

# A Model for Managing Intellectual Property, Commercialisation and Technology Transfer within a Collaborative Research Environment

J. F. Arthur, R. M. Hodge

**Abstract**—The Defence Materials Technology Centre has evolved from the Australian Cooperative Research Centres Program. The Centre receives funding from Government, industry and research sources to fund collaborative research within its participant organisations. The research centre is structured as a company with a small administrative staff and plays the role of the “honest broker” within the collaboration. A corporate culture has been established that is pervasive into the research projects are undertaken. The model is an effective mechanism to deliver outcomes to each of the participant stakeholders.

**Keywords**—Collaboration, Research Centre.

## I. INTRODUCTION

WITH recent trends of industrial R&D being outsourced [1] and delivered through collaborative programs [2], differing models have been used to deliver outcomes to stakeholders. Numerous models for collaboration have been developed with limited understanding of the effectiveness of the management of the collaboration [3]. The Australian Cooperative Research Centres model [4] of research has been ongoing since 1991 and pulls together teams of researchers from universities, public sector research organisations and engages stakeholders including industry, government and public good organisations to deliver agreed research outcomes. This model has been further expanded with the establishment of the Defence Materials Technology Centre (DMTC), a research organisation based on a collaborative research model but operating with the overlay of delivering outcomes to the Australian defence force, industry and research participants.

DMTC was established in 2008 to test the effectiveness of the collaborative research model and deliver cost effective and timely research outcomes to stakeholders. DMTC is comprised of 11 research institutions and 26 companies, ranging in size from SMEs to major transnational corporations [5]. Three government agencies also contribute funding and directly contribute to research outcomes.

This paper presents a case study of how the DMTC model evolved from the Cooperative Research Centres Program and is providing cost effective and efficient R&D outcomes to the stakeholder group.

## II. COLLABORATIVE R&D MODELS

An international trend of outsourcing R&D coupled with research organisations seeking to broaden their funding base and State sponsored R&D investors seeking greater leverage [6] has led to an expansion of collaborative R&D. Numerous case studies analyse the specific benefits of collaborative R&D or the success of specific research projects, yet analysis of models for delivering multi party collaboration are less extensive [3], [7].

A common collaboration model is driven by a university or public sector research organisation engaging directly in a one-on-one relationship with a company to undertake a research project. Such a model can successfully deliver benefit to both parties [2].

The United States National Science Foundation has established research centres programs, including the Engineering Research Centres program that involves multiple research parties and multiple industry participants [8]. This program is university based.

The Cooperative Research Centres (CRC) Program initiated in Australia was established to access existing R&D infrastructure and capability from multiple participants and link this with industry and/or government research requirements [4]. The Government’s objectives of the program have evolved though time;

Initially - to expand Australia’s overall research capability to support national objectives;

This was replaced by - supporting end user driven research capable of producing commercial return; and

Currently - to *deliver significant economic, environmental and social benefits to Australia by supporting end user driven research partnerships between publicly funded researchers and end users to address clearly articulate, major challenges that require medium to long term collaborative efforts*[9].

The Government and the collaboration participants provide the centre funding. The funding mix varies with each CRC, but on average, each CRC has the Government providing 28% of the Centre funding, universities 20%, industry 30%, and other parties 22% (such as public sector research institutions) through cash and in-kind contributions [10]. 190 CRCs had been established over the period 1991-2012, with 117 of these delivering an estimated AUD14.45 billion in direct economic benefits by 2017 [9]. The CRCs are administered through a number of different corporate structures and differing IP management models. These models and corporate structures

J. F. Arthur and R. M. Hodge are with the DMTC, Hawthorn, 3122 Australia (phone: +61 3 9214 4447; e-mail: jim.arthur@dmtc.com.au, mark.hodge@dmtc.com.au).

were initially driven by participant demands but as the program has evolved they have become driven more by delivering operational outcomes, with enough experimental data to suggest certain “best practice” features that the government either expects or prefers are achieved with specific models. The models are:

- Unincorporated joint ventures
- Incorporated companies limited either by shares or guarantee and if limited by guarantee either tax paying or tax exempt [11]. Companies limited by guarantee have members who provide a guarantee for the company rather than shareholders.

A review of the CRC program identified that both the incorporated and unincorporated models can be effective with pros and cons with each of the models [12]. Regardless of the model adopted by a CRC, effort is required to manage the collaboration.

CRCs have different IP ownership structures – ranging from IP ownership residing with participants to IP ownership residing with the CRC Company. In some CRCs legal and beneficial ownership of IP is by different parties enabling some partners to use IP whilst others benefit from commercialisation income.

Varying modes of implementation of the CRC model have resulted in differing IP management and commercialisation practices. CAST CRC, active from 1993-2012, had 19 industry participants, seven universities and three public sector research organisations as participants [13]. CAST CRC had a company structure with the company owning all intellectual property and then licensing the IP to industry participants on commercial terms when the technology had been proven. Technologies developed included new alloys, coatings and manufacturing processes. Usually the industry participants would licence the technologies on an exclusive basis. The author, who was personally responsible for managing the portfolio, found that industry participants would seek a tangible asset to licence and this was generally in the form of a patented IP. The patent served a dual purpose – providing a tangible item to licence as well as the providing a means of protecting the IP. Licensing terms specified the licensee meet patent maintenance costs. The implications of this for CAST CRC was that it developed a substantial patent portfolio that had to be managed and maintained, including meeting the patent costs prior to licensing.

Other CRCs with alternate structures include:

- Antarctic Climate and Ecoscience CRC: This CRC has a public good objective and creates non commercial IP for national benefit. This CRC is structured as an unincorporated joint venture [14].
- Capital Markets CRC: This CRC is a company limited by guarantee linked with a company limited by shares through which commercial value is derived from the IP [15].
- CRC for Aboriginal and Torres Strait Islander Health: This CRC is a public good CRC with operating as a

benevolent institution, structured as a not for profit company limited by guarantee [16].

### III. DMTC MODEL

DMTC was established to capitalise on the CRC model with funding provided by Defence as well as participants. Through the DMTC, Defence seeks to create capability with Australian industry that may provide services or product for future needs. The research venture is established as a tax exempt company limited by guarantee that participants may join as Members. Governance is provided through an independent board elected by Members. The company owns all IP created legally and beneficially. A head agreement with the Commonwealth specifies funding arrangements. Key clauses are replicated in a Participants Agreement (between the DMTC and the participants) reflecting the funding and operations of the research centre. IP use rights are specified through both the Participants Agreement and individual project agreements, with participants provided with a royalty free licence to use project IP within their business. More expansive IP usage rights may be provided by a royalty bearing licence. The company retains the rights to commercialise IP as it sees fit.

DMTC is comprised of 11 university and public sector research participants and 26 industry partners [5]. Over the past five years an administrative team of 11 has managed 150 researchers per year from a pool of around 600 researchers engaged in approximately 50 research projects, ranging in duration from six months to seven years. The annual budget for the company is AUD15.5 million, with 86% directly applied to research and education activities [5]. The company has established research management procedures to enable projects to deliver outcomes to all project participants.

Participants are encouraged to provide background IP to projects that is further developed and implemented. Projects are structured around supply chains addressing multiple issues associated with technology development and deployment.

With a corporate structure and licenses provided within project agreements automatically as part of the entry criteria for a project, DMTC has successfully transferred a number of technologies to its industry partners. No patents are maintained by the company – this is not a policy perse, but more a reflection of the character of the technologies that have been developed and the fact that research results are licensed in defined fields at the commencement of a project rather than when the technologies are developed. Such a model will result in small financial benefits flowing back into the research company from commercialisation, but maximise the speed and efficiency with which the technology finds its way to maturity and commercial utilisation through its industry partners. The future of the company is reliant on key stakeholders perceiving value from participation in just such a manner, and continuing to engage and provide resources for future research.

#### IV. CHALLENGES OF COLLABORATIVE RESEARCH

Successful research collaborations require:

- A method evaluating partners;
- High quality project management;
- Commitment of the partners and trust between partners;
- Flexible management processes to address changes in the external environment and changes experienced by partners; and
- Delivery of benefits to all partners [2].

Whilst previous authors contend that the primary reason for collaboration is based on the principle that technology transfer will occur [17], the authors' contention is that each organisation entering into a collaborative research project is entering with differing and numerous reasons, and at times these reasons are not explicitly stated. Sharing the costs whilst acquiring the benefits remains a universal driver for engaging in the collaboration. As a general observation, the attractiveness of collaborative research is as follows:

- Universities – participate to engage in world class research, securing additional funding for research, secure an additional cohort of post graduate students and engagement of its researchers with industry.
- Public sector research organisations – engage to secure an additional revenue stream and engagement with external researchers and industry.
- Large companies – access to research capability leading creation of technology for commercial gain in a cost effective manner.
- Small companies – low cost access to IP or technology and engagement in supply chains for commercial gain.

Measures on the effectiveness of collaboration will vary between participant types with measures such as publication counts or economic productivity. Such measures don't address whether the collaboration has been effective, rather whether one participant has achieved its objectives [3]. Three measures of successful collaboration are:

1. Satisfaction of common incentives to collaborate;
2. Avoidance of barriers by effective planning and management; and
3. Effective outcomes [3].

Research centres tied to university departments have been observed to have strain placed on staff trying to meet the objectives of the centre whilst also performing departmental tasks [7]. The cultural issues within a research centre and between the participants are a significant factor within the centre achieving its outcomes.

Previous studies have identified that the culture in bureaucratic organisations do not reflect the values that are conducive to the success of large science collaborations [18]. These values include sharing of research progress and results, cooperation of consortium members and some level of trust between members. Within a University environment an identified driver against effective collaboration is the reward system that focuses on individuals rather than teams [18]. Effective engagement with individual researchers thus becomes a critical success factor for the research centre.

The engagement and project management issues become more challenging with cultural issues inherent to each participant organisation [17]. This issue is compounded with many research organisations structured for funding and focus on scientific issues rather than the organisation and management of the centre [7]. With the introduction of the "honest broker" or an intermediary to manage the research collaboration, many of the cultural issues are avoided and effectiveness of the collaboration is enhanced [19]. The honest broker provides effective and efficient management for the collaboration that is transparent to the partners and external parties [19]. This alone is insufficient to deliver successful outcomes; the honest broker must have skills to balance the interests of all the participants, commercial acumen and be able to define success for each of the participants.

An effective culture is essential to the successful operation of a research centre [20]. A significant issue for the CRC model is the establishment of a culture that overlies the organisational culture of each of its participant organisations. This is challenging given that the individuals undertaking the research are typically not employees of the CRC. This is further compounded with the CRC being a close to a virtual organisation with only a centralised administration function and researchers located within their host institutions. Successful organisations tend to have successful cultures but this is only an element of their success. For a research organisation, research excellence is also a requirement. Individual members of teams must be enabled to work with each other on an equal not hierarchical basis [18] and balance the often competing needs from each contributor group.

Within DMTC a culture has been built by:

- Identifying and respecting the outcomes that each of the participants seek from their engagement
- Implement standard operational practices for project management
- Implementing a web based information management system for all participants to access and manage project information
- Implementing an annual conference for all people participating in the centre
- Providing adequate funding for projects
- Honestly and transparently setting project goal and objectives, and being prepared to redirect resources towards activities of higher priority
- Actively managing relationships with all stakeholders.

#### V. CONCLUSION

The DMTC is an effective collaborative research organisation conducting multiparty collaborative R&D. The organisation is seen as an "honest broker" by participants. Value is delivered to participants and other stakeholders by understanding their engagement requirements and delivering outcomes based around these needs.

#### ACKNOWLEDGMENT

The authors wish to acknowledge the Defence Materials Technology Centre for support in preparing this paper.

#### REFERENCES

- [1] J. Hsuan, and V. Mahnke, "Outsourcing R&D: a review model and research agenda," *R&D Management* vol. 41, pp. 1-7, 2010.
- [2] T. Barnes, I. Pashby, and A. Gibbons. "Effective university – industry interaction: a multi-case evaluation of collaborative R&D projects," *European Management Journal*, vol. 20(3), pp. 272-285, 2002.
- [3] E.A. Corley, P.C. Boardman and B. Boozeman, *Research Policy*, vol.35, pp. 975-993, 2006.
- [4] R.O. Slatyer. "Cooperative Research Centres: The concept and its implementation," *Higher Education*, vol. 28, pp. 147-158, 1994.
- [5] DMTC Ltd. "2012 Annual Report," Hawthorn, Victoria, 2012.
- [6] H.A. Daniel, D.J. Hempel and N. Srinivasan, N. 2002. "A model of value assessment in collaborative R&D programs," *Industrial Marketing Management*, vol. 31, pp. 653-664, 2002.
- [7] P.C. Boardman and E.A. Corley, "University research centers and the composition of research collaboration," *Research Policy*, vol. 37, pp. 900-913, 2008.
- [8] B.I. Ponomarev and P.C. Boardman, "Influencing scientists' collaboration and productivity patterns through new institutions: University research centres and scientific and technical human capital," *Research Policy*, vol. 39, pp. 613-624, 2010.
- [9] The Allen Consulting Group, "The economic, social and environmental impacts of the Cooperative Research Centres Program". *Final report to the Department of Industry, Innovation, Science, Research and Tertiary Education*, 2012.
- [10] CRC Association, "How to build a CRC consortium," 2008.
- [11] CRC Association, "CRCs governance & management," 2010.
- [12] M. O'Kane, "Collaborating to a purpose: Review of the Cooperative Research Centres Program," 2008.
- [13] CAST Cooperative Research Centre. 2011. Annual Report 2010-11.
- [14] Antarctic Climate and Ecoscience CRC 2013 <http://www.acccrc.org.au>
- [15] Capital Markets CRC, <http://www.cmcrc.com>, 2013.
- [16] Lowitja Institute, <http://www.lowitja.org.au>, 2012.
- [17] S. Davenport, J. Davies and C. Gimes, "Collaborative research programmes: building trust from difference," *Technovation*, vol. 19, pp. 31-40, 1999.
- [18] E. Welsh, M. Jirotko and D. Gavaghan, "Post-genomic science: cross-disciplinary and large-scale collaborative research and its organizational and technological challenges for the scientific research process," *Phil. Trans. R. Soc.* Vol. 364, pp.1533-1549, 2006.
- [19] M. Goldman, "Public-private partnerships need honest brokering," *Nature Medicine* vol. 18 (3), pp. 341, 2012.
- [20] B. König, K. Diehl, K. Tscherning and K. Helming, "A framework for structuring interdisciplinary research management," *Research Policy* vol. 42 (1), pp. 261-272, 2013.