Northern Territory Submission to the Productivity Commission

Public Support for Science and Innovation

A Joint Submission by

The Northern Territory Government

The Northern Territory Research & Innovation Board

Charles Darwin University

July 2006

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Executive Summary

The Northern Territory places considerable importance on the role of science and innovation in informing and advancing public policy in particular, and enhancing the nation's economic, social and environmental positions more generally.

Throughout government science underpins the development and renewal of legislation, public policy and long term strategy. This science not only emanates from local and regional research and innovation but is drawn from scientific endeavour at national and international levels. The process includes the translation of research and innovation into legislation, for example where legislation underpins National Park Management Plans and Species Management Programs. Similarly with international treaty obligations such as those under the jurisdiction of the International Union for the Conservation of Nature, science underpins such practices as sustainable harvest programs for crocodiles. Vegetation clearing guidelines under Planning Acts utilise science to set minimum thresholds for retention of vegetation. There are numerous examples in the area of conservation as well as many other areas of public policy where science informs public policy and legislation.

Territory Government support for science and innovation over the last five years initially concentrated on the development of Desert Knowledge policy initiatives centred around the Alice Springs region. Subsequently complementary policies were developed in the Top End under the Tropical Knowledge banner with the establishment of the Cooperative Framework on Tropical Science, Knowledge and Innovation between the Northern Territory, Queensland and Western Australia. Most recently, the NT Research and Innovation Board and Fund was established in September 2004.

Innovation is taken to mean in its broadest sense Research and Development, as well as non Research and Development Innovation such as management and organisational practices and restructuring, process adaptation, logistics management, workplace re-organisation, and applications of new technology and capital investment in new plant and equipment (Department of State Development, Trade and Innovation, Queensland Government, 2006).

There are parallels of scale between the Northern Territory and what it may contribute nationally in science and innovation, and Australia and what it may contribute globally in these fields of research. In each case scale dictates that specialisation within the jurisdiction, and broader collaborative engagement for wider knowledge transfer, are arguably the most effective behavioural approaches for development and progress in these areas.

It is argued that robust quantitative measures evaluating science and innovation's economic and social impacts are not always available, or even reliable, so the alternative case study approach can instead provide a useful insight into how research and innovation informs public policy, and in turn, how well public policy is performing. Nevertheless the case study approach itself has its own limitations.

It is further argued the need for caution in applying international comparisons with Australia's performance, and the need to exercise judgement in the evaluation of programs as distinct from adopting quantitative measures, the latter of which may ultimately prove spurious. Caution is also urged where there may be a strong correlation between Research and Development investment and economic growth, implying a case for more investment. Such correlations do not necessarily lead to causative conclusions, in a similar way to the findings of the Commission's own Staff Working Paper in its study of R&D and Productivity, (Productivity Commission, April 2006). There may be reasons of good judgement why Australian business does not appear to invest as heavily in R&D as businesses in some other countries.

The Territory notes the Productivity Commission's Issues Paper makes it clear that the focus of the Inquiry is on the physical and biological sciences, excluding the social sciences '...except to the extent they are relevant to innovation.' The Northern Territory, however, strongly supports the view of the Prime Minister's Science Engineering and Innovation Council in its paper *Imagine Australia : The Role of Creativity in the Innovation Economy*.1 In particular that designers and creative artists are becoming more vital to economic growth, adding value to science and technology innovation. The notion of creativity becoming economic innovation generating new products, services or processes for commercial benefit is very much supported. As we move into the 21st century, creative ideas are recognised as being as important for innovation as commodity innovation. The exclusion of the humanities and social sciences is, of itself, an impediment to Australia's innovation system developing its full potential.

The commercialisation of creative ideas provides a vital link between the social sciences and humanities and the Small and Medium Enterprise sector of the economy. It is these new ideas and skills translated into business activity that will contribute to sustainable economic growth. In a regional context strengthening these SMEs will make them more competitive globally, contributing in turn to incremental economic growth of particular importance to regional economies like the Territory.

The submission does not provide any comment in detail on impediments to research, other than to recommend that the Productivity Commission give some attention to the transaction costs incurred in applying for Federal Government innovation programs.

It is the general perception of Small and Medium Enterprises in the northern Australian economy that application, reporting and evaluation processes are onerous, acting as a disincentive for firms to make application. This view is sometimes shared by research institutions and government agencies. It is important to ensure there is sufficient reporting and evaluation of publicly funded programs. This however should not be at the expense of the research itself, where reporting may consume an excessive amount of time that would otherwise be devoted to the research.

There is a further perception that intellectual property is inadequately safeguarded where SMEs enter research arrangements with the government and/or research sector. It is contended both onerous reporting requirements and inadequate safeguarding of IP are at least perceived to be impediments to Australia's innovation system.

[1] PMSEIC, 2006, *Imagine Australia. The Role of Creativity in the Innovation Economy*.

The submission concludes with some comment on the need for further support for collaborative initiatives within the SME sector, as well as collaboration between that sector and government and research sectors. The submission notes that the emerging focus of engagement with the SME sector will however need to be balanced with the necessary levels of public good research in the Northern Territory that seek to address the Territory's social and environmental needs, as well as build on the strengths of its small but maturing economy.

In the case of support for SMEs, at the national level they make up 95 per cent of private firms by number, employing over 3 million people and contributing 30 per cent to the nation's Gross Domestic Product. The Territory's position is similar to these national figures, if anything even more sharply distinguished by the importance of the SME sector, making up as it does 99 per cent of private sector firms and employing around 60 per cent of the workforce.

It is this sector of northern Australia sorely in need of support from innovation programs because of their importance for sustaining incremental regional economic growth, as distinct from the significant yet discontinuous, one-off contributions made by major projects. Innovation programs can add to the competitiveness of SMEs, measured against global standards where these firms are bidding for major project work. SMEs need support individually, and arguably more importantly support in development of collaborative arrangements, in order for them individually or collaboratively to reach global competitive standards. Support through science and innovation can assist in this process.

The other aspect is public good research. There is concern that should Commonwealth programs reduce or severely curtail funding for public good research, the Territory economy will be disproportionately affected.

As an illustrative example, there are four public good Cooperative Research Centres in which the Territory is a core partner currently. Taking into account these and other CRCs where the Northern Territory has a supporting role, the Territory spends around $35M in cash and in kind over a notional seven year period (the standard cyclical period for a CRC). While difficult to estimate precisely, the Territory conservatively receives more than $100M in cash and in kind over that same period from external sources. If the Commonwealth were to cease funding public good CRCs the impact on the Territory research economy would be significant, as would be the impact on employment in the sector. This in turn would flow on to our long term population and its growth. There would also be considerable loss from the discontinuation of important research that would not be taken up elsewhere.

1. Introduction

The submission is a collaborative effort of the Northern Territory Government, the Northern Territory Research and Innovation Board, and Charles Darwin University. Unless otherwise stated, reference to the Northern Territory throughout this submission means all of these parties.

The section that follows details science and innovation policy in the Northern Territory. This is followed in Section three with a brief review of the Territory economy with some emphasis on innovation.

Section four provides case studies to illustrate how public support has been applied in a diverse range of areas, but notably restricted to public good research. Particular attention is drawn to the first two studies taken from the CRC for Tropical Savanna Management to demonstrate the types of return on investment that may be derived from this type of research.

The submission concludes with some observations on public good research relative to greater emphasis placed on SME research requirements and the need to build greater links from this sector of the economy to the government and research sectors.

2. Northern Territory Science and Innovation Policy

2.1 Policy Objectives

The Northern Territory Government has four key policy objectives for science and innovation in northern Australia:

- *The development of collaborative opportunities at every opportunity, engaging the government, research and Small and Medium Enterprise (SME) sectors of the economy*

The scale of the Northern Territory economy has ensured that from its earliest beginnings the NT has had to seek and forge collaborative alliances in the sciences, and in the development of research and innovation opportunities. This collaboration has been strongest between government and research sectors, particularly within, but not limited to, Australia. More recently, a heightened focus on collaborative opportunities with the SME sector is being pursued. It is the latter sector of the private economy in the NT that makes up the great bulk of business enterprise in northern Australia, and unlike large corporations, has the greatest need for research collaborations and support.

- *The importance given to the support of public good research*

Given the developing nature of the Northern Territory economy, there is considerable emphasis placed on public good research in the areas of social development and the sustainable use of environmental resources, particularly as these areas relate to Indigenous economic development, and social issues of public health, housing, community safety, education, training, literacy and numeracy. As such, while the engagement of the SME sector in the NT is a key concern for Government, it is balanced by the ongoing requirement for public good research to address areas of social reform and environmental sustainability.

- *The transfer of knowledge from publicly funded research to the private sector, and the wealth creating opportunities that arise from this process.*

This is a developing area of public policy for the Territory, with a number of emerging approaches being developed. The underlying principle is the recognition of the importance of the SME sector of the economy as a cornerstone for the creation and growth of sustainable jobs in the northern Australian economy.

- *Deriving value from research.*

The Northern Territory Government supports science and innovation as contributors to both public and private research. It wants to see sound public good research (research that saves money), complemented by research that benefits the private sector (research that makes money). It is important in the NT's case that an appropriate balance is maintained between these broad areas of research, and that one is not discarded in favour of the other.

Further details on the NT's policy on science and innovation are available at the Innovation and Knowledge Economy group's website: http://www.dberd.nt.gov.au/about_us.cfm?cat4id=41

2.2 Policy implementation

Territory Government support for science and innovation over the last five years, initially concentrated on the development of Desert Knowledge policy initiatives centred on the Alice Springs region. Subsequently complementary policies were developed in the Top End under the Tropical Knowledge banner with the establishment of the Cooperative Framework on Tropical Science, Knowledge and Innovation between the Northern Territory, Queensland and Western Australia. Most , recently, the NT Research and Innovation Board and Fund was established in September 2004. Much of the effort under these initiatives has focused on public good research, which remains a key policy objective for the NT Government and seeks to inform public policy and program delivery in northern and central Australia.

In 2006 the Government has developed its science and innovation policies further, with an additional emphasis being to link the SME sector of the economy more closely with the research and government sectors, from a research and development, and innovation perspective.

The approach works on the assumption that SMEs, with a focus on innovation and related investment, are likely to be more resilient, and provide more sustainable jobs to the economy, than those with less of a focus in this area. Equally there is considerably more success in developing innovation and innovative practices by firms that collaborate, as compared to those that do not (Australian Government, Department of Industry, Tourism and Resources, 2006). The task for the Northern Territory then is to encourage greater collaboration between SMEs in particular industry sectors in addition to collaboration between SMEs and the government and research sectors of the economy.

As part of it objective to forging better links between the government, research and SME sectors of the economy, the NTG is working to encourage strong public sector investment in research that will benefit the private sector.

In undertaking its approach to research and innovation, the NT Government has adopted five program areas to achieve its objectives:

2.2.1 Northern Territory Research & Innovation Board (NTRIB) and Fund

- The Northern Territory Government's strong collaborations with the research sector have strengthened considerably with the advent of the NTRIB and associated Fund in 2004-05. Reflective of the NT's collaborative approach, the NTRIB is chaired by Professor Grahame Webb, international wildlife management expert, with Professor Helen Garnett, Vice Chancellor, Charles Darwin University as the Deputy Chair. In addition, membership of the NTRIB is drawn from the private, public and higher education sectors. An initial grant of $1M over three years was provided and the NT Government has recently announced the continuation of the Fund, with an additional $350,000 pa to be provided from 2007-08 for a further three years.

- Linkages to Commonwealth programs are important for co-funding research programs under the Fund. In the first 18 months of the Fund (from late 2004 until mid 2006) there has been an outlay of $0.5M in research grants which have leveraged $4.8M in funding from external sources, principally the Australian Research Council through their industry linkage grant program, and the Commonwealth Environment Research Facilities Program (see Table 1). Further details of some of the research programs supported over the last two years are provided in the section four of this submission dealing with Case Studies.
- Future research grants awarded under the Fund will encourage third party (particularly SME) participation, in line with the recent decision by the NT Government to heighten collaborative activities, including those opportunities for research and innovation, with this sector of the economy.
- The program will be refined by adjusting priorities, including a program that prepares and provides entrepreneurs with assistance, enhancing their ability to make successful applications for Australian Government funding programs, and one that supports collaborative partnerships between SMEs in northern Australia to collectively enhance their competitive position in bidding for work or in undertaking pre-competitive research related to undertaking work in tough Territory conditions.
- The Board will also play an expanded role in advising Government on research commitments under the Cooperative Research Centre Program, which is also increasing its focus on SME participation in research.
- The Board hosts the annual NT Research and Innovation Awards, an important event with high standing in the research community which recognises the dedication and successes from scientists and innovators in Australia's northern economy.
- Collaborations with CDU aimed at building links with the SME sector of the economy are underway, in conjunction with the work of the Research and Innovation Board.
- Further details on the NTRIB and Fund are available at: http://www.nt.gov.au:8501/dberd/research_innovation/index.cfm.

2.2.2 Tropical Knowledge

- The parties to the Cooperative Framework on Tropical Science Knowledge and Innovation, an agreement between the Northern Territory, Queensland and Western Australia signed in 2004, aim to work together to realise the potential of tropical science, knowledge and innovation to enhance the economic performance of Northern Australia, and Australia as a whole. In addition, the parties aim to propagate the significant body of expertise in tropical science, knowledge and innovation residing in these northern jurisdictions. The jurisdictions recognise the potential for undertaking a strategic collaborative approach that utilises expertise to address the distinctive challenges of Tropical Australia, as well as the benefits owing to the transfer of such expertise to other tropical regions. The jurisdictions also acknowledge the benefits to be gained from collaboration with the Commonwealth in this area of expertise. Further details on the Cooperative Framework are available at: http://www.nt.gov.au/tropicalfutures/index.cfm?contentid=12.

Table 1 Projects Commenced as at 11 July 2006

Title	**Researcher**	**NTRIF Committed $'000**	**Actual Leverage/**Source **$'000**
Research capacity building in central Australia for effective institutions for sustainable indigenous economic development	Donna Craig,	150	195 (CDU, CSIRO, DK CRC)
Causes and consequences of population turnover in the Northern Territory	Tony Barnes, Martin Young, Stephen Garnett, Julie Roberts	45	485 (ARC, Dept. of Chief Minister, NT Treasury)
An evaluation framework for enhancing Aboriginal community-based natural resource management	Bev Sithole, Stephen Garnett	50	135 (CSIRO, NLC, CDU-SER)
Causes and decline among granivorous birds in Northern Australia	Stephen Garnett, John Woinarski, Sarah Legge	15	257 (ARC)
Stable Isotope ratio mass spectrometry facility	David Parry, Niels Munksgaard	20	327 (ARC L-IEF, CDU, AIMS, DBIRD)
Monitoring, modelling and control of mosquito-borne diseases in Darwin	David Bowman, Bart Currie, Barry Brook, Corey Bradshaw	60	639 (ARC, DHCS, DIPE, Dept. Defence)
Sustainable management of NT tropical rivers: an integrated research program (i)	Michael Douglas	20	0
Green ants as biological control agents in agroforestry	Keith Christian	35	254 (RIRDC)
Linguistics in Indigenous adult education and its effects on endangered languages	Josephine Caffery	5	66 (Scholarship)
Aboriginal Birth Cohort Study	Susan Sayers	30	
Replant	Angus Cameron	10	60 (Private Investment)
Sustainable management of NT tropical rivers: an integrated research program (ii)	Michael Douglas	30	2,000 (CERF)
Population dynamics and ecological-epidemiological models of feral swamp buffalo in northern Australia	Corey Bradshaw	45	265 (ARC)
Policy and legislative frameworks and impediments to wildlife-based industries	Stephen Garnett, Bruce Campbell	15	74 (ARC)
	TOTAL	**530**	**4,757**

- Some of the areas of collaboration in tropical knowledge include
  - working on global climate change;
  - the spread of exotic vector borne diseases, pests and weeds;
  - improvements for the delivery of community health; and
  - the sustainable management of Australia's surface water, the great bulk of which lies in the tropics.
- Two projects are currently the focus of the agreement :
  - the North Australia Emerging Infectious Diseases Alliance (NAEIDA), with national and international regional implications for Safeguarding Australia which is itself one of four National Research Priorities as set by the Prime Minister in 2002. The focus of the proposed research is the containment of exotic vector borne diseases like Japanese encephalitis and dengue fever as much as possible in our near northern neighbourhood, and the development of rapid diagnostics and rapid response procedures across northern Australia; and
  - the Tropical Rivers and Coastal Knowledge (TRACK) project which will focus on the increasing pressure on the water resources in northern Australia as water becomes scarce in the rest of the country. The TRACK research hub intends to increase understanding of the important natural assets and ecosystem services provided by tropical rivers and coasts, assess the implications of potential developments, and identify opportunities to develop genuinely sustainable enterprises in the region. A critical feature of the research will be economic engagement with Indigenous people, who own and manage large parts of the region's catchments and coasts. The project was successful recently in attracting $8M in funding from the Commonwealth Environmental Research Facilities (CERF) Program, with a further $3M from Land and Water Australia, $2M from the Queensland Government, and $4.8M (in kind) from the Northern Territory Government. The collaboration involves the Commonwealth and the three northern 'states', with headquarters for the project based in Darwin.
- In addition to the Cooperative Framework, both the Northern Territory Government and CDU are core partners in the CRC for Tropical Savannas Management, currently being rebid as the CRC for Tropical Savanna Futures. The current CRC has an investment in the order of $90M in cash and in kind over its seven year life. Further details are provided in Section 4.
- The Territory Government and CDU are also core partners in the CRC for Aboriginal Health, formerly the CRC for Aboriginal and Tropical Health. The current CRC has an investment in the order of $130M in cash and in kind over its seven year life.

2.2.3 Desert Knowledge

- The Northern Territory Government established the Statutory Corporation, Desert Knowledge Australia, in 2003 to provide a national and international focus for research and innovation as well as the development of desert knowledge networks, in this field.
- Desert Knowledge Australia is now fully established with an 11 person Board chaired by the Hon. Fred Chaney AO. Desert Knowledge Australia is establishing networks of people to undertake the research, product development and marketing needed for desert knowledge economies. This includes drawing from informal and formal knowledge bases, developing business models to capitalise in a sustainable way on our natural resources, facilitating better remote delivery of

health and education services, and developing policy and appropriate tenure including Intellectual Property arrangements for communities to progress commercial opportunities.

- In July 2003 the Desert Knowledge CRC commenced operations, with core partners including the NT Government and CDU. There are six core projects currently underway:
    - Livelihoods based on managing natural and cultural heritage
    - Key industry opportunities in remote areas (bush products industry; self-drive tourism industry; and pastoralism)
    - Supporting the emergence of small business in desert Australia (including Indigenous small business)
    - Viability of settlements (what are the drivers of viability)
    - Services to settlements (including approaches to delivering services to remote communities, reducing costs and increasing efficiencies, and models for business and institutional structures); and
    - Desert regions as integrated systems (including understanding a desert region as an integrated system, designing a thriving sustainable region)
- In 2005-06, the NT Government committed $30M over 3 years to complete Stage One of the Desert Knowledge Precinct, including the Desert Peoples Centre which will focus on eduction and training for people in remote communities, and the construction of a Desert Knowledge Business and Innovation Centre to house both Desert Knowledge Australia and the Desert Knowledge CRC.

2.2.4 Partner Up

- A collaborative alliance with the Chamber of Commerce NT and CDU, together with Advance Cairns, Townsville Enterprise and the Kimberley Area Consultative Committee, the Partner Up program is working on business matching for SMEs across northern Australia to boost their capability and capacity to compete in the market place. The first workshop in Darwin in May was very successful, involving the metal fabrication and engineering sectors and their engagement with major projects like ConocoPhillips' operation at Wickham Point, and ALCAN's G3 expansion at Gove.
- The work acknowledges the innovative approach that SME's may take in collaboration to bid for major project work that they may find difficult to do alone, benefiting from economies of scale, including: sharing the cost of preparing occupational health and safety plans; meeting environmental requirements; meeting quality assurance standards; sharing insurance costs; and meeting transaction costs such as legal fees in bidding for major project work. It is intended that opportunities to collaborate on research and development projects of mutual interest will also be explored by this group in the future.
- Future strategic partnership workshops will focus on Indigenous economic development in relation to major (generally remote) projects such as the Tanami Newmont and McArthur River Mines, and in the tourism sector.

2.2.5. Charles Darwin University/Northern Territory Government Partnership Agreement

The Northern Territory Government entered into a Partnership Agreement with Charles Darwin University in July 2003.

- There are four key objectives under the Agreement:
  - Growing resident capacity
  - Meeting Government needs
  - Reorganising the University to better meet Territory needs; and
  - Particular projects enabling Indigenous social and economic development
- There is a close working relationship between the research interests of the University, and the research and innovation policy work of the Government, both through the Schedules to the Agreement, and through the NT Research and Innovation Board and Fund. There is also cooperation between the Government and the University on work under the Cooperative Framework with Queensland and Western Australia, and in applications for Australian Government research funding.
- A second CDU/NTG Partnership Agreement is expected to be signed by the end of 2006, and this Agreement will incorporate a strategic focus towards achieving outcomes from collaborative research priorities between University, Government and the private sector.
- Further information about the Partnership Agreement available at www.cdu.edu.au/government.

2.3 Investment in Research Institutions

2.3.1 Northern Territory Government

The NT Government makes financial and in-kind contributions to a number of research institutions. It should be noted that it is difficult to separate out investment that is directed at research and innovation as per the definition provided in the issues paper, as opposed to socially orientated science and innovation. This is partly attributable to the NT's industry and accompanying research needs that develop in an interlinked sense with areas of social reform and environmental sustainability.

The investment by the Government is in a number of areas:

- Direct research expenditure on key Government research agencies. In 2002-2003, the Northern Territory Government spent $29.4m on research and development (ABS, 2005). A significant proportion of this was direct research expenditure by the Departments of Natural Resources, the Environment and the Arts, and Primary Industries, Fisheries and Mines. Government's focus on the Territory's mature industries is highlighted as well by its contribution of $16.8m to R&D in environmental management, a significantly higher proportion of expenditure than for the whole sector and a field in which the Territory has been undertaking research and development for many years. This is consistent with the Northern Territory government's two largest research agencies being located in the Department of Primary Industry, Fisheries and Mines (DPIFM) and the Department of Natural Resources, Environment and the Arts (NRETA).
- There was additional indirect expenditure by the Territory Government for health and education research primarily concentrated at Charles Darwin University.
- Table 2 provides further details of direct and indirect expenditure combining Commonwealth and NT Government research and development investment. Generally Government expenditure on R&D in the Northern Territory was

directed into the mature industries – primary production, mining and natural resource management.

- Investment through the NT Research and Innovation Board of some $0.35M per annum
- Investment in Charles Darwin University (see section 2.3.2 below)
- Investment in Cooperative Research Centres, which totals some $35M in cash and in kind (over a seven year cyclical period). Tables 3 and 4 provide details by CRC. Even taking the four CRCs in which the NT Government is a core partner, research investment over a seven year cyclical period in these four CRCs totals in the order of $370m. Three of these four CRCs are headquartered in the Northern Territory. While it is difficult to estimate precisely, the Territory conservatively receives from external sources more than $100m in cash and in kind from this total amount of $370m.
- Other collaborative investments such as with CSIRO into joint research laboratories, sharing research facilities with the Arafura Timor Research Facility (a partnership arrangement between the Australian Institute of Marine Science and the Australian National University), and collaborative research projects such as studies of the Douglas Daly catchment with the CSIRO.

Table 2. Government expenditure on R&D by socio-economic objective 2002-2003[2]

Socio economic objective	Expenditure on R&D (Combined Commonwealth and NT)		National Government Expenditure on R&D
	NT $000	NT %	Sector %
Defence	2	0.003	11.4
Economic Development	29 937	59.8	54
Society	2 241	4.4	12
Environment	17 656	35.2	20.5
Non-orientated research	226	0.45	7.2
Total	**50 061**		

*Also referred to as: Government Expenditure on Research and Development (GOVERD

2.3.2 Charles Darwin University

Charles Darwin University (CDU) has a vital role to play not only in education and training in the NT but also in research. The Partnership Agreement underscores the importance the NT Government places on ensuring there is a strong and growing research capacity at the University and it provides funding to the Institute of Advanced Studies at the University to the tune of $1.5m annually. In addition the NT Government spends around $2m annually in research and consultancies at the University. There is an additional annual contribution of $3.6M to the Menzies School of Health Research which is part of CDU.

[2] ABS R&D Government and Private Non-Profit Organisations 8109.0, 2002-2003

Table 3.
NTG Commitments to CRCs (Participant/ Supporting Participant) Based on CRC Annual Reports for 04-05

	CRCTS	DKCRC	CRCAH	CRCTPP	CRCST	CRCWQT	CRCBS	CRCWM	CRCNPB
Level of commitment	Participant	Participant	Participant	Participant	Industry Partner	Industry Participant	Supporting Partner	Supporting Partner	Supporting Partner
NT Department (current)	NRETA and DPIFM	NTG DBERD	DHCS	DPIFM	DBERD	PowerWater	DPIFM	NRETA	DPIFM
Duration	2001-2007	2003-2010	2003-2010	1999-2006	2003-2010	2001-2007	2003-2010	2001-2007	2005-2012
	$	$	$	$	$	$	$	$	$
Total cash commitment	700,000	1,050,000	1,050,000	0	350,000	350,000	0	0	
Projected actual	700,000	1,130,000	1,050,000	0	350,000	350,000	0	0	
Cumulative to June 05	400,000	380,000	300,000	0		50,000	0	0	
Total in kind commitment	7,721,000	9,587,000	10,472,000	1,078,000	372,000	1,083,873	294,000	2,201,000	490,000
Projected actual	8,336,000	8,981,000	9,580,000	2,073,000	492,000	1,166,921	307,000	279,000	
Cumulative to June 05	5,027,000	1,790,000	2,100,000	1,670,000	226,000	702,404	97,000	431,000	
Total agreed commitment	8,421,000	10,637,000	11,522,000	1,078,000	722,000	1,433,873	294,000	2,201,000	490,000
Total projected actual commitment	9,036,000	10,111,000	10,630,000	2,073,000	842,000	1,516,921	307,000	279,000	490,000

Table 4.
Summary of NTG Commitments

		$
Total NTG cash commitment	1999-2010	**3,500,000**
Total NTG in kind commitment	1999-2012	**33,298,873**
Total NTG Commitment (cash and in kind)	1999-2012	**36,798,873**
Total NTG Projected actual in kind commitment	1999-2012	**35,284,921**
Total cumulative in kind commitment to 2005	1999-2005	**12,043,404**

CRCTS	CRC Tropical Savannas
DK CRC	Desert Knowledge CRC
CRCAH	CRC Aboriginal Health
CRCTPP	CRC Tropical Plant Protection
CRCST	CRC Sustainable Tourism
CRCWQM	CRC Water Quality Management
CRCBS	Australian Biosecurity CRC for Emerging Infectious Diseases
CRCWM	CRC Australian Weed Management
CRCNPB	CRC National Plant Biosecurity
CRCWM	CRC Australian Weed Management
CRCNPB	CRC National Plant Biosecurity

There are further association between the Government and the University by way of staff exchanges, aimed at broadening and deepening the relationship between the parties. This practice involves significant in kind contributions shared between the parties with an estimated worth of between $0.5 – 1.0M per annum. This arrangement serves to strengthen the robust research underpinning informed public policy for the Territory, as well as having the flow on benefits in the teaching programs in the University's faculties.

The level of public sector investment in research at the University means it is performing above its class. The combined Commonwealth and Northern Territory Government investment in the research enterprise at CDU is $11.2m per annum, based on 2005 data. CDU is now ranked fifth out of 39 universities in Category 1 research income performance, 14th in refereed journal articles, and 12th in postgraduate completions (2004 data normalised by staff FTE).

With strong support from the NT Government, committed researchers, real problems to solve, and ongoing Commonwealth support, CDU has carved out a strong research profile of benefit to the NT.

3. Innovation and the NT economy

As stated in the Executive Summary, it is advisable to exercise caution when comparing performance in science and innovation, and in research and development, particularly with the use of international comparisons. This section should be read with this proviso in mind.

3.1 Population

The Northern Territory comprises about 18% of the Australian land mass, and its residents make up about 1% of the Australian population. The Territory's population of around 200,000 has:

- A high proportion of young people;
- A high proportion of Aboriginal and Torres Strait Islander people – about 28%;
- A higher than average population growth rate, indicated by Total Fertility Rate, with the Northern Territory rate being 2.2 compared with the national average of 1.79 (ABS, 2004-05), with the Indigenous population in the Territory having a total fertility rate of 2.9 (Taylor, ANU, 2002).
- For the non-Indigenous population a transient workforce.

As a large and sparsely populated region, the Territory has higher infrastructure requirements per capita than in most other parts of the country. For example, strong telecommunication and air transportation links are crucial. Major infrastructure projects provide wide-ranging benefits to residents, businesses and the local economy, and there is a social equity component to much of the NT's infrastructure needs, such as in the construction of remote road infrastructure, that is not necessarily linked to positive economic outcomes, at least in the short term.

3.2 The Territory Economy

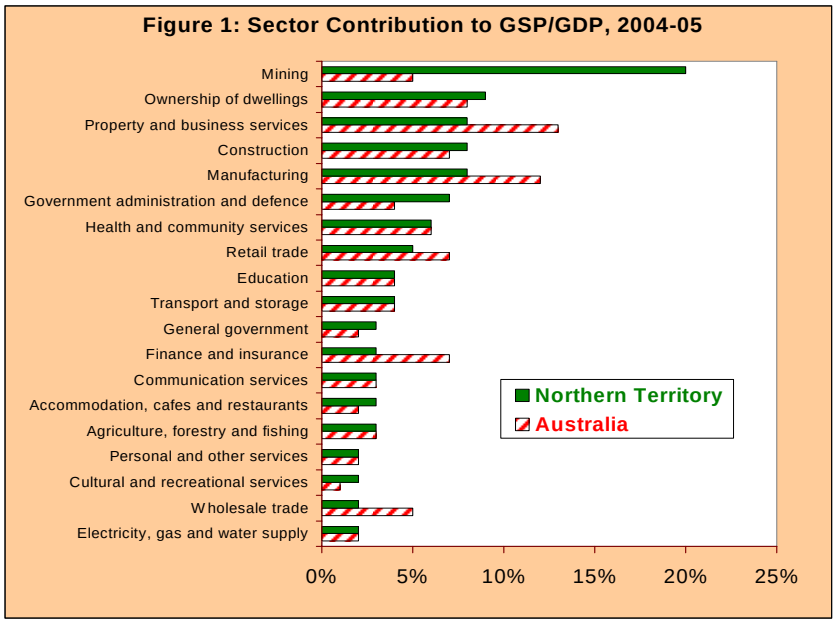
The NT Gross State Product (GSP) was estimated at $10,418 million (expressed as current prices) in 2004-2005, with industry sectors contributing $9,865 million. In December 2005, Access Economics forecast an annual average GSP growth rate of 4.4% for the five years to 2009-2010 compared to 3% per annum nationally for the same period.

As Figure 1 illustrates, the Territory economy differs from the national average in terms of its industry make up. Three key sectors make a proportionately larger contribution to our economy:

- Mining (including Energy) – the NT is rich in resources, with significant land-based mining, and sea-based oil and gas extraction operations. This sector is volatile, export orientated and characterised by long lead times for development;
- Government Administration and Defence – this sector employs about 18% of the Territory's population with seven major defence facilities providing a stable employment base and population for the economy; and
- Tourism – the Territory's iconic, nature based tourism attractions make tourism a significant and growing industry.

Other important sectors in the Northern Territory include: Health and Community Services; Education; Property and Business Services; Construction; Manufacturing; and Wholesale and Retail Trade. The Agriculture, Forestry and Fisheries sector is also important in a regional context.

The Northern Territory economy is volatile due to its small size and the large proportion of exports, which are subject to variable global demand and prices. While relatively small, the domestic component of the economy, including sectors such as: Retail; Health and Community Services; and Property and Business Services, does however serve to balance the economy's volatility.



The small size of our economy means that the NT often lacks critical R&D mass in both the public and private sectors. In the public sector this may be seen in a lack of leading R&D institutions for example. On the positive side, as a small but maturing economy, the NT is well placed to reap the benefits derived from innovation spillovers from other jurisdictions

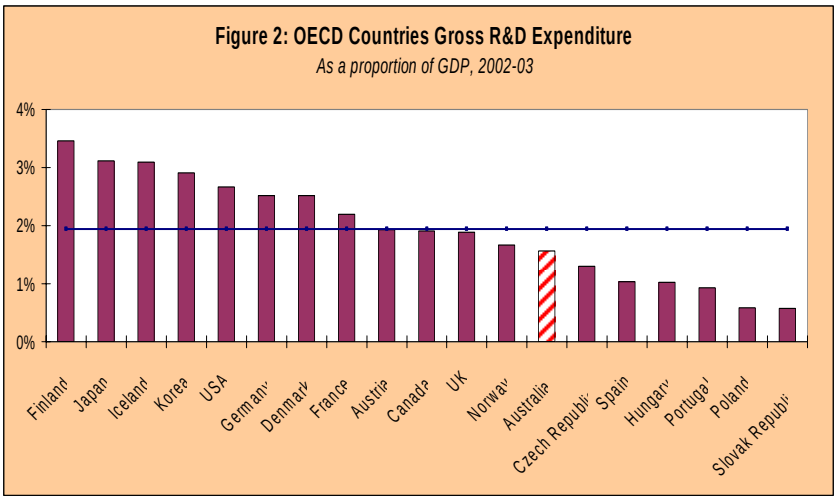
3.3 Innovation and the Economic Development Framework

The Northern Territory Government has recently drafted the Economic Development Framework (the Framework) which will set a common direction for economic growth of the NT's economy over the next 10 years.

The Framework recognises that improved productivity is the most important way to generate competitive advantages in the provision of goods and services and drive long-term economic growth. Further, the Framework acknowledges that investment in technology, and R&D is vital to the continuing expansion of productivity. To this end, one of the Framework's five main objectives focuses on improving productivity in the private and public sector. Progress toward this objective will be monitored using business R&D expenditure as a proxy for private sector innovation.

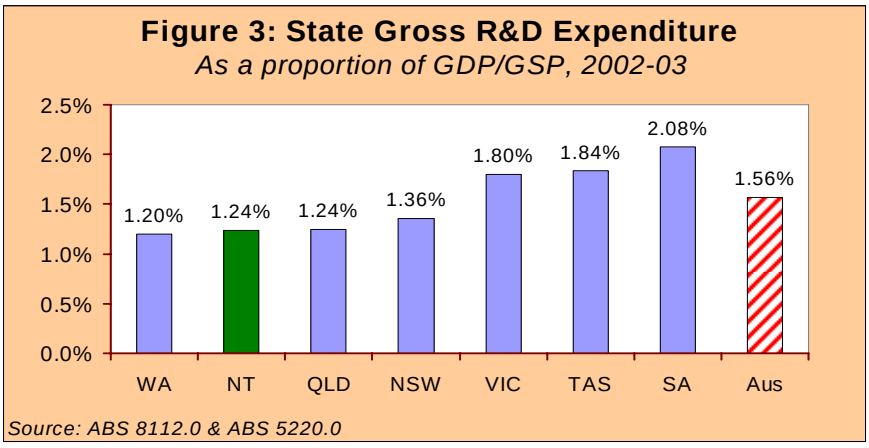
3.4 Measuring Northern Territory innovation

R&D expenditure[3] (an input measure) and number of patents[4] (an output measure) are two commonly used proxies for measuring innovation. Australia's GERD/GDP ratio (Figure 2) is low compared with other OECD countries, falling well below the OECD average. The ABS notes that Australia's low ranking is due to the small contribution of business sector R&D expenditure.



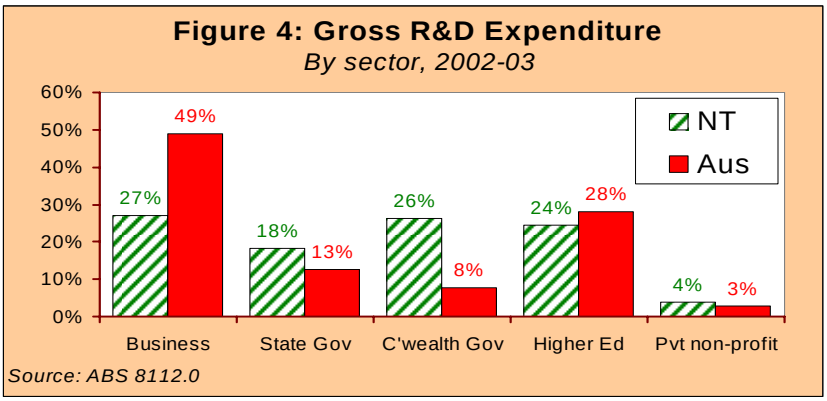
An examination of the GERD/GSP ratio within Australia (Figure 3) reveals that the Northern Territory ratio is low compared with other jurisdictions. The contribution of public sector R&D, for both State/Territory and Commonwealth Governments (Figure 4), is more important in the NT than the Australian average. In contrast, the business sector contributes significantly less in the NT compared to the national average.

Putting this in the national context, NT business expenditure on R&D as a share of output in 2003-04 is the second lowest of any Australian jurisdiction (Figure 5). This low ratio can be attributed in part to the relatively small size of the Territory Manufacturing sector. In 2003-04 the Manufacturing sector undertook 44% of all R&D business investment in Australia.



[3] Gross R&D expenditure (GERD)/GDP ratio.
[4] Number of patents per capita.

The contribution of public sector R&D, in both State/Territory and Commonwealth Governments (Figure 4) is more important in the NT than the Australian average. In contrast, the business sector contributes significantly less in the NT compared to the national average.

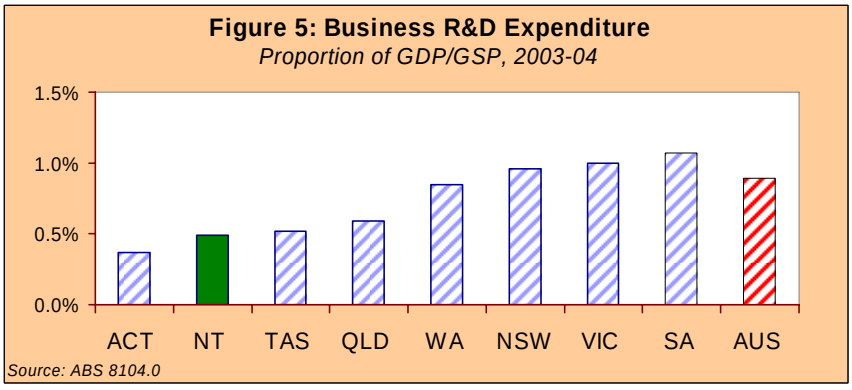


3.4.1 Patents

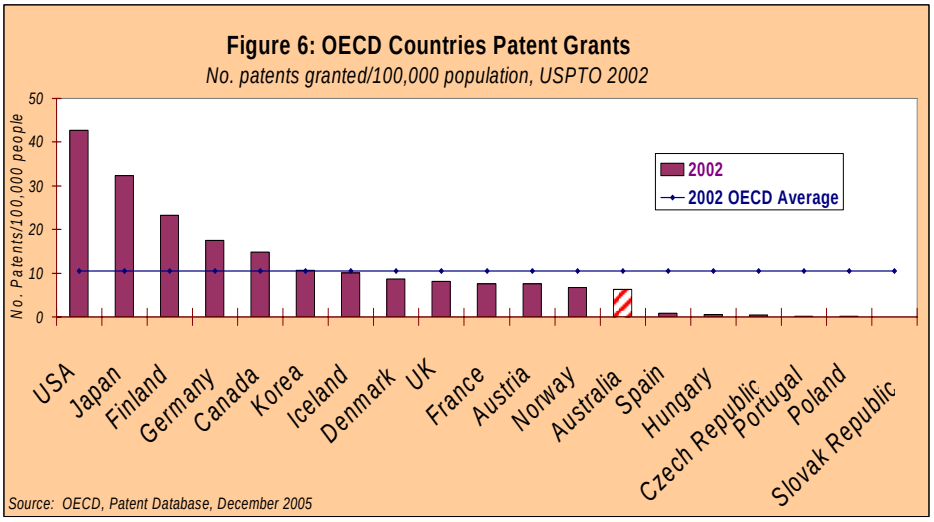
Australia's per capita patent grants (Figure 6) are low compared with other OECD countries, falling well below the OECD average. In the Australian context the Northern Territory R&D expenditure story is reflected in the number of patents granted (Figure 7). The number of per capita patent grants in the NT is the lowest of all jurisdictions. It should be noted that patents are not a perfect measure of innovation outcomes as not all innovation is patented. This is particularly relevant to public sector R&D such as agricultural research. In the NT's case, for example, significant R&D efforts have produced new cattle grazing management practices that while being innovative, are not patented and provided to industry. (See the case studies from the CRC Tropical Savannas Management in this submission).

3.5 Benchmarking in the Northern Territory and Australia

Clearly, compared to Australian, and even more so the OECD average, Northern Territory innovation is underperforming with respect to standard benchmarks. While this may be in part explained by differences in economic structure, the fact remains that the Territory needs to lift its innovation game to realise continued improvements in productivity

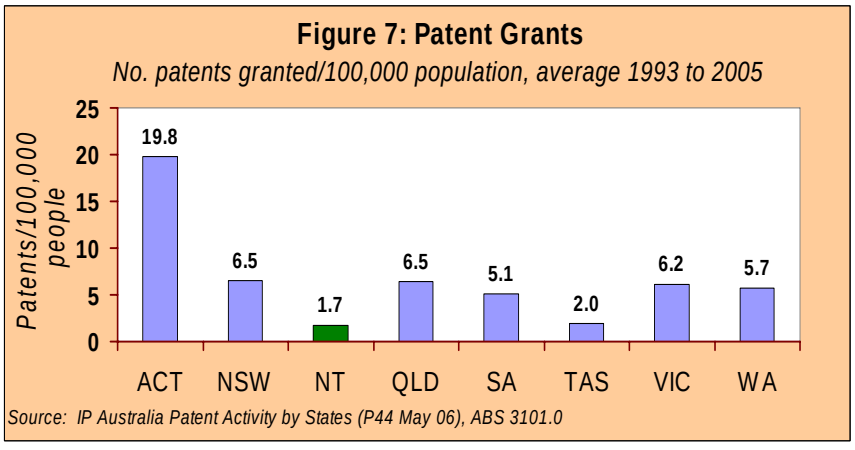


This is recognised by the NT Government and the NT business community, and is reflected in the strong productivity and innovation focus in the Government's draft Economic Development Framework. While business R&D should be the driver, the role of public sector support for R&D cannot be understated in the NT's case, and this applies particularly to public good innovations that have no commercial imperatives.



As previously outlined, the well developed role for public support for R&D in the NT is representative of the NT's broad ranging social obligations, as well as the early stage of economic development for the NT in which government support is required, for example, in the development of greenfields infrastructure such as the AustralAsia rail link from Adelaide to Darwin.

Over the longer term, however, it will be innovation in the SME sector that will drive growth in productivity in the Territory and continuing Federal Government support for innovation in this sector will be critical.



The relationships between innovation and productivity are also the subject of a research project currently underway through the Department of Business, Economic and Regional Development (DBERD) to further improve our understanding of this critical area. Outcomes from the study, *Enhancing private sector engagement in research and development* are expected to be realised by later in 2006.

Taking a wider focus, however, for both Australia and the Northern Territory, current benchmarking practices for research and innovation are not as effective as they should be, especially with regard to innovation in the business sector. For the NT Government, this translates into a lack of good data impacts on policy development and program evaluation.

Limitations on effective comparisons are, to some extent, the result of the way BERD data is collected in different countries. However, and especially when benchmarking BERD globally, more telling are the key characteristics of the economies against which Australia is being benchmarked.

- 95% of firms in Australia are SMEs whereas the OECD countries are dominated by large corporations;
- Australia's economy has a low advanced manufacturing sector and a high proportion of service industries; and
- Australia is an export economy[5].

There are issues as well with the scope of BERD data, including:

- the ABS, as previously noted, does not include agricultural, forestry and fishing industries in BERD data; and
- ABS data does not include non R&D innovation expenditure. Businesses survey reports only on activities undertaken under the themes of basic research, applied research and experimental research and ignores economically important innovation in such areas as service delivery and productivity improvements.

ABS research on patterns of innovation concludes that approximately 30% of expenditure on innovation in firms relates to R&D activities. The other 70% of non R&D related innovation expenditure by businesses is about improvements delivered through increasing efficiency and operational processes such as management practices, process adaptation, logistics management, workplace re-organisation, applications of new technologies and capital investment in new plant and equipment (Business Council of Australia 06, CSTACI p 10). These activities clearly fall within the broader scope of innovation activities. R&D is only one of the wide range of innovation activities businesses undertake.

[5] CSTACI, Working Draft paper, *Industry –Research Links*

4. Case Studies

The complexity and problematic nature of measuring the economic, social and environmental impacts of research and innovation are well documented. This issue has been the focus of a number of studies commissioned recently by the Australian Government Department of Education, Science and Training, and may be known to the Commission.[6]

How to properly define and measure knowledge transfer has become central to the discussions, [7] especially as the proposed Research Quality Framework (RQF), in evaluating research, will require an impact statement which provides evidence of outcomes, beneficiaries, and how research is applied. The current Minister for Education, Science and Training has made clear the Government's commitment to rewarding not only high quality research, but research that "makes a demonstrable change to the way we live or enjoy our lives."[8]

The concept of knowledge transfer tends to have been dichotomised – either knowledge transfer results in commercial gain or it enhances material, human, social and environmental wellbeing. We suggest that a position that does not see these outcomes as either mutually exclusive or part of a linear process is preferable – one that recognises that economic benefit can be quite explicit and lead to commercial benefit but also, and equally valuable, the impact can be indirect but lead to tangible, measurable economic and social benefits. Either way, however, the focus remains on how to quantify the benefits to, and impact on, the community.

The following case studies draw out the complexity of analysing the impact of research and of putting an economic value against the direct and indirect benefits of public good research. The CRC Tropical Savannas Management case studies not only demonstrate how research outputs can be scoped but also are evaluations that put a specific dollar value on the social and economic benefits of the research. The research output of the Menzies School of Health Research, Charles Darwin University, directly impacts on the health and well being of people in the Territory, which ultimately leads to a reduction on both private and public expenditure on health. The National Accelerated Literacy Project is an outstanding example of public sector investment in innovation and research that that will have multiple outcomes in the longer term. The case studies from NT Research and Innovation Fund illustrate the importance of research providing evidence to guide ground breaking public policy in the NT.

4.1 CRC for Tropical Savannas Management Case Studies

The CRC Tropical Savannas Management has commissioned two case studies to evaluate the impact of research in two of its major projects. Neither of these projects

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[6] For example: The Allen Consulting Group, 2005, report to DEST, *Measuring the Impact of Publicly Funded Research.* The Allen Consulting Group, 2005, a report for the CRC Association Inc, *The economic impact of CRCs in Australia.*

[7] PhillipsKPA, 2006, report to DEST, *Knowledge Transfer and Australian Universities and Publicly Funded Research Agencies.*

[8] The Hon Julie Bishop, Minister for Education, Science and Training. Knowledge Transfer and Engagement Forum Keynote Address, Crown Plaza Darling Harbour, Sydney 16 June 2006.

is completed. In both case studies, the impact of the research activity is evaluated both qualitatively and quantitatively. The work on developing the quantitative impact of the research outcomes and especially the net benefits is not yet validated. However, the Commission's attention is drawn to each of the case studies because of the methodology that is used to develop the net benefit of the research impact.

The CRC for Tropical Savannas Management is headquartered in the Northern Territory – the total partner contributions of cash and in kind to the CRC over the current 7 years is around $90M with the NTG contribution of $8.4m, and Charles Darwin University contributing $11.6m. Most of the partners are publicly funded organisations and the CRC can be classified as a 'public good' CRC. This focus will change to include a greater private sector focus should the current rebid be successful.

Further information on the CRC Tropical Savannas Management is available at: http://savanna.ntu.edu.au/.

4.1.1 Grazing tools case study

Problem/Issue

The CRC Tropical Savannas has undertaken a series of projects to develop and promote sustainable land use among cattle graziers by developing grazing management tools for graziers to better manage their land.

The tools provide information on the appropriate carrying capacity of the land, incorporating research on ecosystems, stocking rates and satellite data. The tools allow graziers to optimise their natural resource use and provide sustainable livestock production, while minimising damage to the environment.

These are the four projects.

- Customising methods for estimating safe carrying capacity for regions across the tropical savannas.
- Developing a property-scale decision support and risk management tool.
- Establishing a scientific basis for use of MODIS satellite data for paddock- scale monitoring.
- Demonstrating and promoting the role of safe carrying capacity through education and meetings with stakeholders.

Total cost

The total cost for the four projects, spanning January 2003 to June 2009 is around $1.2m.

Project outputs

Project outputs consist of information, products and recommendations generated directly from the CRC Tropical Savannas research which then may be used by industry to improve production methods. In all 20 project outputs are currently documented.

Project outcomes

The outcomes of the grazing management tools project depend on:

- adoption by graziers; and
- the extent to which adoption changes decisions by graziers on stocking and management decisions from what they would have done had the project not been undertaken.
- effectiveness of adopted changes in increasing overall economic efficiency

Outcomes from the project can be classified into three groups – economic, environmental and social. Figure 8 maps the expected benefits from the research on grazing management.

Quantitative analysis - net benefit
A further component of the grazing tools evaluation is an exercise to quantify the expected net benefits from the project. Validation of this data is still in train, but indications are that for an outlay in the order of $25m net benefit may be up to $60m with maximum benefit (should the project continue) in the order of $100m.

The assumption underpinning this analysis was that using the grazing land management tools resulted in an increase in production through improved weight of the herd, an increase in the number of cattle that can be produced in the long term and decrease in operating costs.

Note that the net benefits are still an underestimation of the total benefit to the economy as they do not include the value of reduced environmental degradation for over grazing and the positive social impacts from a more sustainable beef industry, that includes regional development and stronger livelihoods.

4.1.2 Fireplan case study

Problem/issues

The tropical savannas has the largest and most frequent fires in the Australian continent, so large, in fact, that up to half the Top End is burnt each year. While the area of land burnt annually is extensive, the degree of infrastructure lost and other negative impacts of the fire depend significantly on the size, intensity and time of year of each fire. Through the development of fire management practices combining traditional land management practices and modern technology, the research aims to reduce the incidence of, and associated damage, from large fires.

The specific objectives of this cooperative, regionally based approach to fire management are to:
- minimise the risk of fire resulting in loss of life, property, habitat and biodiversity;
- improve the productivity of the region for agricultural (grazing) and other economic pursuits including wild harvest;
- recognise the value of local indigenous practice and engage the community in participatory processes, building community capacity; and
- further enhance the Provision of Environmental Services (PES) within the northern savanna.

Total cost
For the period 2002-2006, financial inputs in cash and in kind in the order of $3m.

Project outputs

Fireplan has a large number of outputs, defined as products and services delivered to stakeholders, ranging from developing fire management toolkits through to undertaking research, documenting, measuring and proposing land management techniques aimed at both reducing the incidence and measuring the impact of large fires.

Project outcomes

The outcomes are documented in Figure 9.

Quantitative analysis – net benefit

A cost benefit evaluation is also being developed that takes into account the quantifiable benefits of Fireplan, based on the assumed changes associated with the peak adoption of Fireplan that includes reductions in:

- mine shut downs;
- infrastructure losses;
- cost of fire fighting resources to search for and monitor fires;
- human fatalities and injuries;
  hospital admissions as a result of widespread smoke pollution.

Cattle productivity is assumed to increase and the provision of environmental services through carbon trading is included.

Over the twenty year life of Fireplan, the analysis, while not yet complete, indicates the project will yield a strong return on investment, with net benefits over the first five years exceeding $10 million.

Figure 8. Summary of Grazing Tool's Project inputs, outcomes and benefits.

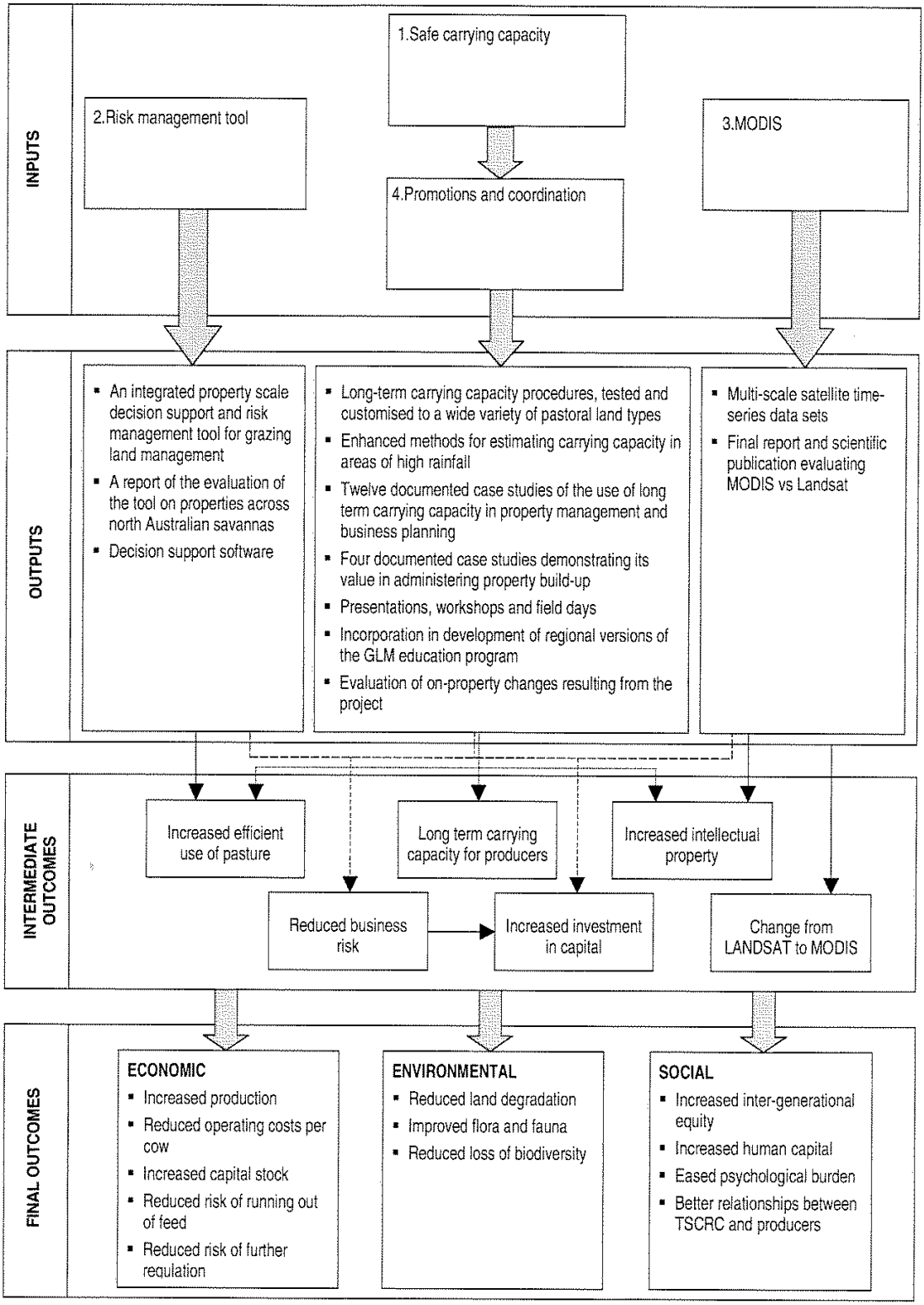
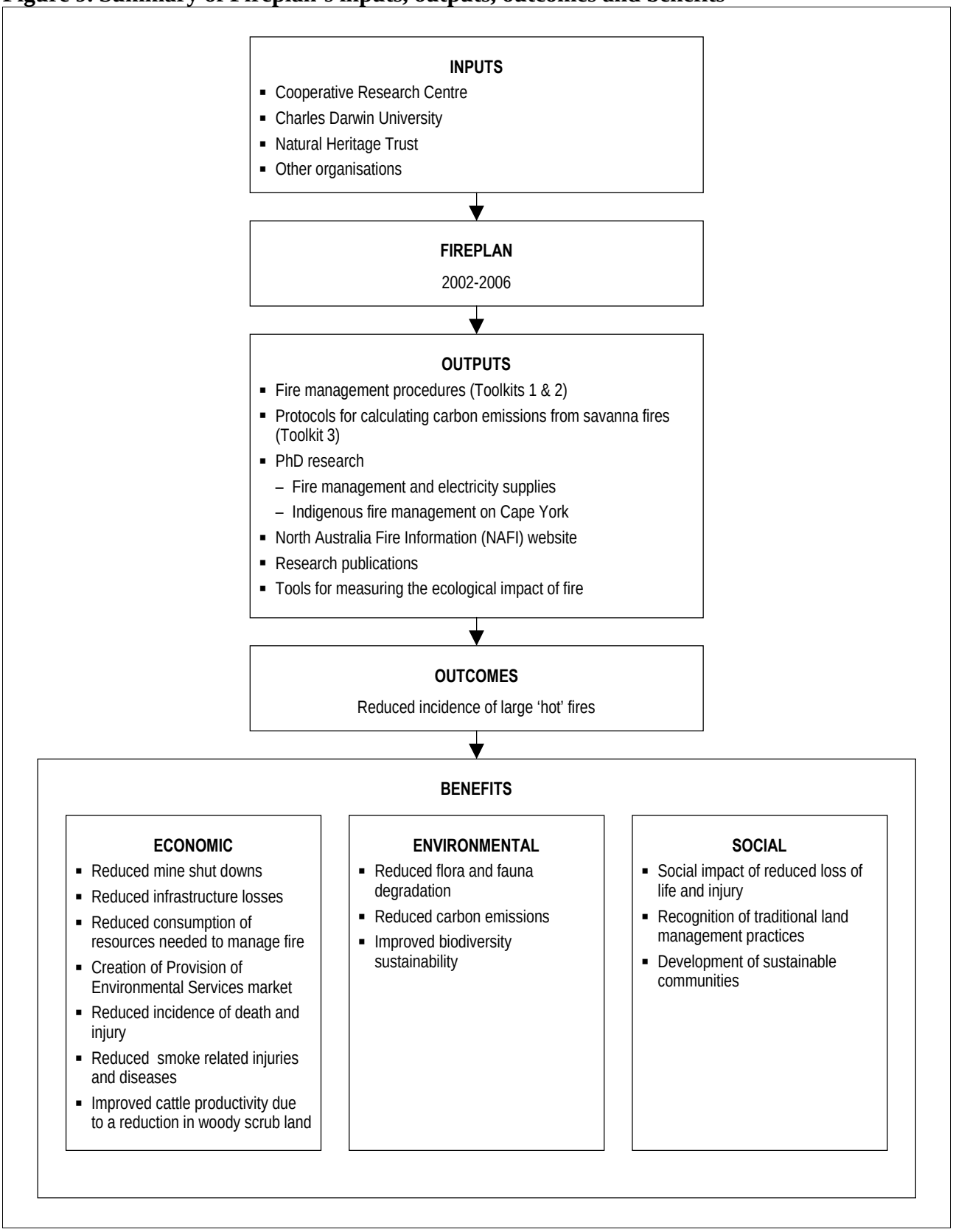


Figure 9. Summary of Fireplan's inputs, outputs, outcomes and benefits



4.2 The Menzies School of Health Research, CDU – A Case Study

Menzies School of Health Research (MSHR), based in Darwin, was established in 1985, with a mission to improve the health of people of northern and Central Australia and regions to the near north. MSHR focuses on Aboriginal and tropical health research. The School is now a controlled entity under Charles Darwin University.

The research conducted at MSHR is a combination of applied research and strategic basic research. It focuses on health determinants and inequalities of Indigenous people and on health issues related to Tropical and Northern Australia - a rich and unique research environment but one that is relatively costly, with transportation costs to field locations in remote areas a major component of research project budgets.

Public support of science and innovation at both State/Territory and Commonwealth levels underpin the health research sector in the NT. Competitive grant funding, infrastructure funding and tax concessions within the Australian Taxation system are the major financial supports of MSHR. Public financial support of research is fundamental to leveraging funds from the private sector.

Over a period of 20 years the MSHR can claim significant research outcomes that have engaged the broader health sector enhancing the ability of these outcomes to shape local practice and policy. However, the impact of research in preventative medicine and health promotion does not necessarily lead to commercial benefit, though in some instances it may, but measuring the economic impact of healthier populations would be a valid measure (eg a more productive workforce; fewer days lost to illness) as would be the reduction in public expenditure on illness, and the social consequences to the community of poor health.

Following are some significant research outcomes from research at MSHR, the social and economic impact of which should be measurable:

- Established an Aboriginal birth cohort of 686 Aboriginal babies from 1987, currently in the third wave of data collection.
- Improved quality of food in the communities' local stores following community based interventions.
- Designed a coordinated program for the prevention and treatment of rheumatic fever.
- Introduced a systematic pharmaco-therapy program to treat renal disease on the Tiwi Islands leading to marked improvements in blood pressure and stabilisation of renal function.
- Excluded dogs as a reservoir of human scabies in remote Aboriginal communities through the use of DNA fingerprinting, thus changing the focus of programs to be on prevention and treatment of scabies in children, rather than targeting the dogs.
- Dramatic reductions in scabies and streptococcal skin sores resulting from a mix of clinical, public health, community-based interventions and laboratory initiatives leading to a stronger evidence base for practice.
- Development of national prevention and treatment guidelines for middle-ear disease in Aboriginal children.

- Halved the number of deaths in the NT from melioidosis following clinical studies of new treatments, combined with public health information on prevention and early diagnosis and treatment of melioidosis.
- Documented the harmful effects of kava, alcohol and petrol sniffing in remote Aboriginal communities and advocated for regulation to control the supply of kava and alcohol availability.
- Movement disorder on Groote Eylandt shown to be independent of manganese exposure and genetically diagnosed as Machado Joseph disease.
- Identified and sequenced the CLAG (cytoadherence) gene for malarial parasites.
- First Australian sequencing of the chlamydia plasmid and the first Australian isolation of *Chlamydia pneumoniae*.
- Compilation of national data on health-related infrastructure in remote Aboriginal communities used as a key tool for policymakers and Indigenous leaders planning services in remote Indigenous communities in the NT.
- Studies finding that it is possible to recover brain function after sustained abstinence from petrol sniffing.
- Developed clinical audit tools and a continuous quality improvement framework for Aboriginal health services, thus boosting the quality of care for people with chronic disease.
- Pioneered the culture of the causative organism of donovanosis using chlamydial tissue culture techniques and the development of a new PCR technique for rapid diagnosis of donovanosis.
- Studied the long term trends in cancer mortality in NT Indigenous people and the identification of factors that are responsible for low cancer survival for Indigenous cancer patients.
- Analysed the disparities between Indigenous people and other Australians treated in Australian public hospitals, resulting in important implications for addressing the barriers to health care for Indigenous people.
- Malaria research studies that have changed global, Indonesian and Australian malaria treatment protocols

4.3. National Accelerated Literacy Project

The National Accelerated Literacy Program (NALP) is jointly funded by the Australian Government, through the Department of Education, Science and Training (DEST) and the Northern Territory Government, through the Department of Employment, Education and Training (NT DEET)The project, which will cost over $16 million over four years.

The NALP aims to bridge the educational divide between Indigenous and non-Indigenous students in the Northern Territory. NALP is a ‘lighthouse’ project with a national scope and focus. A key challenge for the project is confronting the history of failure in Indigenous education reforms. Change management in such a context is a highly complex and wide ranging process. The NALP project represents the first attempt in Australian pedagogic reform to address these broader systemic issues as part of a school and classroom intervention program.The aim is to implement the approach in 100 schools in the NT, thereby taking the methodology from a series of pilot projects through to an embedded system.

NT DEET is responsible for the development of strategies, systems and processes for the four year expansion of the project. As NT DEET's main project partner, Charles Darwin University has been contracted to document the Accelerated Literacy methodology and provide expert training to practitioners, so that it can be implemented and embedded across schools in the Northern Territory and in existing sites outside of the NT.

The collaboration between DEET and CDU is formalised under Schedule 4.2 of the CDU/NTG Partnership Agreement, *The National Accelerated Literacy Program*. Further details on the Schedule, including its Objectives, Goals and Targets, and Performance Indicators, are available at:http://www.cdu.edu.au/government/documents/4.2nalpjun05.PDF.

Subject to the learnings of the project, the methodology will be made accessible to other schools across Australia.

4.4 Research and Innovation Board and Fund: Case Studies

With such a small population base, NT Government investment in research is strategically geared to ensure outputs and benefits are linked to priority issues for the Northern Territory. The following case studies are examples of NT Government investment in research projects through the NT Research and Innovation Fund which have been successful in attracting external funding to undertake research in public health, natural resource management and the Northern Territory demography.

Currently, applications for NT Research and Innovation Fund grant funding are assessed against the following criteria:

1. Benefit to the Territory (social/economic)
2. Ability to build/retain research capacity in the Territory
3. Alignment with Territory Government objectives e.g. Tropical/Desert Knowledge
4. Ability to leverage external funds to the Territory
5. Ability to foster collaborations among research providers and users in the Territory
6. Possible commercialisation or utilisation of research outcomes
7. Transferability of research outcomes ie use nationally/globally

4.4.1 Causes and consequences of population turnover in the Northern Territory

Collaborators
CDU; NT Department of Treasury; Australian Bureau of Statistics

ARC Linkage Grant - Contributions consisting of:

Actual leveraged	$485,000
NTRIF	$45,000 ($15,000 for three years)
Department of the Chief Minister	$30,000
NT Treasury	$70,000

Problem/Issue
The Northern Territory experiences an extraordinarily high population turnover. Approximately one quarter of the Territory's resident population in 2001 had lived somewhere else five years earlier compared the national average of 10%.

Expected outcomes
The broad outcome is a sociologically informed understanding of the process of population turnover and how this may be influencing the integrity, relevance and effectiveness of our knowledge systems, particularly as they relate to living in the tropics and the desert. The project expects to provide:

- a quantitative descriptive model of recent population turnover in the Northern Territory;
- a motivation analysis for residential migration in and out of the Northern Territory;
- an analysis of the impact of population turnover on the knowledge systems within selected professional groups; and
- the outcomes will be used to inform population policy by identifying ways to influence or modify population flows and by exploring ways to better manage their consequences for the knowledge economy.

4.4.2 Monitoring, modelling and control of mosquito borne diseases in Darwin

Collaborators: NT Department of Health and Community Services; NT Department of IPE; Commonwealth Department of Defence and the Bureau of Meteorology.

ARC Linkage Grant - $639,000 and contributions consisting of:

In cash	
NTRIF	$60,000
*DHCS	$30,000
**DIPE	$10,000
Department of Defence	$30,000
In kind	
Bureau Meteorology	$30,000
NT Government departments	$560,000
MSHR, CDU	$150,000
Defence	$40,000

* NT Department of Health and Community Services
** NT Department of Industry, Planning and Environment

Problem / Issue
There has been no formal evaluation of massive investment by the NT Government over the last twenty years to control mosquitoes and thereby reduce exposure of the human population to mosquito-born diseases. The project aims to undertake a rigorous analysis of the long-term trends in mosquito populations and mosquito-born disease, and evaluate the effectiveness of the mosquito control program.

Expected outcomes

- enable assessment of the suitability of the current monitoring programs in the Greater Darwin region and make recommendations for improving the scope and effectiveness of monitoring programs that will serve the entire population;

- identify new ways to achieve cost-effective mosquito control programs through environmentally responsive and spatially targeted spraying programs;
- a baseline will be established to monitor mosquito born diseases. Predictions for their threat will be more rigorously grounded by a longer-term understanding of the links between climate, landscape change and vector population dynamics; and
- given the increasing threat of mosquito born diseases, the program will generate results that are of relevance to northern Australia and the tropics as a whole and will link human health, landscape ecology and mosquito population dynamics.

4.3.3 Commonwealth Environment Research Facilities Program (CERF)

Collaborators
CDU, Griffith University, University of Western Australia, CSIRO, the North Australian Indigenous Land and Sea Management Alliance, CRC Tropical Savannas Management and Land & Water Australia.

NTRIF	$50,000
CERF	$8m
LWA	$3m
NTG (in kind)	$5m
QLD Govt. (Smart State Funding)	$2m

The total budget for this initiative is estimated at $43m over five years involving more than 50 researchers. The research will be headquartered and coordinated from CDU in Darwin. There is a further application for funding through the National Water Commission under its National Water Initiative. Subject to the success of this application, total funding commitments are expected to at least meet half of the total budget by the end of 2006.

Problem/Issue
Northern Australia, generally defined as being from the Kimberly to Cape York, covers approximately one sixth of Australia's continental land mass and holds in the order of two thirds of its total surface fresh water. In the context of climate change, this is a particularly valuable resource for the nation. The study will focus on tropical river catchments and associated coastal estuarine waters across northern Australia. Importantly, it will also engage in research leading to sustainable economic development for Indigenous coastal communities.

Expected outcomes
The northern river catchments area covers the rivers and coasts between the tip of Cape York Peninsula in Queensland and Broome in Western Australia, and includes the Fitzroy, Daly, Mitchell, Ord, East Alligator, Gregory and Nicholson rivers. It is home to the world's oldest living culture and contains the world's most significant concentration of river catchments still retaining their ecological integrity. The research will identify important natural assets and ecosystem services to provide a solid base upon which to assess the social, economic and environmental impacts and the viability of proposed developments in the region. The research will also identify opportunities to develop genuinely sustainable and culturally appropriate enterprises.

5. Linking research and the SME Sector

The Northern Territory advocates the need for consolidation of public support for science and innovation in relation to publicly funded and conducted research, while also building much closer links between the government and research sectors of the economy (which have close and strong alliances), and the Small to Medium Enterprise sector.

The Northern Territory also argues for the need to support much closer collaborative alliances within appropriate industry groups of the SME sector, groups that have compatible interests and complementary skills, such as the metal fabrication and engineering sector. In doing so, the SMEs can take advantage of the considerable economies of scale arising from such strategic alliances, making their collective position much more competitive in both a national and global context.

Such an initiative is particularly pertinent when it is considered that 95 per cent of Australian companies are small to medium enterprises, contributing 30 per cent to the nation's GDP, and employing more than 3 million Australians.

It is argued that the SME sector has a pre-eminent need for support from the public sector's science and innovation programs over major corporations, the latter of which have significant research programs to support their national and global positions and to remain globally competitive.

It is also pertinent to note that the Australian economy with its predominant SME sector by number is in contrast to that of the United States and large European Union nations, whose economic structures exhibit fewer smaller enterprises out of the total number of companies, and are instead dominated by large corporations.

This structural difference is all the more reason for Australia's research effort to support the SME sector, to ensure it retains and expands its innovative position, which in turn has an important bearing on its global competitiveness.

Knowledge transfer from publicly funded research through its commercial application in the private sector will make a significant contribution to this process. The public policy position in relation to research and SME engagement outlined in this submission is being adopted by the Northern Territory Government and will contribute to this process.

The engagement of the SME sector for research and innovation needs to be balanced and integrated, at least in the Northern Territory's case, with the ongoing basic need for public good research that supports the Territory's requirements for both social reform and environmental sustainability, as well as the nurturing of our maturing economy as it grows in both the national and international marketplace.

The application of publicly funded research to the commercial sector will make a significant contribution to SME competitiveness. The Territory Government is also looking at ways in which SMEs can both contribute to research and become involved directly with research partners. Preliminary results from a study of the research needs

of Northern Territory SMEs suggests that they are highly flexible and innovative, particularly where it comes to adapting imported technologies to NT environments. At the same time the SMEs can benefit from working collaboratively with research organisations to take innovations to the market place, and in undertaking pre-competitive research on problems facing multiple industries.

They may also benefit from informed assistance to overcome what are perceived to be high transaction costs associated with applying for publicly-funded research assistance. The public policy position in relation to research and SME engagement outlined in this submission as being adopted by the Territory Government aims to enhance SME benefits from their innovative behaviour.

Finally, and to reiterate, public good research remains the mainstay of the research economy in the Territory. Its contribution in saving money and informing public policy on such complex issues as Indigenous development (including economic development) is invaluable. A withdrawal of support for this research at the Federal level will severely disrupt the Territory's economic and social fabric in a disproportionate manner as compared to larger jurisdictions of the Federation.

The submission strongly advocates a measured and balanced approach to any assessment of public support for science and innovation, exercising sound judgement in recognition of the importance of both public good and commercial research for Australia's social and economic prosperity.

References

2015: Moving the Territory Ahead: Draft Northern Territory Economic Development Framework.

ABS 5220.0, Australian National Accounts: State Accounts, 2004-05.

ABS 8104.0 Research & Experimental Development, Businesses, Australia, 2003-04.

ABS 8109.0 Research & Experimental Development, Government and Private Non-Profit Organisations, Australia, 2002-03.

ABS 8112.0 Research & Experimental Development, All Sector Summary, Australia, 2002-03.

CSTACI, Working Draft paper, *Industry –Research Links*

IP Australia, P44 Grants by States and Technology, May 2006.

OECD, Patent Database, December 2005.

PhillipsKPA, 2006, report to DEST, *Knowledge Transfer and Australian Universities and Publicly Funded Research Agencies*

The Allen Consulting Group, 2005, report to DEST, *Measuring the Impact of Publicly Funded Research.*

The Allen Consulting Group, 2005, a report for the CRC Association Inc, *The economic impact of CRCs in Australia*

The Hon Julie Bishop, Minister for Education, Science and Training. Knowledge Transfer and Engagement Forum Keynote Address, Crown Plaza Darling Harbour, Sydney 16 June 2006.

Report to DEST, 2004, *Review of Closer Collaboration between Universities and Major Publicly Funded Research Agencies*.