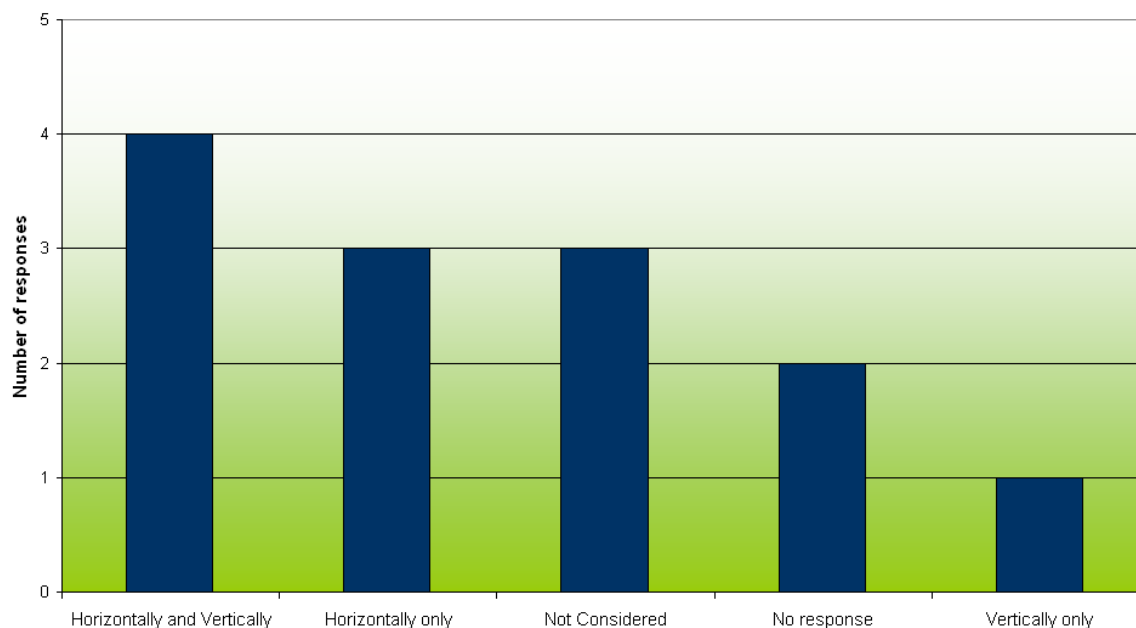


4.1.5.2 Partner Identification

CRCs were asked if partners of the CRC were horizontally or vertically selected from the supply chain of the industry in which they operated. Horizontal supply chain partners are those in the same position of the supply chain where they may be direct competitors or use the same technology with different market applications. Vertical supply chain partners are those that either supply or receive into others as distributors and suppliers within the same supply chain, and are not considered competitors in this regard.

Three of the thirteen CRCs stated their selected industry partners were horizontally placed within the supply chain; in some situations they were competitors, while in others they had different market applications for the CRC research. Only one CRC selected private industry partners vertically down the supply chain, while four CRCs had partners both horizontally and vertically. The remaining three CRCs stated that no consideration was taken into the positions of their industry partners within the supply chain before selection.

Figure 9: Partner Identification

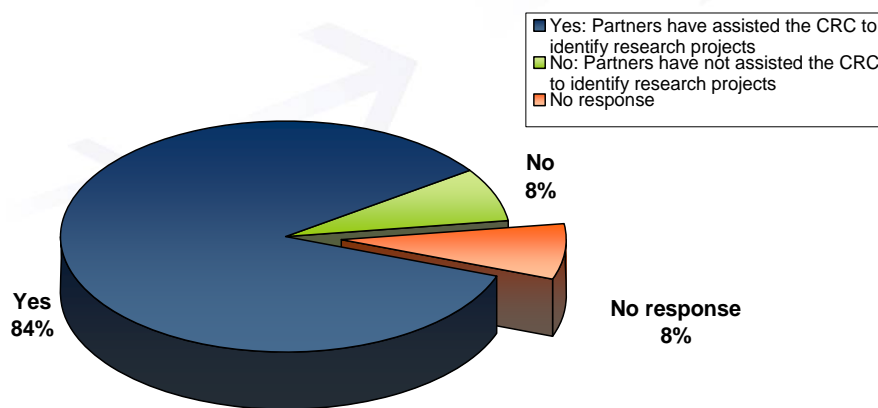


4.1.5.3 Partner Interaction

4.1.5.4 Industry Partners in Project Selection

The thirteen CRCs were asked if they allowed industry partners to select research projects. The majority of the thirteen CRCs indicated that they have generally allowed industry partners to select research projects.

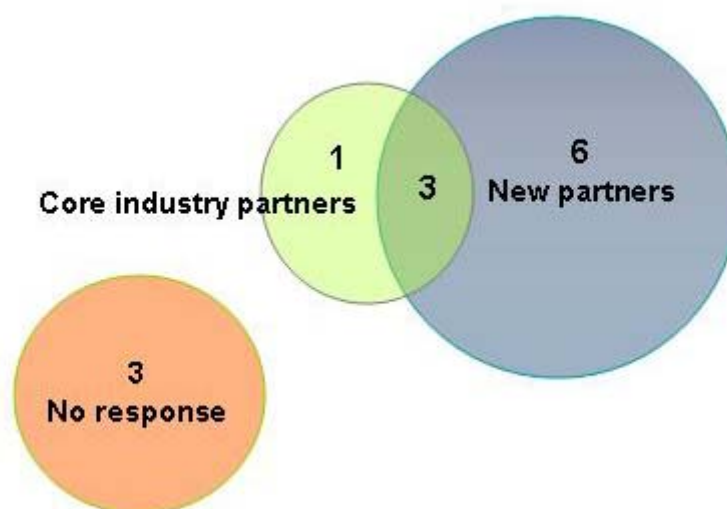
Figure 10: Partner Interaction



4.1.5.5 Project Participation

The participating CRCs were asked if the CRC only collaborated on research projects with core industry partners, or if it conducted projects with other external organisations on a project basis. Seventy percent of CRC respondents indicated that they conducted projects with other external organisations and many encouraged those organisations to become members. Thirty percent of respondents indicated that they did not conduct projects with non-member partners, citing the interests of core industry partners.

Figure 11: Project Participation



4.1.5.6 Strength & Relationship

The majority of the respondents believed that the strength and depth of their relationships, in terms of trust, loyalty and communication with their industry partners ranged from strong to very strong.

4.2 Qualitative Results of the Industry Participant Surveys

To establish how CRCs interacted in their various collaborations with industry, as well as the research user's perspective of the CRC's knowledge diffusion capability, an industry participant from eleven of the thirteen CRCs were surveyed. It is important to recall that each of the CRCs volunteered an industry participant nominee to survey and the results should therefore be interpreted in that context.

4.2.1 Relationship with the CRC

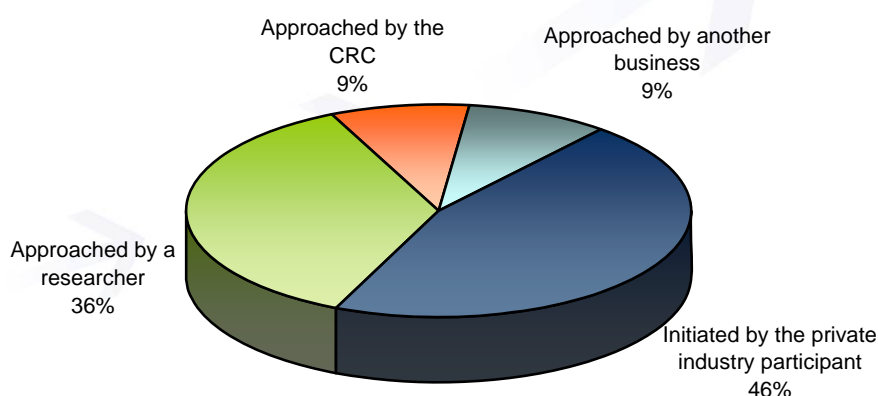
4.2.1.1 Nature of Involvement with the CRC

The eleven industry partners were asked about the nature of their involvement with the CRC. Of those interviewed each was a core participant of their respective CRC, however one of the eleven was an external research partner. Core industry participants are those industry partners that form the core of the CRC and they may also be members of the joint venture that governs the CRC and its operations.

4.2.1.2 Initiation of the relationship

Participants were asked how they became involved in the CRC. Forty-six percent indicated that it was their firm or business that initiated the CRC relationship; while 36% of participants were approached by researchers. The remaining participants were either approached by the CRC or by another business.

Figure 12: Initiation of Industry Participant Relationship



4.2.1.3 Stage in the CRCs lifecycle that relationship began

The eleven respondents were asked about the stage of the CRC lifecycle of the program when they began collaborating with the CRC. Of the surveyed industry partners, eight joined the CRC at its foundation, while two joined the CRC at the commencement of a subsequent round. One was involved in a previous incarnation of the present CRC.

4.2.1.4 Organisation's Level of Involvement in CRC Projects

The extent of collaboration between the industry participant and the CRC was reported to occur at specific levels of intensity and depth, as detailed below. Fifty-five percent of participants indicated that their involvement in projects was quite substantial, from driving the creation of research questions through to active project participation. Twenty-seven percent of respondents stated that their level of involvement was greater, e.g. claiming a stake in the IP generated by the research project. Only 18% indicated that they just provided input and participated in projects; and, as might be expected, none of the industry respondents indicated that their level of involvement was anything less than this minimum.

Figure 13: Industry's Level of Involvement in CRC Projects

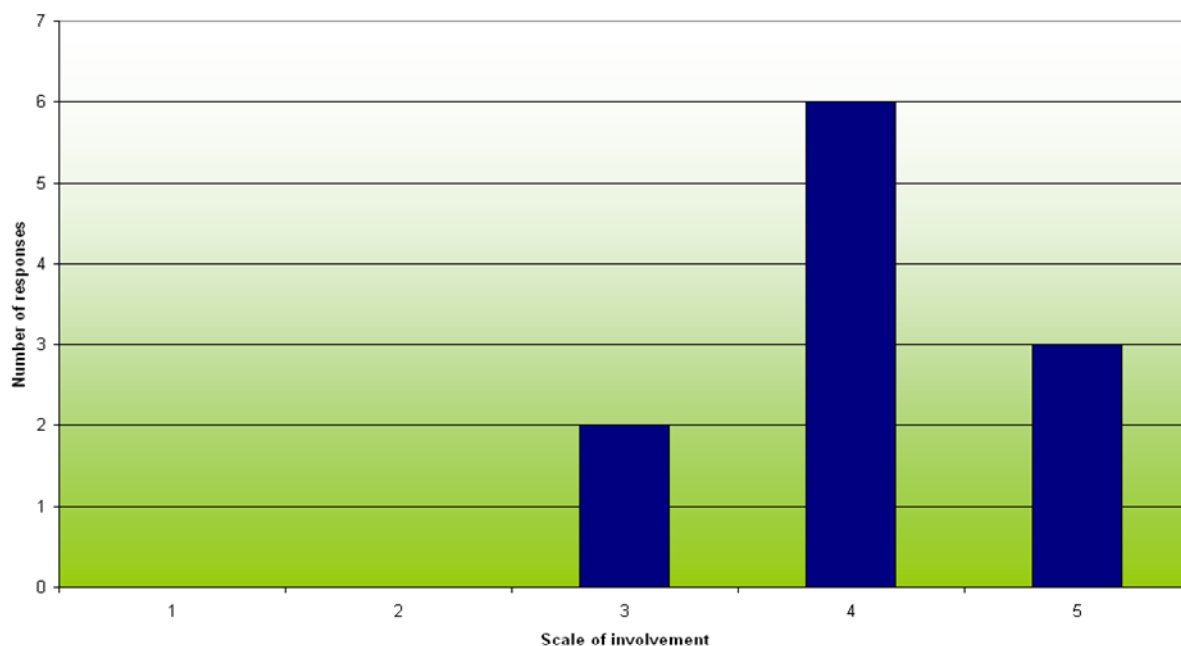


Table 2: Scale of Involvement Description

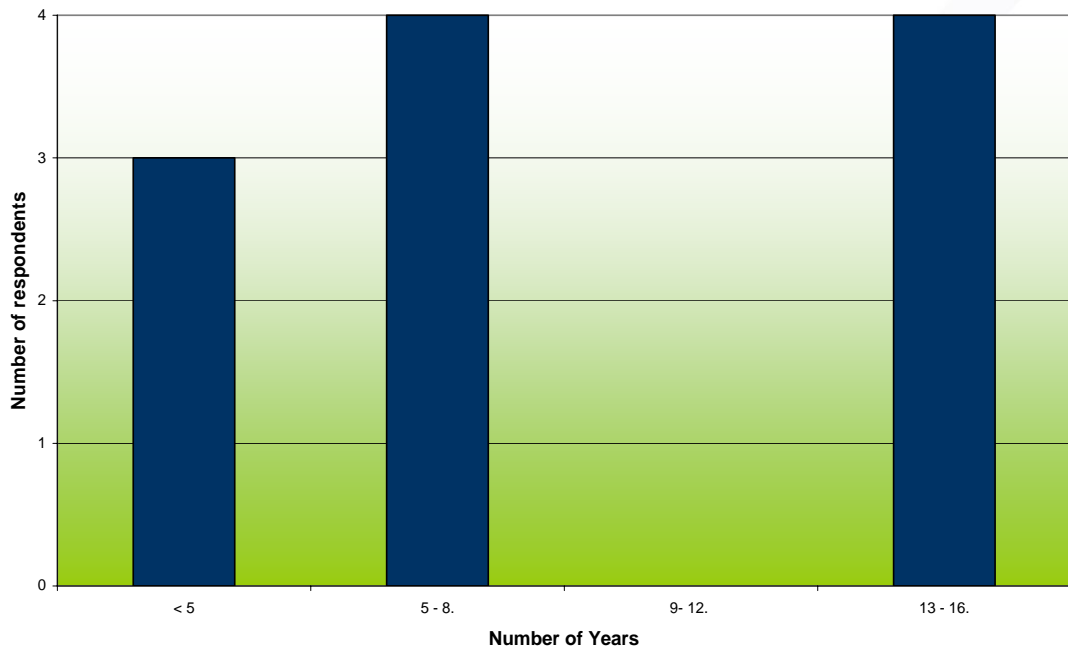
Scale of Involvement	Description
1	No involvement
2	Participant in projects
3	Input in research project creation; Participant in projects
4	Drive research project creation; Input in research project creation; Participant in projects
5	Ownership of IP generated; Drive research project creation; Input in research project creation; Participant in projects

NB: 5 being the highest

4.2.1.5 Years as a participant

The majority of the surveyed participants were found to have joined their respective CRC's at the conception stage. It was found that of the eleven respondents, 73% had been with their CRCs for over 5 years.

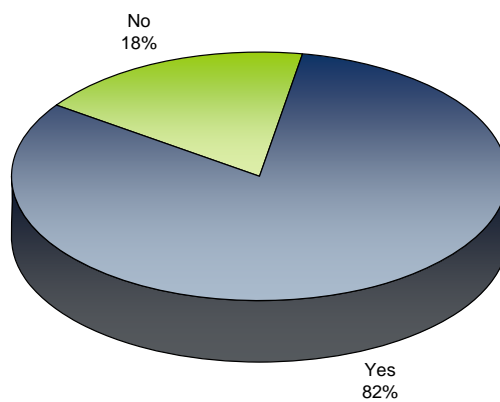
Figure 14: Years with CRC



4.2.1.6 Other Research Collaborations

When asked if each industry partner had research collaboration relationships with other organisations, 82% of the 11 respondents stated that they did in fact use other non-CRC research organisations. A number of them had over 50 external collaborators, however the majority of the respondents in the affirmative had less than twenty.

Figure 15: Non-CRC Research Collaborations with Other Organisations



4.2.1.7 Driver of the CRC's Research Agenda

The respondents were asked whether they believed that the CRC's research agenda was determined by the market drivers created by the end user participants. Nine believed the CRC's research agenda was determined by end user need, while two indicated that the CRC initiated its research projects. Furthermore, the 11 industry participants identified a number of approaches to gauge end user need, including:

- ❑ Industry partners presenting projects to the CRC;
- ❑ Technical Advisory panel in place;
- ❑ Workshops; and
- ❑ Formal process in place to identify research gaps in knowledge.

All respondents agreed that market research was completed to inform directions of the research, and some also identified that the industry participants completed the market research themselves. However, all industry respondents suggested that the market research completed by CRCs was not exhaustive.

4.2.1.8 Industry's Role in Identifying Research Projects

All of the participants surveyed indicated that they had approached their respective CRCs with research projects in an informal manner. Most partners simply approached the CRC with a potential project at a workshop focused on driving the CRC's research program.

4.2.1.9 Expectations of Involvement with the CRC

When questioned about their initial expectations from CRC collaboration, the eleven respondents were mainly interested in developing their R&D and routes to commercialisation. All but one of the industry partners stated that the CRC collaboration met or exceeded their initial expectations. Some of the other feedback from the respondents regarding their initial expectations of their CRC collaboration included:

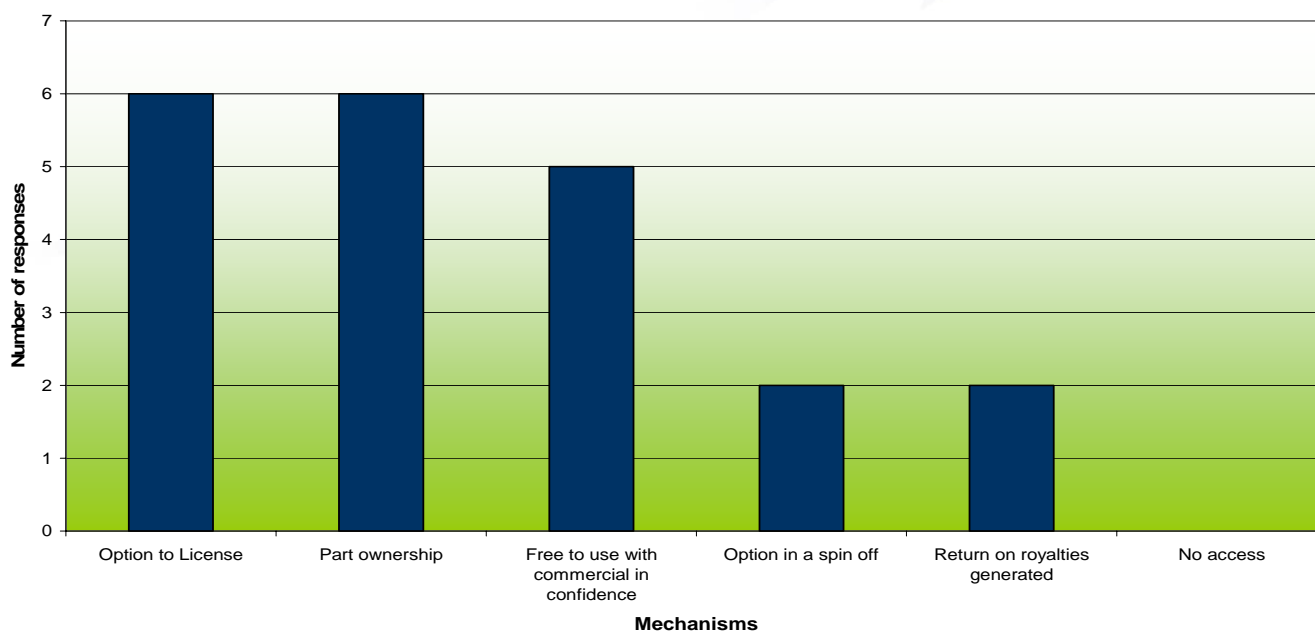
- ❑ Establishing integrated partnerships;
- ❑ Gaining an independent and quality information data source;
- ❑ Gaining credibility through association with a CRC

4.2.2 Accounting for Value

4.2.2.1 Access to Intellectual Property

When surveyed about how the industry participant accesses IP, there was consistently more than one dominant response. Overall, however, the most common method of accessing IP was through either an option to license IP, or part ownership of IP. There was unanimous agreement that an industry partner would not be restricted in accessing the IP created by the CRC.

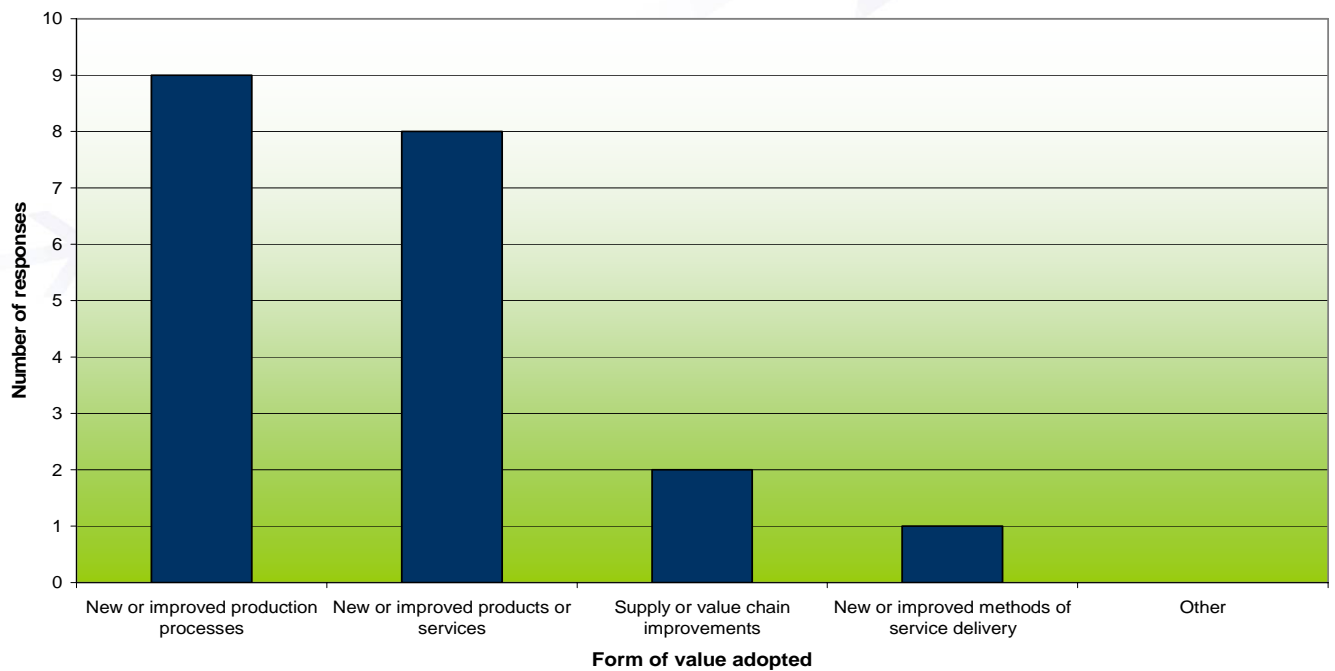
Figure 16: Access to IP



4.2.2.2 Value Creation

When surveyed about how the industry participant benefited from the knowledge created by the CRC there was consistently more than one response. Overall, however, it is apparent that the two most common methods of value creation were through either new or improved production processes, or through new or improved products and services.

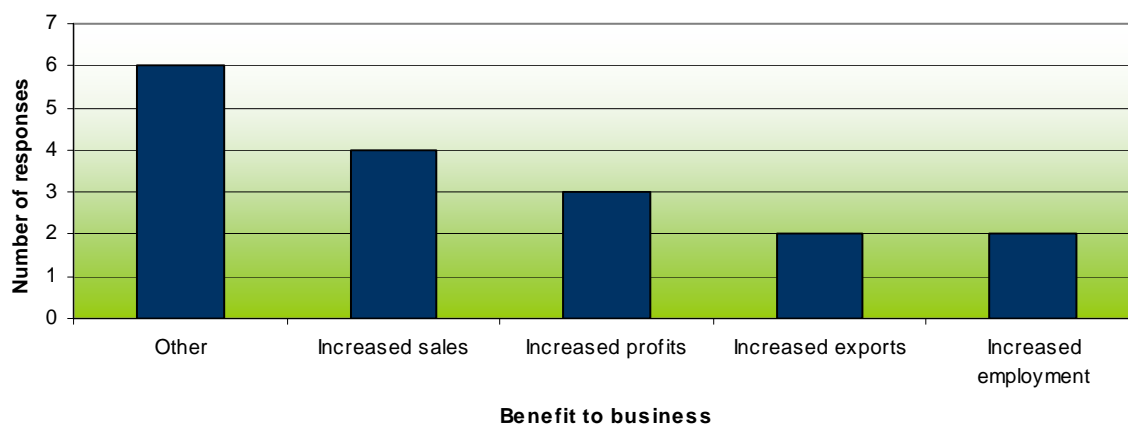
Figure 17: Absorption of Value Generated by CRC



4.2.2.3 Benefit From Value

The eleven participants were asked in what way their business had benefited from value generated by the CRC. Increased sales were identified as the primary benefit from the value created by the CRCs. The response labelled 'other' was the most popular option as most of the participants were in a developmental stage and had not yet reached commercial maturity.

Figure 18: Benefit from Created Value



4.2.3 Knowledge Diffusion

4.2.3.1 Evaluating CRC Relationship Management

Participants were asked if they believed that the CRC they collaborated with had appropriate internal mechanisms to manage their ongoing customer relationships. Nine of the respondents felt that the CRC did have appropriate relationship management mechanisms in place, while two believed that the CRC did not. The respondents answering in the negative were asked to explain the situation further. One felt that the CRC lacked the ability to manage differing interests between partners, and the other felt the relationship did not allow for enough interaction between the technical staff of each organisation.

4.2.3.2 Sharing Tangible and Intangible knowledge

Participants were questioned about how they shared tangible and intangible knowledge generated by the CRC. For both tangible and intangible knowledge, the participants were asked to respond according to a scale that illustrated the level of knowledge that was shared between them. The results are outlined in the following sections.

4.2.3.3 Sharing Tangible Knowledge

In this survey, tangible knowledge refers to knowledge in the form of processes and procedures that were produced by the CRC.

Figure 19: Scale of Tangible Knowledge Shared

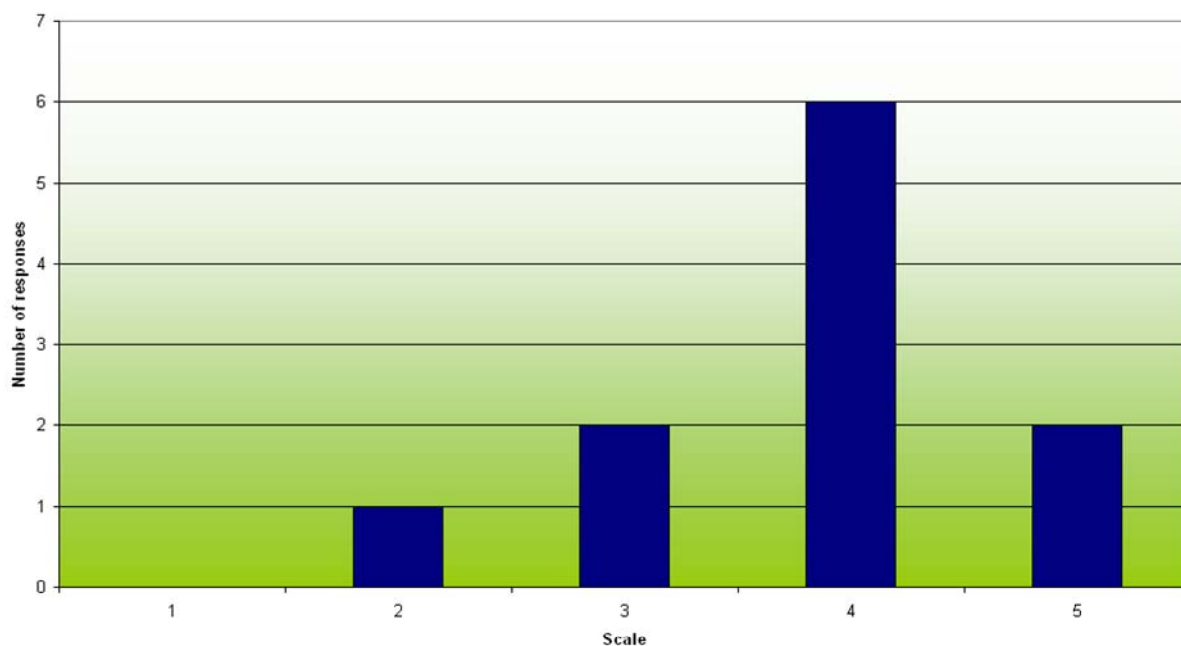


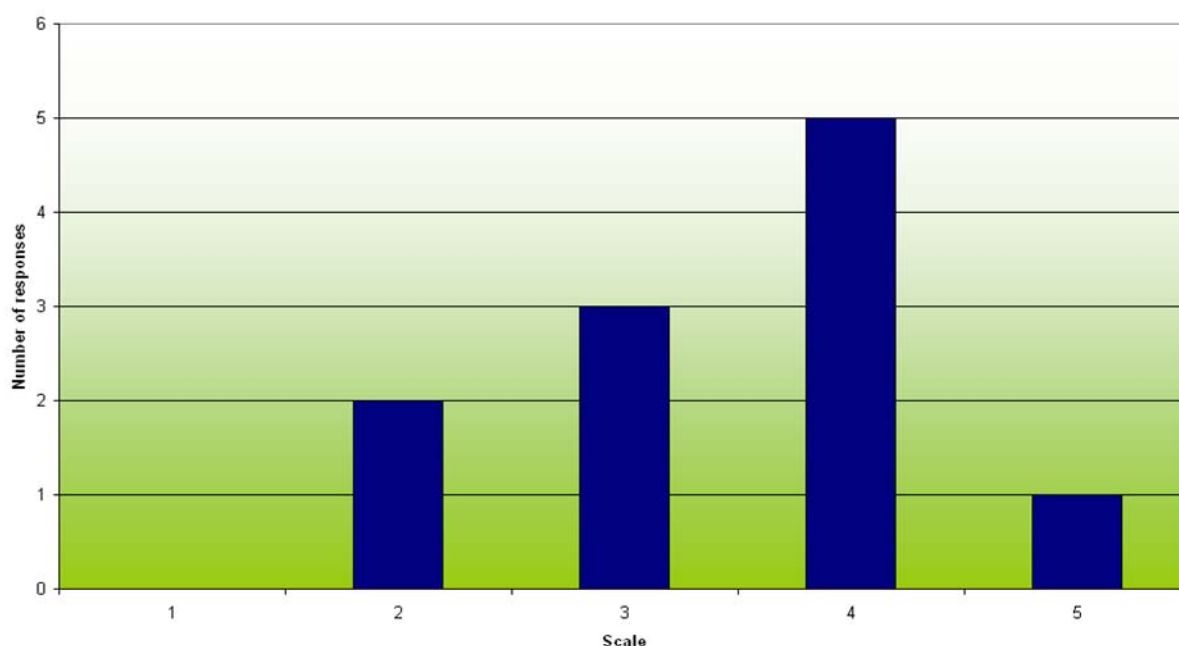
Table 3: Scale of Tangible Knowledge Shared Description

Scale of Tangible Knowledge Shared	Description
1	Knowledge is not shared
2	Receive internal communications or publications from the CRC
3	Openly share knowledge on projects that the participant is involved in
4	Openly share knowledge on projects that the participant contributes to
5	All processes and procedures are shared

4.2.3.4 Sharing Intangible Knowledge

In this survey, intangible knowledge refers to the knowledge that was generated and held by the researchers within the CRC, also referred to as intellectual capital.

Figure 20: Scale of Intangible Knowledge Shared



Note: Refer to the following table for scale description

Table 4: Scale of Intangible Knowledge Shared Description

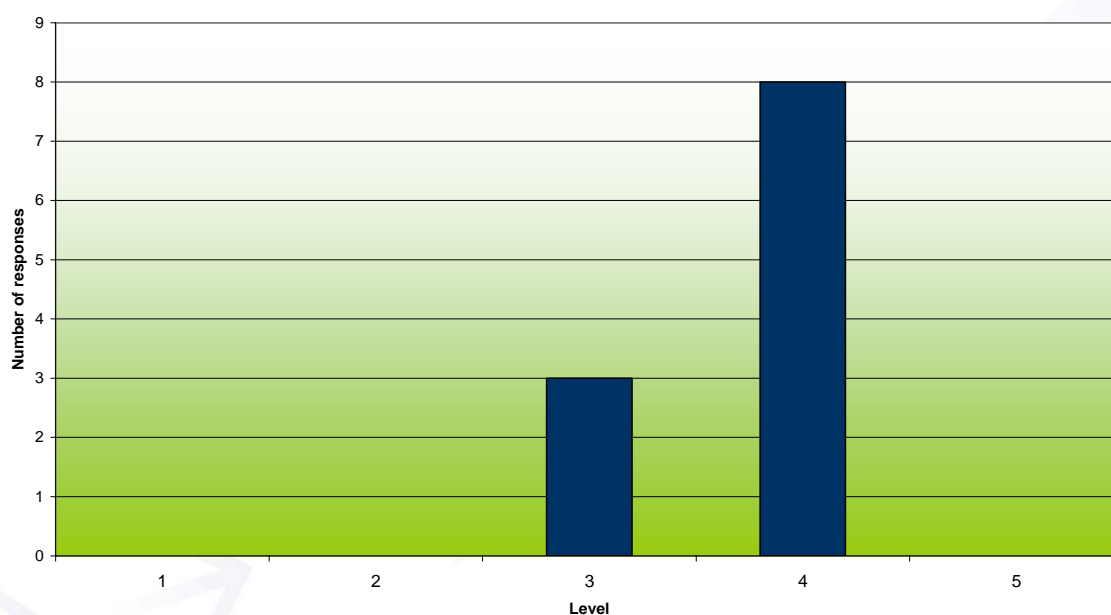
Scale of intangible Knowledge Shared	Description
1	No access to intellectual capital
2	Sporadic interaction between researchers to acquire intellectual capital
3	Intellectual capital is shared in a regulated or stage manner
4	Unregulated frequent interaction with researchers to acquire intellectual capital
5	CRC researchers are embedded in the industry participant

In each situation the higher the respondent rated the scale out of 5, the greater the level of knowledge diffusion occurring between the organisations.

4.2.3.5 Utilisation of Knowledge Created by the CRC

The eleven private industry participants were asked to scale, from their perspective, how well the CRC utilised the knowledge it created.

Figure 21: Level of Knowledge Utilised



Note: Refer to table below for levels explanation

Table 5: Level of Knowledge Utilised Description

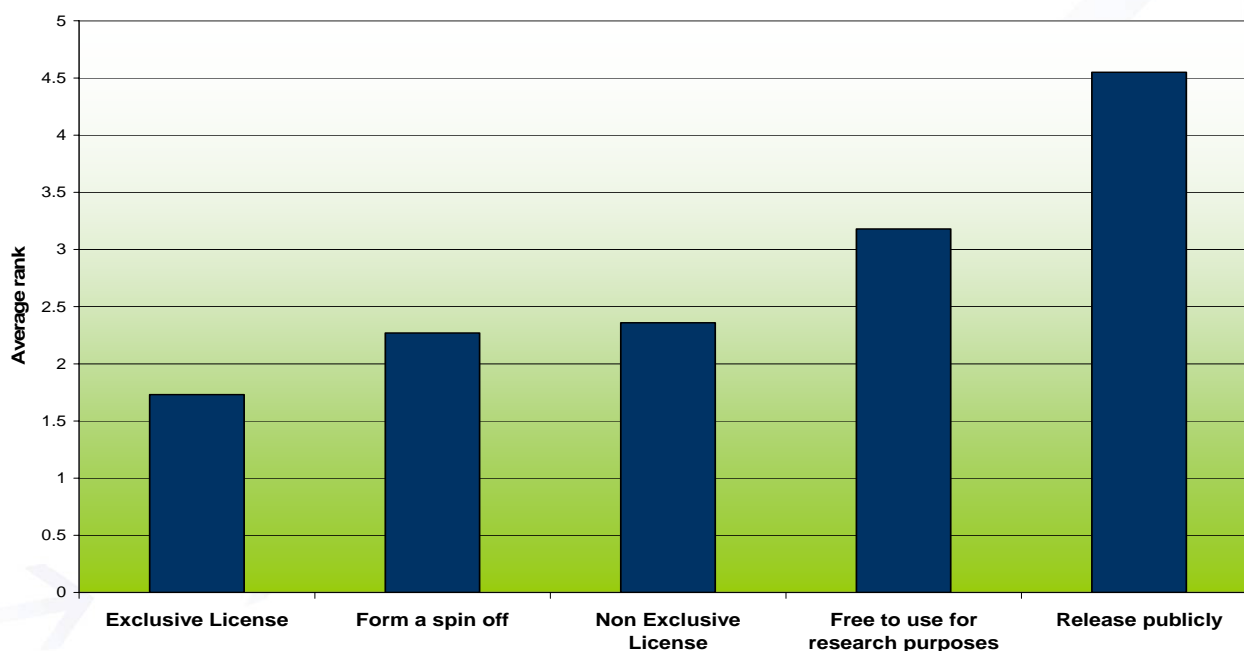
Level of Knowledge Utilised	Description
1	Completely unutilised
2	Serendipitous, not deliberate utilisation
3	Deliberate efforts to exploit, partly utilised
4	Deliberate efforts to exploit, more utilised
5	Completely utilised

The greater the score, the better the private industry partner believed the CRC had attempted to exploit the value it creates. One participant felt that it was too soon in its relationship with the CRC to rate how well the CRC's IP was being utilised.

4.2.3.6 Preferred method of knowledge diffusion

The industry participants were asked to rank their preferred method of knowledge diffusion. The most favourable method was to exclusively license IP created by the CRC. Seven respondents ranked this as their priority. This method generated an average ranking of 1.5 out of 5. The least preferred method for the uptake of generated IP is to release it publicly. Nine respondents ranked this as their least favoured method.

Figure 22: Average Ranking for Methods of Knowledge Diffusion



NB: Ranking of 1 is the most favoured and 5 being least favoured

4.2.3.7 Resources of the CRC

When asked if they believed the CRC possessed adequate resources to diffuse the knowledge they created into the industry participant, eight of the eleven respondents indicated that they did think the CRC had adequate resources. The remaining three respondents were asked to elaborate upon their negative responses; one felt that the CRC was doing a good job however the communications team was under resourced, another felt that while the CEO of the CRC was competent, the CRC did not have the team to be successful commercially. The last respondent believed insufficient resources were used by the CRC to develop implementation processes.

4.2.3.8 Strength of the Relationship

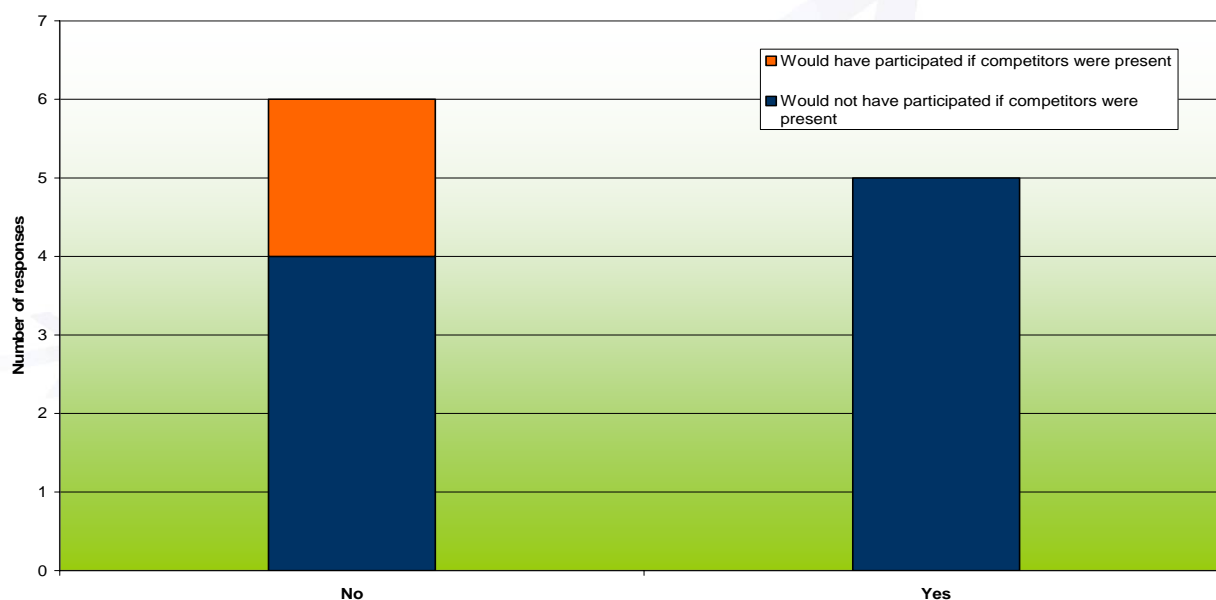
All eleven private industry respondents felt that they had a strong relationship with the CRC and its partners. One indicated that although it was a strong relationship, employee turnover within the CRC was damaging the strength of the research relationship.

4.2.3.9 Competitors in the CRC

Of the industry participants, six had not worked with a competitor in the CRC while five had worked with a competitor. Of the six that had not worked with competitors, four stated that they would not be willing to work with competitors at any point in time.

Some of the five respondents that had worked with competitors within the CRC indicated that the projects carried out were managed in the strictest confidence with no one competitor having access to all the key information. In one CRC, the projects were general industry projects so all members benefited, while in another CRC, all IP was openly shared.

Figure 23: Competitors within the CRC



4.3.1 Summary of Survey Findings from the CRC Senior Managers

On the basis of the above analysis of the CRC survey results, the following summary of findings represents the posture of CRC senior management:

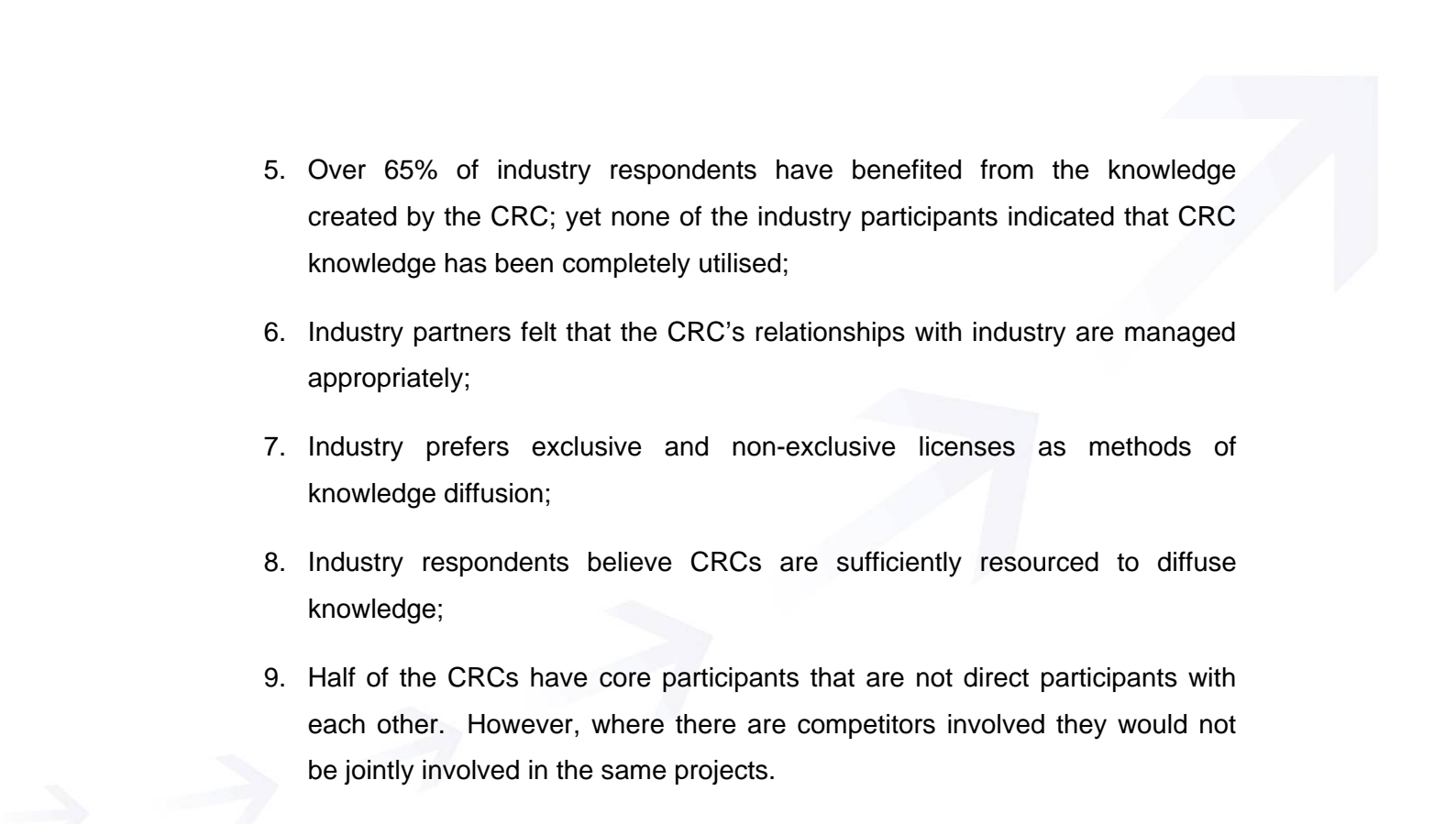
1. Eighty-five percent of the respondents claimed that the Management Data Questionnaire does not adequately capture the value that the CRC generates from their knowledge. This particularly includes less tangible outputs such as intellectual capital and national cost-benefit ratios of public research; as well as projects under development that represented substantial work in progress;
2. Key methods utilised to communicate research findings from the CRC to target markets included having a non-confidential communications strategy, appointing education managers and aligning research with communication activities;
3. Nine distinct activities were identified to assist research commercialisation, including: requesting expressions of interest, appointing a commercialisation manager, partnering with another organisation, appointing a commercialisation committee, using a rigid IP management process, forming

- a separate commercialisation company, using a licensing strategy, pre-licensing to further develop and beta test IP, and creating a predefined commercialisation strategy at research conceptualisation;
4. Human resource capacity within the CRCs was adequate to realise user needs and expectations;
 5. Collaborative research is predominantly driven by a CRC's commercial partners and their market need. Eighty percent of CRCs thought that their research program was end-user based and hence driven by market-need;
 6. Sixty percent of CRCs do not provide incentives to their staff to create knowledge for end-user need and adoption;
 7. Seventy-five percent of the respondents use comparable market as an intellectual property valuation method;
 8. Forty-two percent of CRCs surveyed had commenced an exit plan or included a re-bid under the program as an exit plan strategy. More than half stated that they had not yet commenced an exit plan or had already ceased operation.
 9. Fifty-eight percent of respondents conduct other contract research with industry partners external to the CRC.

4.3.2 Summary of the Survey Findings from the Industry Partner's Senior Managers

On the basis of the above analysis of the industry partner survey results, the following summarises the view of industry partners selected by the participating CRC's:

1. Half of the industry members approached the CRC to join;
2. Industry participants are heavily involved in driving the research program, with 82% of the industry respondents indicating that they actively drive the research program, create projects and participate;
3. Market research is regularly completed to inform direction of the CRC research programs, suggesting CRC research is end-user driven;
4. All industry partners surveyed have adopted IP in some form from CRC research;

- 
5. Over 65% of industry respondents have benefited from the knowledge created by the CRC; yet none of the industry participants indicated that CRC knowledge has been completely utilised;
 6. Industry partners felt that the CRC's relationships with industry are managed appropriately;
 7. Industry prefers exclusive and non-exclusive licenses as methods of knowledge diffusion;
 8. Industry respondents believe CRCs are sufficiently resourced to diffuse knowledge;
 9. Half of the CRCs have core participants that are not direct participants with each other. However, where there are competitors involved they would not be jointly involved in the same projects.

5. Conclusions

The analysis and interpretation of the survey responses of the thirteen CRCs and their corresponding industry partners has uncovered a number of characteristics that reveal how successful CRC's are able to optimise the value that can be created from the knowledge they generate. The conclusions are presented in the following three sections:

1. A suggested framework of the prevailing characteristics and features that enable CRCs to maximise the value delivered from generated knowledge;
2. Critical Success Factors;
3. Key observations.

5.1 Prevailing Features and Characteristics Common to an Effective CRC

Numerous case studies, drawn from the survey set of thirteen CRCs and their corresponding industry partners, enable the development of a framework that articulates some of the features, characteristics and factors of success in knowledge creation, commercialisation and knowledge transfer that contribute to an effective CRC. The following tables represent consolidated and distilled views of a proposed model for an effective CRC from two different perspectives. The first is a more refined and relevant selection of summarised elements of the features and characteristics from the CRC responses to the five indicators below:

- CRC Details and Structure
- Accounting for Value
- Knowledge Diffusion
- Internal Conditions
- External Conditions

The second represents a distilled summary of the relevant elements of the industry partner responses to the three indicators below:

- Relationship to the CRC
- Accounting for Value
- Knowledge Diffusion

5.2 Model of Prevailing Common Features and Characteristics of an Effective CRC: The CRC's View

Criteria	Features and Characteristics
Project Abandonment Process	<p>The extent of abandoned research projects varied from nil through to 30%, expressed across various stages of the project management lifecycle. Processes and guidelines were established to govern decision-making around the continuation of CRC research projects. Features included:</p> <ul style="list-style-type: none"> • Technical review committee comprised of members to evaluate each project • Project evaluated according to industry acceptance, recognition and industry solution • Project continuation criteria includes: a clear path to commercialisation or end-user uptake • Six-monthly formal review panel process, that includes a stage-gate evaluation of projects <p>The review process also stimulates further discussion and debate about the merits of the research, leading to thorough analysis and informed decision making.</p>
Research Translation	<p>A number of research translation features were described, including having in place:</p> <ul style="list-style-type: none"> • Defined project structure and reporting • Innovation register • Policy initiatives and knowledge outcomes open to the community • Employment of a Development Officer
Research Communication	<p>CRCs utilise several processes and procedures to communicate research to target markets. Key practices identified by participants include the use of:</p> <ul style="list-style-type: none"> • Open and transparent communication • Education managers employed • Alignment of communication with research • Seminars, Workshops and Conferences • E-bookshop • Publications • Public relations • Monthly reporting • Media, publications and marketing staff appointed
Research Commercialisation	<p>Some of the methods to realise many of the research commercialisation objectives of CRCs will include the use of:</p> <ul style="list-style-type: none"> • Expressions of Interest • A commercialisation manager • Partnering with another organisation • Appointing a commercialisation committee • A product development group • An IP management process • A separate commercialisation company • A licensing strategy • Pre-licensing to develop IP further • A pre-defined commercialisation strategy at research conceptualisation

Human Resources	<p>The responsibility for a CRC's knowledge diffusion has been best demonstrated when staff are tasked with that function, for instance:</p> <ul style="list-style-type: none"> • Commercialisation manager; Business Development/Commercial Manager/s; • Program leaders and work area leaders; • COOs and CEOs; • Education and training coordinators; • Publications staff; • Media and Events staff.
Research Drivers	<p>Research is driven by industry, with an expressed market or end-user need. The potential for industry adoption and user uptake, whether stimulated by a business opportunity, change process or commercial need, will likely dominate research decisions. Commercial participants feature heavily in the decision-making process.</p>
Incentives	<p>A small percentage of CRCs offer incentives to non-research, executive staff. Not one CRC surveyed incentivised a research staff member. Within the small incidence of CRCs that offer incentives, the rewards appear generous. For example:</p> <ul style="list-style-type: none"> • Rewards when commercialisation outcomes are achieved – participation as shareholders; • In one CRC, for every spin-off there is 10% equity equally shared to all staff and 20% shared across commercialisation contributors; • In another, some managers are incentivised (COO and CEO).
Relationship Management	<p>Approaches to managing customer relationships were mixed and varied, but apparently equally successful. There can be formal mechanisms and flexibility in managing relationships, including:</p> <ul style="list-style-type: none"> • Through the Executive Committee • Employing a Relationship Manager • Treating partners equally • Defining the form of the relationship in the Centre Agreement • Quarterly User or Project Reviews • Formal screening of partners for suitability • Undertaking Customer surveys and case studies • Use of a CRM system
Program Exit Planning	<p>The extent of program exit planning varied across a range of options and activities. Of the CRCs still operating, a variety of strategies were articulated:</p> <ul style="list-style-type: none"> • No exit planning completed. Next round re-bid and funding is being considered. • Close down, extend for one year with or without funding, re-bid. Transition plan not in place. • Transition strategy to continue with a reduced scope, with no intention to use exit strategy. • Commenced business planning for CRC exit from the program and has an exit strategy in place. <p>The one CRC that had ceased operations recalled that its exit plan involved placing technology and staff elsewhere to complete the Centre's obligations. Centre IP was packaged up and either sold, transferred or gifted to recipients.</p> <p>Some post-CRC models that were suggested if the re-bid was unsuccessful included:</p> <ul style="list-style-type: none"> • RDC model for future sustainability • Develop a national centre outside of CRC program.

<p>Informing the Research Program</p>	<p>The CRC's research program is largely informed by industry and end-user needs. The methods range from partner consultation, through to primary market research.</p> <ul style="list-style-type: none"> • To embark on a project partners are consulted individually, then in clusters, to establish the importance of project and then match to resources. • Market research is internally completed, with external consultation which informs the CRC's research program as a whole. • Primary market research is completed by end-users. • 30% of projects stem from industry ideas • Research is driven by partners <p>CRCs undertake market research to achieve different objectives:</p> <ul style="list-style-type: none"> • to determine the uniqueness of the research itself. • to survey consumers, users and new customers directly to understand their needs and products, as well as to bolster business cases. <p>On an individual project level, internal market research is conducted which is not believed to be sufficiently robust. Some CRCs perform no market research and the CRC research agenda is led by industry.</p>
<p>Partner Identification</p>	<p>CRC partners are identified both horizontally and vertically through the value chain. Some are selected on the basis of their contribution to the CRC's research program, some on their perceived capacity to absorb new technology and products; others are selected on the basis of their regulatory function, national constituency and international links in the industry's value chain. Some CRCs have partners and members who are competitors.</p>
<p>Partner Interaction</p>	<p>The level of partner interaction can vary, depending on the formality, needs and objectives of each interaction. Some mechanisms in place include:</p> <ul style="list-style-type: none"> • Two industry and two research partners on each research project is a requirement; • Industry partners are the project leaders. • Program directors are research members, deputy program directors are industry members. • Partners interact on a contract basis at the project level. • Effective relationships depend on the needs of the partners. • Lack of core funding prevents engaging new industry participants. Depends on availability of resources already available in that area of expertise. <p>Some CRCs conduct a quarterly showcase to encourage dialogue between researchers and industry to identify research projects.</p>
<p>Partner Assistance to Identify Research projects</p>	<p>Industry and end-users actively assist the CRC to identify research projects, yet some caveats may apply:</p> <ul style="list-style-type: none"> • Partners attempt to identify projects, but require close scrutiny due to wide ranging needs. • A joint approach is required to understand industry's real research needs.
<p>Attracting New Partners</p>	<p>CRCs frequently interact with industry partners external to the CRC, however the nature and extent of those projects differ between them. CRC activity to attract partners can be grouped according to the following bases:</p> <ul style="list-style-type: none"> • New partners can participate on a project by project basis only; • New partners can participate but not on a project-basis (ie. become core members); • CRC may perform work for non-members on a contract basis;

	<ul style="list-style-type: none"> • Very little, or no, interaction with new partners in deference to the CRC centre commitment to core members. <p>In terms of ease in joining a CRC two clear poles emerged. It was either very easy for a new industry partner to join the CRC, or it was difficult for new industry partners to join. Screening and financial contributions are normally required in the latter case.</p>
Strength and Depth of Collaboration	<p>Trusting, loyal and committed relationships between CRC members are essential to the ongoing conduct of the CRC's activities. Good communication was cited as a vehicle to sustain deep relationships. While some CRCs have impressive track records of partner commitment, others noted that some partners withdrew before the end of the CRC.</p>

5.3 Model of Prevailing Common Features and Characteristics of an effective CRC: The Industry Partner's View

Criteria	Features and Characteristics
Driver of CRC research agenda	<p>End-user market need determined by the firm's market research. The consensus industry view was that the CRC's market research is not exhaustive</p>
Research projects identified by the participant	<p>Yes. Mostly on an informal basis through interaction with CRC researchers.</p>
Level of involvement in CRC projects	<p>The following list expresses the majority view of industry user's assessment of their level of involvement in CRC projects:</p> <ol style="list-style-type: none"> 1. Driver of research 2. Provider of input into project creation 3. Participant in projects
Access to IP	<p>While the most common method of accessing IP in the CRC centred on exercising a license option and part ownership, end-user access to CRC IP covered the full spectrum and included:</p> <ul style="list-style-type: none"> • Free to use with commercial in confidence • Option to license • Part ownership • Option in a spin off • Return on royalties generated by the IP
Absorption of Created Value	<p>The two most common methods of absorption were:</p> <ul style="list-style-type: none"> • New or improved production processes • New or improved products and services.
Benefit From Value	<p>Increased sales were seen by the participants as the primary benefit from the value created by the CRCs. For several participants the value had not yet been realised due to the developmental stage of IP and lack of commercial maturity.</p>

Evaluation of CRC relationship management	While managing the differing interests between divergent partners and the interactions between technical specialists and researchers was a challenge for industry-CRC relationships, the industry consensus overall was that the CRCs have suitable procedures, processes and resources in place to manage relationships with their customers – the research end-users.
Sharing tangible knowledge	Overall, tangible knowledge is openly shared on projects in which the industry participant is involved.
Sharing intangible knowledge	While some industry-CRC relationships tended toward researchers being embedded in the industry participant on a project basis, unregulated frequent interaction with researchers to acquire knowledge was the most common form of sharing intangible knowledge.
Utilisation of value	Overall, industry end-users are committed to long term relationships to exploit and continue to develop value created by the CRCs as a utilisation strategy. There was a smaller incidence of end-users deliberately exploiting, but partly utilizing the CRC's created value.
Preferred method of knowledge diffusion	Industry end-user's preferred method of uptake was to exclusively license the IP created. Other methods (in decreasing order of preference) were to: <ol style="list-style-type: none"> 1. Negotiate a non-exclusive license 2. Form a spin-off company 3. Use IP freely, but only for research purposes 4. Release publicly to industry.
CRC resources	Overall, the industry partners surveyed believed the CRCs possess sufficient resources, project teams, skills, capability and training, and are committed to the research and technology areas of the program.
Strength of the relationship	Overall, the industry partners surveyed appeared to have very good relationships with their respective CRCs; characterised by trust, loyalty and open communications.

5.4 The pull between public benefit and commercial outcomes

Recently, there has emerged a strong theme that the CRC movement should revert back to its “public good” mission, and that the drive to achieve commercial outcomes from CRCs is misplaced. For example, in its submission to the National Innovation Review, the Group of 8 universities states:

“There is a need to redraw the objectives of the CRC program to realign with the ‘public good’ principles that underpinned its inception... consideration should be given to the establishment of two administrative arrangements— one governing ‘public good’ CRCs, the other applying to those with a commercial focus. ”

In the AIC's view, such a suggestion falls into the same trap that philosophers for the past two thousand years have warned about, that of posing a philosophical choice as being between two alternatives, when the problem should not be framed as an EITHER/OR choice.

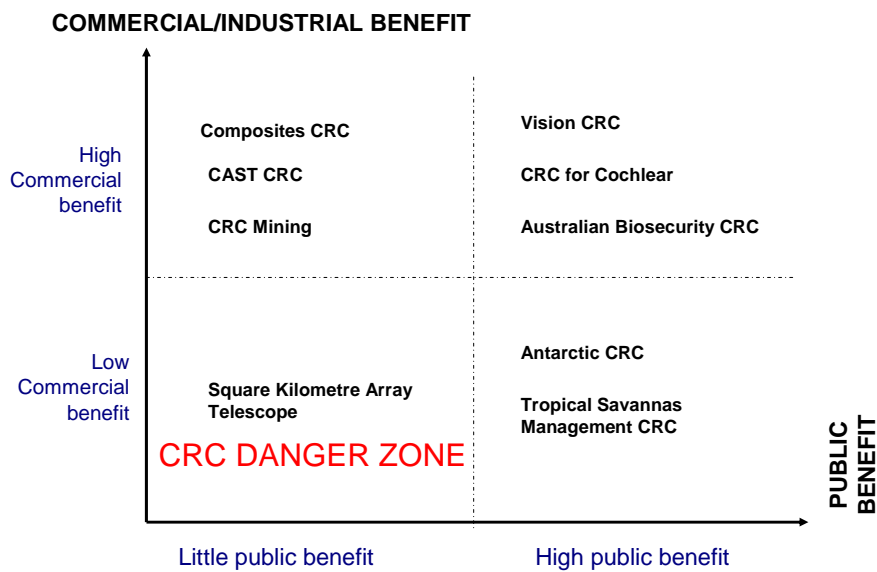
Consider the dilemma such a choice imposes, when a CRC such as the Vision CRC must be arbitrarily placed on an axis somewhere between the two suggested endpoints - public benefit OR commercial outcomes:

The false logic of 'value' labels



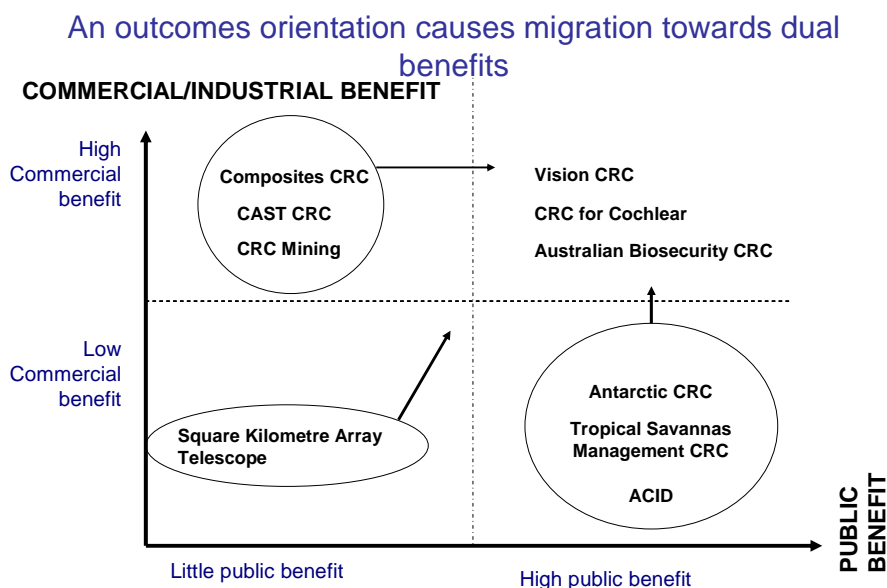
Where exactly does the Vision CRC fit? It was established to achieve public benefit: its chief aim is to deliver better eyecare for Australia and the world. It has clearly progressed this. Along the way, it has spawned some profitable industrial relationships as well, with partners who have commercialised their soft contact lens technology. Or consider the Australian Biosecurity CRC, whose mission is to protect Australia's public health, livestock, wildlife and economic resources through research and education to better respond to emerging infectious disease threats. Where does its bird-flu diagnostic fit?

The dilemma can be resolved by moving from a one dimensional model to a two dimensional model (borrowed heavily from the logic in "Pasteur's Quadrant" by D. Stokes). Such a model pulls the two "opposing" endpoints together and avoids the problem that public benefit and commercial benefits are not mutually exclusive. There are now two axes; a horizontal axis that ranges from low to high public benefit, and a vertical axis that ranges from low to high commercial or industrial benefit:



Here we've plotted how several CRCs might appear. Some are primarily commercial in focus, others primarily public good; but some CRCs, such as the two mentioned above, must be placed into the fourth quadrant, where they achieve both. Clearly, CRCs want to avoid falling into the first quadrant, perhaps the realm of pure basic science endeavours, where neither the commercial benefit nor public benefit are able to be initially articulated.

The keyword is 'initially'. For although the primary INTENT may lie along one axis or the other, the pressure to achieve outcomes along both axes should be unrelenting, as it is this pressure that in fact drives outcomes and creates value.



It is the pressure to extract commercial benefit that has resulted in some of the so-called 'public benefit' CRCs being very successful with industry engagement and migrating towards the fourth quadrant. For instance, the Antarctic CRC now has insurance companies and the shipping industry interested in its modelling of sea levels. Without that commercial pressure, and activities such as continued AIC Commercialisation Bootcamps, researchers would have been "let off the hook" (in the words of one researcher), and never have been forced to consider collaboration with industry partners).

Similarly, the demand to prove public benefit has moved the CRC Mining to consider environmental benefits to its research, or the Cast CRC to explain how the use of composites and light metals in fabrications will reduce CO2 emissions in aircraft and automobiles.

Adopting the false logic of either/or actually removes the pressure to achieve dual benefits.

It is quite critical in determining value to distinguish between intent and outcome. Commercial benefits sometimes can not be predicted a priori and *may* not result from research motivated for public benefit. That does not mean that dual benefits should not be **expected**. The AIC is constantly surprised by the mismatch in the level of support, even amounting to disdain, for commercialisation in some sections of the

research community, compared with that of the general population whose taxes fund the research and which overwhelmingly **expects it**.

In the AIC's view, the debate around public benefit and commercial outcomes for CRCs is not only misleading, it is a red herring. It can be resolved quite simply by talking about *value currencies* instead, which may not necessarily be a monetary currency, but can be social, community, or environmental currency as well. All CRCs can demonstrate their value to society by creating wealth, best measured in terms of a value currency.

5.5 Critical Success Factors

The factors considered by CRCs to be critical to their success can be grouped into five broad themes:

1. CRC Governance, Management and Human Resources
 - ❑ Appointing an independent Chairman
 - ❑ Appointing a small board that is representative of members allowing for quick decision making
 - ❑ Strong CEO leadership, with science leadership and business acumen
 - ❑ Experienced employees and management team
 - ❑ Simplicity of processes and organisation
 - ❑ Diversity of staff expertise
 - ❑ Strong communication of research outcomes
 - ❑ Strong dialogue between government and researchers; and take up by industry.
 - ❑ Skills to blend the obligations to the Commonwealth with the needs of the partners and board members

2. Program Oversight and Management
 - ❑ Review every project – re-budget and approve
 - ❑ Outcomes focussed program management
 - ❑ Formal project reviews, with capacity to abandon projects
 - ❑ Interlinked processes enabling effective decision-making
 - ❑ Flexibility in project selection

3. Partner Identification, Selection and Involvement

- ❑ Restricted level of CSIRO involvement
- ❑ Quality industry and research partners
- ❑ Commitment to the CRC
- ❑ Flexibility in partner selection
- ❑ Strategic industry involvement
- ❑ Partnership with direct path to market (right partners)

4. Quality of Research

- ❑ Entrepreneurship promoted among researchers
- ❑ Researcher involved in applied research to create an impact in the market by drawing on their research background and their intellectual capacity.
- ❑ Applied research with some blue-sky thinking
- ❑ Funds are not used to feed unrelated research
- ❑ No block grants to any research provider

5. Quality of the End-user

- ❑ Overwhelming support by industry, however defined – without industry support, the CRC should not proceed
- ❑ Market driven
- ❑ Heavy engagement with SMEs
- ❑ Heavy engagement by industry

5.6 Key Conclusions

The following key points represent the project team's evaluation of the more strategic conclusions of the research completed in this project. It is important to recall that these conclusions relate only to the research survey results of thirteen CRCs and their nominated industry partners.

- ❑ A CRC's type and operating structure does not appear to have any bearing on its organisational capacity to create value for its members or affect diffusion to end-users;

- The *Trajectory in the Evolution of the CRC System*⁶ is not a useful methodology to categorise the CRCs because it appeared to create some confusion, and is ambiguous because the classifications are not mutually exclusive;
- A CRC's MDQ appears to have genuine *administrative* value in terms of enabling the performance of a reporting function to DEST. However, as a tool to capture a CRC's complete value it does not adequately or effectively achieve the task;
- The CRCs in the survey population exercise strong strategic project management, ongoing implementation, and review, particularly to determine if projects should be terminated. It is apparent that there are different levels of rigour used to manage the cessation of research projects. Industry influence in CRC project management is substantiated by the strong level of industry partner involvement in project selection;
- From the CRC population surveyed for this project it is evident that research communication is the Centre's preferred method of knowledge diffusion, followed closely by research commercialisation. Research communication also appears to benefit industry participants given their overall approval of the CRC's open communication channels, and sharing of tangible and intangible knowledge. Industry's preferred method of knowledge diffusion is through commercialisation of IP, largely because their value benefits are articulated in terms of commercial returns. Given the nature of the CRC population diversity in this survey set, this conclusion should be exercised cautiously;
- CRC's and their industry end-users generally agree about the adequacy of the CRC's investment in human resources to operate the CRC. The claim by senior management of the CRC that the CRC's customer relationship management resources are adequate was vindicated, at least by the industry partner that each CRC selected to be surveyed.
- The CRC's claim that their research program is industry driven by the market needs of their commercial partners resonated with the majority of the industry participants. While CRC's claim to complete market research to further inform research directions, their industry partners claimed that such research

⁶ Howard Partners, *Evaluation of the Cooperative Research Centres Programme*, p 133. July 2003

is not exhaustive. CRC's future market research activities perhaps might focus on evaluating research uniqueness, while industry partners should be tasked to conduct market research to enable an independent and objective evaluation of market need, size and segmentation that the research opportunity might address;

- Many CRC's have neglected to plan for their exit from the program. Those that have completed some planning are considering a CRC re-bid as their preferred option. Over 60% of the CRCs have interpreted "exit planning" synonymously with re-bidding under the CRC program. It was also evident that the corresponding lack of transition planning raises concerns around the risks of potential IP and value loss. CRCs in their current forms are not sustainable entities so a program re-bid does not constitute an exit from the CRC program.
- It is evident that many CRCs and commercial industry members diversify their research investment by exploring multiple sources and partners outside of the CRC program to conduct research. It remains unclear in which portfolios both industry members and the CRCs complete external research, but the mutual agreement around the high level of trust and loyalty between both groups might suggest there is little concern in this regard.
- There is no single objective factor that can adequately explain the level of a CRC's success. The CRCs articulated a complex admixture of multiple factors crucial to their successful operation and they have been classified into the following five broad categories:
 1. CRC Governance, Management and Human Resources
 2. Program Oversight and Management
 3. Partner Identification, Selection and Involvement
 4. Quality of Research
 5. Quality of End-user Involvement

6. Recommendations

On the basis of this study the AIC has developed a number of recommendations, grouped into discrete elements, to present in this report. They are articulated through the development of a model that comprise some features and characteristics of what the AIC considers to be a “Great CRC”. They also include broader recommendations based on the AIC’s interpretation of findings and conclusions within the broader framework of the project. It is important to recall that while these recommendations stem principally from the AIC’s research effort with the survey set of thirteen CRCs and their nominated industry partners, they have also been partly framed within the context of the AIC’s knowledge and experience within the CRC research domain.

6.1 Features and Characteristics of a “Great CRC”: The AIC’s View

The following model comprises some features and characteristics of what the AIC considers to be a “Great CRC”. The project team contends, on the basis of the research project results and validated by the AIC’s experience with numerous CRCs and the CRC research program over several years, that a “Great CRC” will exhibit many of the features and characteristics described in the following table.

	Features and Characteristics
CRC Pre-establishment	<ul style="list-style-type: none">• Commercial partners should selected from all areas of the supply/value chain• The partner selection process is flexible and transparent from beginning to end• The level of CSIRO influence should only equal or be aligned to their anticipated level of involvement, participation and contribution (some CRCs suggested that CSIRO stifled dissemination of IP through their involvement)• Industry and research partners should be of a quality consistent with the overall vision and impact of the CRC• Partners must demonstrate commitment to the CRC• Partnerships should have a clear and direct view of the path to market
Corporate Governance	<ul style="list-style-type: none">• An independent Chairman should be appointed• A small board is preferred that is representative of members to enable rapid decision making is than a large board dominated by one CRC constituency• Strong CEO leadership essential, with science knowledge and business acumen• Simplified processes and organisational structure• Strong dialogue between government and researchers; and take up by industry.• Skills to blend the obligations to the Commonwealth with the needs of the partners and board members
Program and Project Management	<ul style="list-style-type: none">• Program management must be outcomes and deliverables focussed• Program and project management processes must be interlinked and harmonised to enable effective decision-making, resource allocation, accountability and reporting

	<ul style="list-style-type: none"> • Project selection processes will benefit from a flexible approach from time to time • Subject all research programs to formal project review, with established processes and guidelines to govern decision-making that determines the continuation or abandonment of research projects, requiring: <ol style="list-style-type: none"> 1. A technical review committee 2. Project evaluation criteria, including capacity to continue or abandon projects 3. Formal review dates 4. Industry evaluation and input
<p>Some Leading Practice Strategies</p>	<ul style="list-style-type: none"> • Future market research activities should focus on evaluating research uniqueness • Industry partners should be tasked to conduct market research to enable an independent and objective evaluation of market need, size and segmentation that the research opportunity might address • Entrepreneurship should be actively encouraged and promoted among researchers • Applied research with some blue-sky thinking should be encouraged • Funds must not be used to feed unrelated research activities • Untied block grants should not be provided to any research provider
<p>Relationship Management</p>	<ul style="list-style-type: none"> • There should be a combination of formal mechanisms and flexibility in managing relationships with key customers and stakeholders. These might include: <ol style="list-style-type: none"> 1. Through relationships forged by the Executive and/or Board 2. Employing a relationship Manager 3. Defining the form of the relationship in the Centre Agreement 4. Quarterly User and Project Reviews 5. Formal screening of partners for suitability 6. Undertaking Customer surveys and case studies 7. Use of a CRM system 8. A review process to manage customer expectations
<p>Increased Collaboration</p>	<ul style="list-style-type: none"> • Core industry partners remain key determinants of end user or market need and must act as the voice of industry in CRCs • Industry collaboration is a key enabler for without industry support, the CRC should not proceed • There should be ongoing sustained engagement with SMEs and industry to realise the long term benefits of collaboration • To ensure that knowledge and IP are diffused into industry the collaboration with industry partners beyond the CRC core partners needs to be considered. Many CRCs demonstrated collaboration with organisations outside the CRC core partners thereby maximising value.
<p>Optimised Knowledge Transfer</p>	<p>Knowledge transfer is optimised by developing strategies for research commercialisation, research communication and research collaboration:</p> <p>Research Communication</p> <ul style="list-style-type: none"> • Appoint a communications manager • Align research outcomes with communication • Open and transparent communication with all stakeholders • Implement a communication strategy to become thought leader in the industry <p>Research Commercialisation</p> <ul style="list-style-type: none"> • Appoint a commercialisation manager • Heavy industry participation in commercialisation • Develop an IP register

	<p>Research Collaboration</p> <ul style="list-style-type: none"> • Encourage participation of non core participants in collaborative research
Transition Plan	<ul style="list-style-type: none"> • Transition planning must occur at the beginning of the CRC and should evaluate all potential forms the CRC can take, as well as the post CRC structure the collaboration could form • CRCs should have in place by their fifth year review a transition plan to ensure that knowledge and IP are positioned and plans are in place to affect their transference into industry and the wider community at an earlier stage rather than waiting for either a re-bid or for the CRC to be discontinued.
Termination Strategy	<ul style="list-style-type: none"> • A termination strategy should be developed as early as possible to address such topics as: <ol style="list-style-type: none"> 1. Assignment of intellectual property held by the CRC 2. Placement of employees in new positions • Planning to exit the CRC is just as critical as planning for establishment and start up. Re-bidding under the CRC program is not valid “exit planning” activity.

7. Appendices

Appendix A - Objectives of the CRC program

The CRC program is a Commonwealth Government funded initiative that is actively boosting commercially focused research and development for the benefit of Australian industry and business. The close interaction between academic researchers, industry and business operators fostered by the program is translating Australian research and scientific breakthroughs into successful new products and services – many of which are entering international markets. The formal objective of the program 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.”

The objectives of the CRC program were identified in the Evaluation of Cooperative Research Centres (2003)⁷:

- ❑ To enhance the contribution of long-term scientific and technological research and innovation to Australia's sustainable economic and social development;
- ❑ To enhance the transfer of research outputs into commercial or other outcomes of economic, environmental or social benefit to Australia;
- ❑ To enhance the value to Australia of graduate researchers; and
- ❑ To enhance collaboration among researchers, and between researchers and industry or other users, and to improve efficiency in the use of intellectual and other research resources.

Since the commencement of the CRC program, there have been nine CRC selection rounds, resulting in the establishment of 158 CRCs over the life of the program (100 new CRCs and 58 new from existing CRCs). In total all stakeholders have committed \$11.1 billion (cash and in-kind) to CRCs. This includes \$2.7 billion from the CRC program, \$2.9 billion from universities, \$2.1 billion from industry, \$1.3 billion from States, \$1.2 billion from CSIRO and \$0.8 billion from other sources. There are currently 57 CRCs operating across six sectors.

⁷ Howard Partners 2003, *Evaluation of the Cooperative Research Centres Programme*, p. 134.

Over its nine funding rounds, particularly in the two most recent rounds, the CRC program has steadily evolved both in terms of how applicants are selected and how outcomes are evaluated. It is clear that in recent funding rounds, successful CRC proposals must be genuinely end user driven, including pathways through which high quality research will find application. At the same time there has been a shift in the structure of CRCs – with CRCs now being established as incorporated entities rather than unincorporated joint ventures – to promote better governance arrangements within CRCs and assist in the effective uptake and use of research.

A CRC is a company formed through a collaboration of businesses and universities and can include Government agencies and research organisations such as CSIRO. The collaboration then works together to identify and address business challenges. CRC participants vary from large companies comprising more than 200 employees right down to small businesses; highlighting that the CRC program is accessible to businesses of all sizes. The CRC program currently includes a network of seventy-two (72) all of which fall into one of the following six sectors:

- ❑ Manufacturing technology;
- ❑ Information and Communications Technology;
- ❑ Mining and Energy;
- ❑ Agriculture and Rural-based Manufacturing;
- ❑ Environment;
- ❑ Medical Science and Technology;

It should be noted that these sectors are broadly defined under the CRC program so even if a sector may not appear to be listed, most fields of research can be assigned to one of these sectors e.g. biotech in horticulture. The Australian Government awards between \$20 and \$40 million in funding to each CRC over a seven year period. This funding must be matched by cash and/or in-kind contributions (e.g. expertise and research facilities) from CRC participants. There is no prescribed upper or lower funding limit available for applicants and the upper limit for the funding period is seven (7) years.

Benefits to industry and business include:

- ❑ Increased profit due to new and improved products, services and industrial processes;
- ❑ Direct access to leading researchers;
- ❑ Increased company visibility and top scientific backing to attract potential investors;
- ❑ Opportunities to build strategic partnerships with industry experts;
- ❑ High quality, industry-ready graduates to address operational requirements;
- ❑ Professional development courses to keep skills current;

In 2004-05 more than 1100 businesses participated in the CRC program which generated:

- ❑ 67 new patents filed in Australia and 22 overseas
- ❑ More than 4000 licenses earning income of more than \$9 million
- ❑ 12 new spin-off companies

The CRC program was established in 1990 with the objective of increasing collaboration and technology transfer between the research sector and industry. The program attempted to remove the chasm between academia and industry which at the time was identified as a major impediment to the commercialisation of Australia's research outcomes. Although the program has been successful overall, it can be argued that a number of opportunities exist to improve its impact. Opportunities include addressing some of the following issues:

- ❑ Ownership and management of intellectual property generated by CRCs;
- ❑ The appropriate CRC structure and its impact on taxation;
- ❑ The extent of market pull from industry, versus technology push from the research sector;
- ❑ Management and corporate governance issues;
- ❑ Increased exploitation of IP generated by CRCs;
- ❑ Enhancing commercialisation capability to reduce the time to commercial outcomes; and
- ❑ Increasing the overall return on investment of the program.

Survey of Cooperative Research Centres

Survey of Industry Partners

The survey documents are available from the AIC on request, subject to non disclosure agreement. They test for a number of factors, both internal and external to the collaboration.