Submission to Productivity Commission Inquiry into Public Support for Science and Innovation

Professor Stuart Cunningham
Director, ARC Centre of Excellence for Creative Industries and Innovation

Terry Cutler
Chair, Advisory Board, ***ARC Centre of Excellence for Creative Industries and Innovation***

Please direct communication to Professor Stuart Cunningham, *ARC Centre of Excellence for Creative Industries and Innovation,* Queensland University of Technology, Creative Industries Precinct, Z1 – 515, Musk Avenue, Kelvin Grove QLD 4059. *Email:* s.cunningham@qut.edu.au. Phone 0407-195-304.

Introduction

The Productivity Commission has been tasked to inquire into a wide range of aspects of Public Support for Science and Innovation. This submission from the ARC Centre of Excellence for Creative Industries and Innovation addresses several of the terms of reference for the inquiry.

It will address in particular:

1. Report on:
. the economic impact of public support for science and innovation in Australia and, in particular, its impact on Australia's recent productivity performance; …
The analysis should cover all key elements of the innovation system, including research and development, taking into account interaction with private support for science and innovation, and paying regard to Australia's industrial structure.
2. Identify impediments to the effective functioning of Australia's innovation system including knowledge transfer, technology acquisition and transfer, skills development, commercialisation, collaboration between research organisations and industry, and the creation and use of intellectual property, and identify any scope for improvements.
3. Evaluate the decision-making principles and programme design elements that:
a. influence the effectiveness and efficiency of Australia's innovation system; and
b. guide the allocation of funding between and within the different components of Australia's innovation system;
and identify any scope for improvements and, to the extent possible, comment on any implications from changing the level and balance of current support.
4. Report on the broader social and environmental impacts of public support for science and innovation in Australia.

It will do this by analysing the full scope of the innovation system, which must be taken to include elements, linkages and attributes which are broader in scope and effect than only that which science takes part in. It will identify impediments to the effective functioning of Australia's innovation system and identify any scope for improvements, by taking into building a more inclusive and dynamic innovation system covering the contributions which are made by the content, particularly the digital content, sectors of the Australian innovation economy.

Overview of ARC Centre of Excellence for Creative Industries and Innovation (CCI)

The ARC Centre of Excellence for Creative Industries and Innovation (CCI) is the first Centre of Excellence whose lead disciplines are based outside the science, engineering and technology sectors. The CCI was established to address shortcomings in Australia's national innovation system insofar as it does not take into account the digital content-enabled sectors of economy and society.

The 'value proposition' addressed by the Centre is: how does Australia build a 'creative' economy and society suited to the conditions for content production and distribution, business sustainability, workforce requirements, citizenship, and legal and regulatory regimes emerging across the globe in the 21st century? Our aim is to help build a more dynamic and inclusive innovation system for Australia with a focus on the contributions that industry sectors fed by humanities, creative arts and social sciences expertise can make to innovation in advanced, services-based economies and societies. The Centre brings together discipline leaders from media and communication studies, cultural studies, law, education, economics and business, and information technology with a national, strategic focus.

The Centre was established in 2005 under the ARC's Centres of Excellence program with funding of $7m for five years commencing 2005, plus $3.8m in cash from partners. The Centre is based at Queensland University of Technology in partnership with universities in five other states and territories: The Australian National University, Charles Darwin University, Edith Cowan University, Swinburne University, and University of Wollongong. There is industry support for the centre's operations from a number of partners, including The Salvation Army, the Australian Film, Television and Radio School, Australasian CRC for Interaction Design, the Australia Council, Australian Film Commission and Department of Communications, Information Technology and the Arts and several national and state cultural institutions (State Library of Queensland, The Australia Council for the Arts, Australian Museum, National Museum of Australia, Queensland Museum).

Addressing Terms of Reference 2 and 3

The authors were lead writers on 'Research and Innovation Systems in the Production of Digital Content and Applications', one of the reports within the Creative Industries Cluster Study. The Australian Government's Creative Industries Cluster Study (cultureandrecreation.gov.au/cics) conducted through the Department of Communications, Information Technology and the Arts and the National Office for the Information Economy in 2001-3, formed the research background to the

development of the Digital Content Industry Action Agenda and its report, *Unlocking the Potential*, in 2006.

'Research and Innovation Systems in the Production of Digital Content and Applications' uniquely addressed the content industries from an innovation systems perspective, and identified systematic weakness in Australia's national innovation system along with outline proposals for improving it. This study addresses directly the ToR of the inquiry, while broadening the scope of Australia's innovation system to include digital content and applications, a fast growing and integral part of contemporary economies. The fact that this aspect of the innovation system and these industry sectors cannot be excluded without damage to Australia's overall performance in R&D and innovation is underlined by the integral part they play in Australia's national research priorities.

The Appendix to this submission, 'From 'Culture' to 'Knowledge': An Innovation Systems Approach to the Content Industries', is a published book chapter which summarises the rather more lengthy report 'Research and Innovation Systems in the Production of Digital Content and Applications'. It provides a detailed analysis of systematic weakness in Australia's national innovation system in dealing with sectors, disciplines and approaches outside the science, engineering and technology sectors.

In summary, the Appendix:

- Establishes that digital content and creative industries sector clusters matter in terms of their economic significance and within the context of national innovation capabilities;
- Demonstrates the evolution of innovation policies from earlier models based on the idea of a linear process, to contemporary models which take account of the complex, iterative and often non-linear nature of innovation, with many feedback loops
- Breaks the elements of an innovation system into components, relationships and attributes, and shows in detail how there are many *elements* of such an innovation system in place. However, the *quality of linkages* and the *lack of clear public policy signals and frameworks*, together with a number of other critical issues mark the innovation system as embryonic at best;
- In conclusion, it outlines several possible strategies for improving the innovation system.

Programs of the ARC Centre of Excellence for Creative Industries and Innovation which address these ToR

How has the value proposition on which the Centre is based been worked into the program structure for the Centre? Each program addresses a key gap in the innovation system:

Crisis in Innovation

Australia faces a crisis in innovation in the sphere of economic development and policy; it is over-dependent on Science, Engineering and Technology (SET) and

undervalues the dynamic services, consumer and creative sectors of the economy – a 'creative innovation' system is embryonic at best. We need to know better than we do currently what are the basic dimensions, trends and dynamics of the creative economy. The centre will continue work addressing the shortcomings of statistical understandings of the digital content and broader creative industries, but also tracing the way creative inputs, both human and goods and services, are becoming more thoroughly embedded in the wider economy. There will be focused policy research around international innovation systems, the policy frameworks that support them, and targeted evidence-building to support advocacy for a more comprehensive approach to innovation.

Creative Workforce

A creative workforce is a key longer-term investment in a creative economy and society. However, the role of formal educational institutions in preparing such a workforce remains a matter of much debate. While it has been argued that future knowledge workers will need both formal qualifications and "edgy know-how", it is less than clear how such know-how is to be developed. This Program will model and test how both formal education and less formal learning environments can be oriented to build creative capacity in an environment characterised by innovation and risk, by the increasing impact of knowledge and creativity on the economy, and by globalisation and new technologies across all areas of work and experience. As a contributing organisation to the centre, the Australia Council for the Arts is particularly interested in partnering in research into education's articulation with creativity and innovation.

Citizen Consumer

This Program focuses on redefining consumption from behaviour to action, and on the interconnected domains of consumption (private) and citizenship (public) in contemporary commercial democracies. The program investigates the shift towards the consumer in the content value-chain, and scopes longer-term opportunities arising from wider uptake of digital television and broadband. It prototypes models of innovative content co-creation by citizen-consumers.

Distinctions between consumption and production, labour and citizenship have blurred, allowing new commercial and community opportunities in such areas as user-led and 'pro-am' (professional-amateur) innovation, open source, and broad-based consumer creativity as a basis for lower-cost content generation and dissemination.

Enterprise Formation and Sustainability

Key gaps in the creative innovation system include evidence-based research on what is needed for creative professionals to form enterprises at a level of sustainability above that of the sole artist, including how to access a wider range of capitalisation and investment funding than is typical now. Another question is how to mobilise existing cultural assets, often locked up as Crown copyright or encumbered by antiquated access, technical, or excessive payment regimes.

Ways of improving the formation and sustainability of creative enterprises and the business and regulatory environment in which they work are crucial to a functioning innovation system. This Program seeks to develop these through several projects, For illustrative purposes, the main ones are outlined here:

1. The Business of Creativity
This project is led by program leader Malcolm Long, Director of the Australian Film Television & Radio School, with David Court, Director of the AFTRS Centre for Screen Business. The project is conceived as a longitudinal survey of production entities operating in the screen production industries. The aim of the project is to obtain insight into:

- the business models and capital structure of Australian production entities;
- their ownership and business history;
- their asset profiles, including intellectual property and off balance sheet assets;
- the skills and training of their owners and managers; and
- the aspirations and expectations of their owners and managers.

Although considerable data has been collected by the Australian Film Commission and the Australian Bureau of Statistics concerning the outputs of production entities, and other aggregate measures, the entities themselves are not well documented or understood. The project is expected to contribute to policy development in the sector as well as business planning.

2. Business Process Management
Two world class researchers in business process management, Professor Michael Rosemann and Associate Professor Arthur ter Hofstede, are exploring the potential for applications of this methodology, usually deployed in large multinational organizations, to the fragmented small business sector that mostly characterizes the creative industries. The aim of the project is to develop a comprehensive reference model of screen content creation from conception through development, production, and post-production to end exploitation. The reference model will have significant value as a teaching tool and may have other commercial applications. Professors Rosemann and ter Hofstede work closely on this with the AFTRS and its Centre for Screen Business in a joint venture.

3. Standards and Metadata
This project will develop a common suite of metadata standards that enable discovery, licensing and delivery of material in order to lower the infrastructure costs of the creative sector, opening up distribution and delivery channels and improving the re-use of cultural, educational and creative material. The project will explore potential connections to developments of research infrastructure through the National Collaborative Research Infrastructure Strategy.

Legal and Regulatory Impasses and Innovation

We are faced with a legal and technological environment that is increasingly beset by differing approaches to the problem of intellectual property: on the one hand, formidable efforts are being made to sequester and control intellectual property through stronger copyright regimes and technological fixes such as digital rights

management. On the other, a groundswell of support for open content licensing approaches, including Creative Commons-style regimes, is now really beginning to make its mark. Without progress in fashioning a better balance between these two forces, the future of Australia's creative economy and society will be measurably compromised.

This Program will examine the way in which existing copyright law promotes or hinders the production, dissemination and consumption of digital content. In particular the research will consider the Creative Commons model and how it can work within the Australian legal system to harness innovation as well as consider the use of Creative Commons licensing to make publicly funded creative archives more accessible and to facilitate collaborative online communities.

International Creative Content Cultures and Australian Advantage

This Program locates CCI's research in a global and regional frame. The Program will enhance the international profile of Australian research, and at the same time respond to the needs of the Australian content sectors to understand Australian markets in regional and global contexts.

This Program includes participating in the World Internet Project, Surveying the Digital Future, and major projects on the future of China's and East Asia's creative industries and economy, and the legal and regulatory environments of South East Asia, particularly as they relate to intellectual property. The Program will contribute a 'Globalization and the Cultural Economy' study for the World Cultures Yearbook in 2008 being led out of the University of California Los Angeles.

This submission and related submissions:

As has been outlined above, CCI programs address systematic weaknesses in Australia's national innovation system. This submission is to be read as an introduction to a series of related submissions which will address in greater detail some of these weaknesses and develop proposals for dealing with these weaknesses. These related submissions are:

Terry Cutler's submission on 'A framework for innovation policy, which offers a comprehensive discussion of the terms of innovation policy and the logic by which it proceeds.
Prof Brian Fitzgerald's submission on the intellectual property issues surrounding open innovation and the significance of this to modern commercial endeavour.
Jason Potts's two submissions on (1) the importance of innovation in services, and (2) the significance of competition policy as innovation policy.
Kate Morrison's (Volterra Pacific, an economics consultancy) submission on industry policy as innovation policy.

The theme that connects these submissions is an overriding concern that innovation policy be analysed with respect to a full appreciation of its scope (i.e. encompassing the legal system, the education system, the service sector, etc) as well as its connection to the growth of knowledge and economics opportunity, which is the

reason for the overarching focus on evolutionary approaches to economic analysis. The work at the *ARC centre of excellence for creative industries and innovation* seeks to advance our economic understanding of these sectors and their relation to the national innovation system, and some of the research done already here may be of use to the Productivity Commission in analysing public support for science and innovation.

Appendix:
From 'Culture' to 'Knowledge': An Innovation Systems Approach to the Content Industries

From 'Culture' to 'Knowledge': An Innovation Systems Approach to the Content Industries

Stuart Cunningham, Terry Cutler, Greg Hearn, Mark Ryan, Michael Keane

Chapter in
Accounting for Culture: Thinking Through Cultural Citizenship eds Caroline Andrew, Monica Gattinger, M. Sharon Jeannotte, Will Straw, Ottawa, University of Ottawa Press, 2005, pp. 104-123.

Professor Stuart Cunningham is Director, Creative Industries Research and Applications Centre, Queensland University of Technology. Dr Terry Cutler is Principal of Cutler and Company, a high-level communications consultancy based in Melbourne. Professor Greg Hearn is Research and Development Coordinator; Mark Ryan is a doctoral candidate; and Dr Michael Keane is an ARC Postdoctoral Fellow in the Creative Industries Research and Applications Centre.

FROM CULTURE…

Culture is very much the home patch of us content proselytizers – where many of us grew up intellectually and feel most comfortable. It has been around as a fundamental rationale for government's interest in regulation and subsidy for decades. The 'cultural industries' was a term invented to embrace the commercial industry sectors – principally film, television, book publishing and music - which also delivered fundamental, popular culture to a national population. This led to a cultural industries policy 'heyday' around the 1980s and 1990s, as the domain of culture expanded. (In some places it is still expanding, but is not carrying much heft in the way of public dollars with it, and this expansion has elements trending towards the – perfectly reasonable - social policy end of the policy space, with its emphasis on culture for community development ends).

Meanwhile, cultural policy fundamentals are being squeezed. They are nation-state specific in a time of WTO and globalization. Cultural nationalism is no longer in the ascendancy socially and culturally. Policy rationales for the defense of national culture are less effective in the convergence space of new media. Marion Jacka's (2001) recent study shows that broadband content needs industry development strategies, not so much cultural strategies, as broadband content is not the sort of higher-end content that has typically attracted regulatory or subsidy support. The sheer size of the content industries and the relatively minute size of the arts, crafts and performing arts sub-sectors within them underline the need for clarity about the strategic direction of cultural policy (John Howkins in *The Creative Economy* (2001) estimates the total at $US2.2 trillion in 1999, with the arts at 2% of this). Perhaps most interestingly, and ironically, cultural industries policy was a 'victim of its own success': cultural industry arguments have indeed been taken seriously, often leading to the agenda being taken over by other, more powerful, industry and innovation departments (see O'Regan 2001 and Cunningham 2002).

The core concept of cultural citizenship has come to the fore even as, and perhaps even because of, the need to negotiate such 'squeezing' of cultural policy fundamentals. It is this chapter's perspective, and its distinctive contribution to the debate on cultural citizenship, that culture is best grasped through *propagation* into the future – its active insertion into both mainstream and cutting-edge public policy – rather than only *preservation*. A renewed focus on genuine production diversity (beyond the charmed circle of professionalised production enclaves), the fundamental role of cultural consumption in driving innovation, and the responsibility of government and thought leaders to take culture into the mainstream of public policy are some of the perspectives derived from this approach. The themes of the colloquium from which this volume has come included 'rebuilding the case for culture' and 'new public interest discourses in cultural policy'. The colloquium sought – and this volume seeks - to address 'the changed context for cultural policy'. By advancing an industry development and innovation approach to cultural production, we contribute to these aims.

AND SERVICES …

This doesn't get talked about much in the cultural/audiovisual industries 'family', but it's *sine qua non* in telecommunications and in, well really, pretty much the rest of the

economy. Many of the content and entertainment industries – especially the bigger ones such as publishing, broadcasting and music - can be and are classified as service industries. But the broader and larger service industries, such as health, telecommunications, finance, education and government services, are needing more creativity through increased intermediate inputs, and it is here that much of the growth opportunities for content creation is occurring. Just as it has been received wisdom for two decades that society and economy are becoming more information-intensive through ICT uptake and embedding, so it is now increasingly clear that the trend is toward 'creativity-intensive' industry sectors. This is what Lash and Urry (1994) refer to as the 'culturalization of everyday life' and why Venturelli (2002) calls for 'moving culture to the center of international public policy'.

It is not surprising that this is where the growth opportunities are, as all OECD countries display service sectors which are by far the biggest sectors of their respective economies (the services sector is in the 70-80% range for total businesses; total gross value added; and employment across almost all OECD economies), and that relative size has generally been growing steadily for decades.

TO KNOWLEDGE AND INNOVATION

How and why might content industries qualify as high value added, knowledge-based industry sectors, and from where has this new macro-focus emerged? In part, it's been around for some time, with notional sub-divisions of the service or tertiary industry sector into quaternary and quinary sectors based on information management (4th sector) and knowledge generation (5th sector). But the shorter term influence is traceable to new growth theory in economics which has pointed to the limitations for wealth creation of only micro-economic efficiency gains and liberalisation strategies (Arthur 1997; Romer 1994, 1995). These have been the classic services industries strategies.

Governments are now attempting to advance knowledge-based economy models, which imply a renewed interventionary role for the state in setting twenty-first century industry policies, prioritisation of innovation and R&D-driven industries, intensive reskilling and education of the population, and a focus on universalising the benefits of connectivity through mass ICT literacy upgrades. Every OECD economy, large or small, or even emerging economies (eg., Malaysia) can try to play this game, because a knowledge-based economy is not based on old-style comparative factor advantages, but on competitive advantage, namely what can be constructed out of an integrated labour force, education, technology and investment strategies.

The content and entertainment industries *don't as a rule figure* in knowledge and innovation strategies, dominated as they are by the science, engineering and technology sectors. But they should. Creative production and cultural consumption are an integral part of most contemporary economies, and the structure of those economies are being challenged by new paradigms that creativity and culture bring to them.

What, in outline form, is a conceptual frame that may begin to see the content industries in the context of a knowledge and innovation agenda? This is important for two reasons: it opens up dynamic and central policy territory which has been the

preserve of science, engineering and technology (SET) worldwide; and it asks new questions, outside the domain of cultural support, which may precipitate a more holistic approach to the content industries.

THE NATURE OF THE INNOVATION SYSTEM

The nature of R&D and innovation within the creative and content industries generally has not been closely examined. This largely reflects the sorry fact that these industries have tended to be, at best, *at the fringes* of national discussions about science and innovation policy, and of related funding and industry programs. A further complication is that there is little systematic data about the extent and nature of R&D activity and funding in the content industries in general and for digital content production in particular.

In part, this is a result of 'category confusion' which has given rise to numerous ways of approaching this sector around the world:

Figure 1: The category confusion with content industries

Creative Industries	**Copyright Industries**	**Content Industries**	**Cultural Industries**	**Digital content**
-largely characterised by nature of labour inputs: Ncreative individuals Ó	***-defined by nature of asset and industry output***	***-defined by focus of industry production***	***-defined by public policy function and funding***	***-defined by combination of technology and focus of industry production***
Advertising	**Commercial art**	**Pre-recorded music, recorded**	**Museums & galleries**	**Commercial art**
Architecture	**Creative arts**	**Music retailing**	**Visual arts & crafts**	**Film & video**
Design	**Film & video**	**Broadcasting & Film**	**Arts education**	**Photography**
Interactive software	**Music**	**Software**	**Broadcasting & film**	**Electronic games**
Film and TV	**Publishing**	**Multimedia services**	**Music**	**Recorded media**
Music	**Recorded media**		**Performing arts**	**Sound recording**
Publishing	**Data processing**		**Literature**	**Information storage & retrieval**
Performing arts	**Software**		**Libraries**	

This category confusion means that it is extremely difficult to gather accurate, authoritative and timely data about the sector and that it is subject to unfocused analysis and intervention. Having said this, it is a problem generic to much of the service sector. Despite the problems, it is important to establish why digital content should be an important area of focus within a national innovation system. There are several reasons why the content industries in general and digital content in particular are important.

- *this industry cluster is economically significant.* In 2000 sector turnover in Australia represented $19 billion, or 3.3% of GDP. Comparison with the UK and US, where GDP shares are 5% and 7.8% respectively, shows that the potential significance of the sector in Australia is even greater.
- *the creative industries is a high growth sector. A* survey of a cross-section of countries (see Figure 2) shows that the content industries have been growing faster than the rest of the economy. In the UK and US average annual growth

rates for the creative industries have consistently been *more than twice* that of the economy at large. This translates directly into jobs and economic growth.

- the content industries and digital technology are becoming *important enablers as intermediate inputs* to other industry sectors. Digital content is becoming an important enabler across the economy, and especially in the services sector. This translates directly into the competitive advantage and innovation capability of other sectors of the economy.
- the *creative industries fuel the creative capital* and creative workers which are increasingly being recognized as key drivers within national innovation systems.

All these reasons support the contention that digital content and creative industries sector clusters matter, both in their own right and within the context of national innovation capabilities.

Figure 2: Cross-country comparisons of the economic value of content industries

Country	Year	% GDP	Ave Annual Growth (Content industries/ overall economy)	Value aded	Export	% national employment
US	2001	7.8	**6.9**/3.2 (1997 Š2001)	US$708b	US$89b (Core copyright only)	6
UK	1997/8	5	**16**/<6 1997-1998	STG 113b	STG10.3b	5
Australia	1999/ 2000	3.3	**5.7**/4.8 (1995 Š 2000)	AU$19b	AU$1.2b	4
Singapore	2000	2.8	**13.4**/10.6 (1986 Š 2000)	S$4.8b	S$4b	3.4

Source: Singapore, Creative Industries Development Strategy, 2002
Note: Treatment of industry statistics varies slightly across countries.

Innovation and innovation systems approaches are a relatively new public policy framework, which means that general definitions of innovation are subject to contest and reformulation. "Business innovation is the process whereby ideas are transformed, through economic activity, into sustainable value-creating outcomes or a measurable change in output" is a working definition of innovation which has gained currency (Livingstone 2000: 3).

The conventional wisdom (and normative framework) for policy on innovation resides in the OECD's Oslo Manual (OECD, Paris 1997). What matters within such a framework is how we understand the dynamic processes giving rise to systemic effects and industry outcomes. Despite the difficulties in shoehorning content and entertainment industries into innovation frameworks - designed as they are fundamentally for the manufacturing sector - it is beginning to occur, as innovation and R&D policies evolve. Lengrand *et al* (2002) talk of 'third generation' innovation policy, while Rothwell (1994) contemplates five generations of innovation. The trend is the same, however. Earlier models are based on the idea of a linear process for the development of innovations. This process begins with basic knowledge breakthroughs courtesy of laboratory science and public funding of pure/basic research and moves through and successive stages – seeding, pre-commercial, testing, prototyping - till the

new knowledge is built into commercial applications that diffuse through widespread consumer and business adoption. Contemporary models take account of the complex, iterative and often non-linear nature of innovation, with many feedback loops, and seeks to bolster the process by emphasising the importance of the systems and infrastructures that support innovation. This model can be cross-referenced well enough, without too much mutilation either way, with industry models like Michael Porter's representations of industry and cluster competitiveness. Both attempt to chart non-linear and multi-causal systems.

While this migration from a simplistic "technology push" model of innovation driven by upstream R&D to the more real-world characterization of industry markets as complex systems, old paradigms die hard. This is because science and research institutions change slowly. This has also been compounded by the false dichotomy between "hard" science and manufacturing policy on the one hand, and the "soft" research of the social sciences and the relative neglect of the services sector - within industry policy - on the other. Digital content production falls between this gap.

One of the shortcomings of most embedded models of innovation and their related policy programmes is that many of these were established within the context of stable, relatively mature industries, primarily in the primary production and manufacturing sectors. The challenge is how to adapt and extend thinking about innovation systems to the services sector and to emerging, technology-based firms in service industries. Addressing this challenge has shifted the focus to the dynamics of industry change and structural adjustment within a globally turbulent environment and shifted attention to new levels of granularity in seeking to understand innovation processes in terms of dynamic feedback loops, non-linear change processes, and the learning processes associated with organizational and institutional adaptiveness.

Any system is defined by the relationships between the component elements. The nature and calibre of those linkages will be determined, *inter alia*, by various organisational attributes.

Figure 3: The elements of a digital content innovation system (cf Carlson et al 1999)

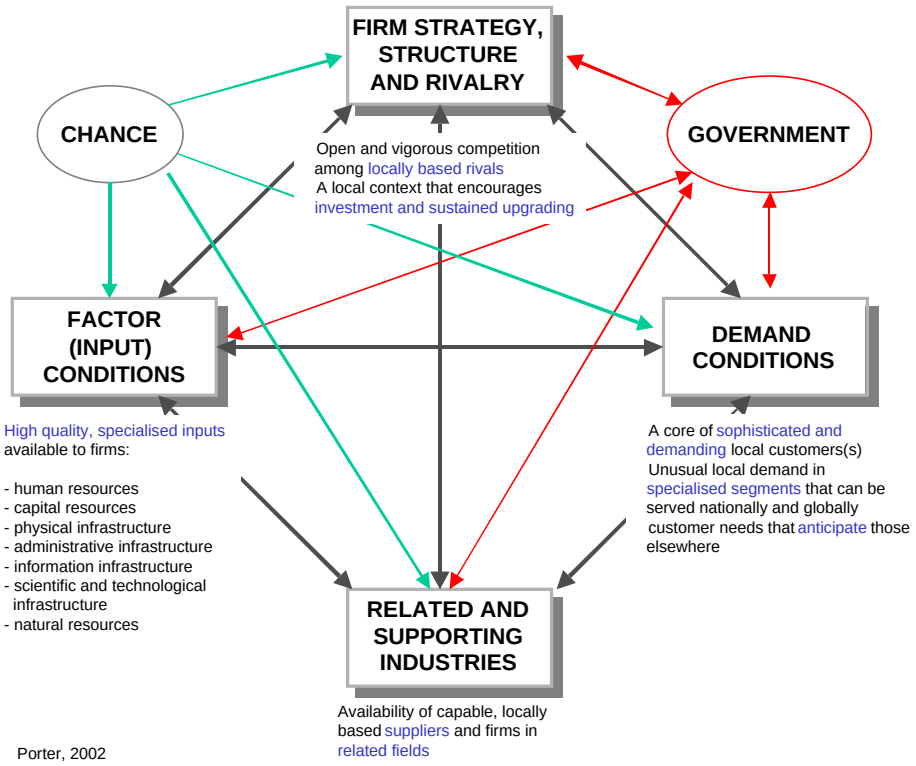
Components	Relationships	Attributes
The operating parts of a system: • organisations (firms, universities, research centres, research agencies, industry associations, cultural agencies, funding agencies, regulatory agencies, customers and users); • properties and assets (technology, IP, human capital, skills, finance, infrastructure, repositories); • Institutional regimes (IP law, rights management, content and market regulation consumer protection, competition law)	Linkages between system components: • market transactions • non-market linkages • information flows • technology transfer • capital flows (people; capital)	• economic competencies • organisational (integrative or co-ordinating) ability • functional ability • learning (adaptive) ability

ANALYSING THE INNOVATION SYSTEM

Having regard to the limits and criticisms of innovation system thinking just canvassed, the key for conceptualising such a system for digital content is to marry innovation frameworks with proven industry development paradigms.

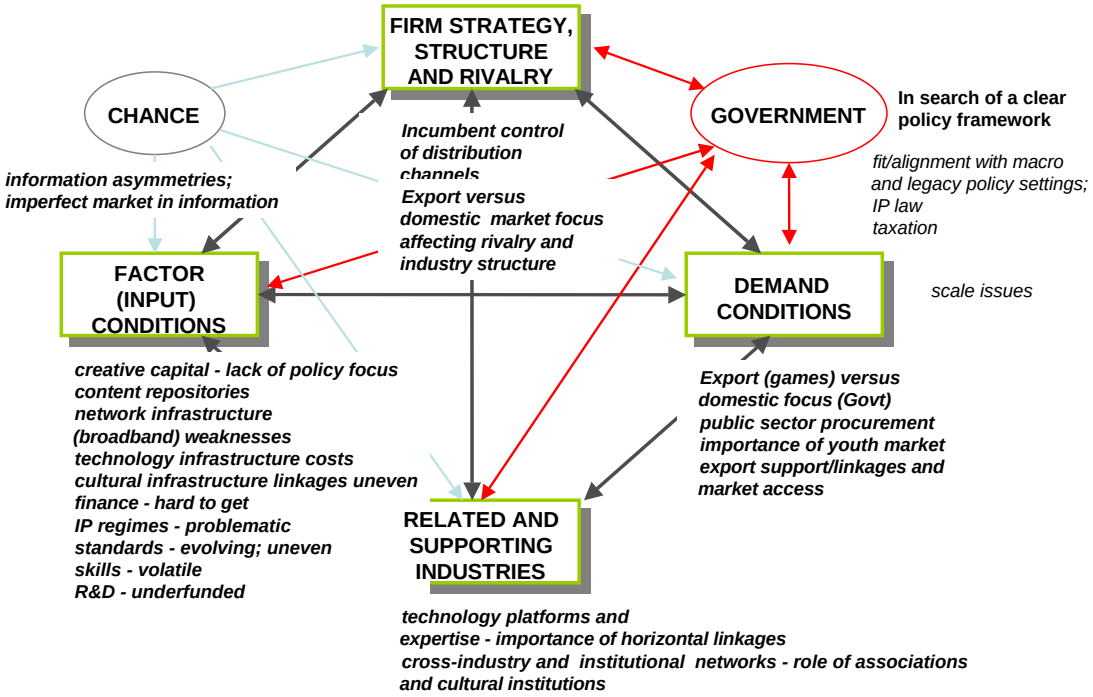
Michael Porter's work in progress on assessing key parameters to cluster competitiveness provides an industry lens for identifying potential requirements of an innovation system as well as linking this to what successful innovation *outcomes* might involve. It should be noted that linking a situation analysis with possible outcomes is about optimizing identified pre-requisites for industry competitiveness and success. As an aside, it is noteworthy that the role of government and of chance (for which we can read externalities) feature increasingly strongly as Porter has concentrated more and more on applying his industry diagnostics to the issue of industry clusters. In the context of innovation systems, the arrows representing interactions and linkages in this model are as important as the component building blocks. The analysis of industry innovation involves the examination of both the component building blocks and the network processes – the links.

Figure 4: Porter's determinants of industry cluster competitiveness



Modelling the drivers of competitiveness and innovation specific to digital content production against the wider industry systems of either creative or content industry descriptors provides a comprehensive - albeit complex - picture of the mapping required to elaborate a policy framework for innovation systems affecting digital content production.

Figure 5: Overview of elements in cluster competitiveness in digital content production



We will exemplify this model of an innovation system by treating Australia as a case study. [1] (In this article, it will only be possible to focus on a few key elements of the system. In particular, we have chosen to focus on weaknesses in certain key components of the system as this is where most research has taken place.)

Components – organisations

Firms

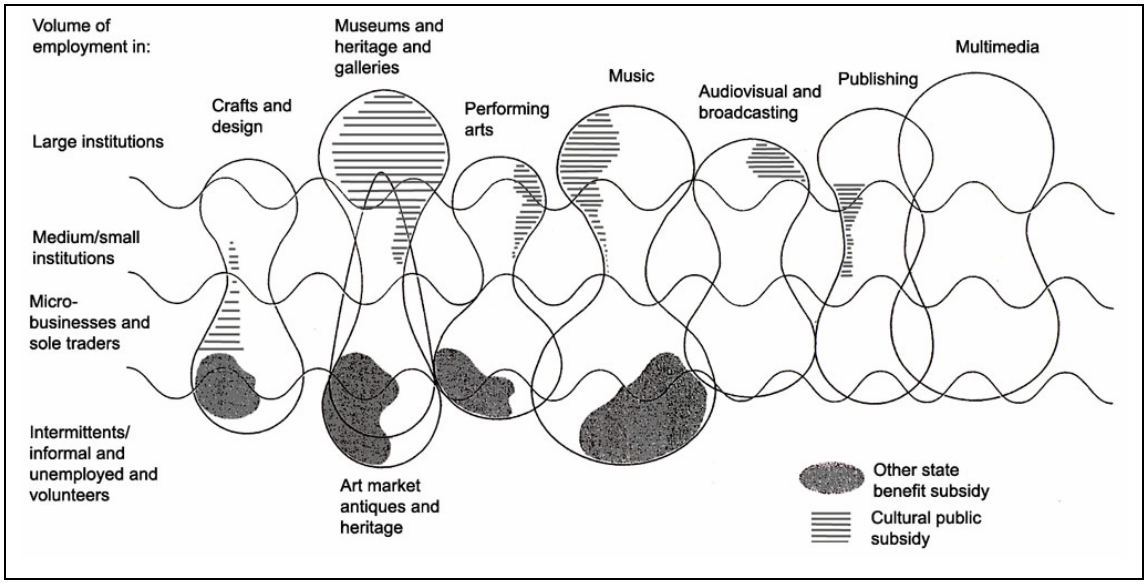
The market is characterised by few large players – usually deriving their market position from strong incumbency in established traditional content industries or related markets, and a large, fragmented base of small enterprises. Few companies occupy the middle ground.

The distinctive economics of creative industries makes for unusual organisational forms and a viral form of growth and activity that is often hard for industrial age statistics and strategies to accommodate. A recent study (Hackett *et al* 2000) of the shape and trends in European businesses in the sector points to high levels of employment volatility (apart from the echelon of senior executives and managers), concentration of power amongst a small number of large multinational companies at the distribution and aggregation end of the value chain, and an 'hourglass effect' (see the diagram below) in the distribution of employment, with much smaller employment in medium sized businesses than is normal for industry sectors in general, which exhibit a pyramidal rather than hourglass shape. "The difference between [the creative industries] and other industries is the result of public support

[1] The Australian Government's Creative Industries Cluster Study (cultureandrecreation.gov.au/cics) conducted through the Department of Communications, Information Technology and the Arts and the National Office for the Information Economy in 2001-3, resulted in the announcement of a Digital Content Industry Action Plan in February 2004. This case study is drawn from the authors' 'Research and Innovation Systems in the Production of Digital Content and Applications', one of the reports within the Creative Industries Cluster Study.

inflating the number of larger organizations and the difficulty and lack of propensity of small scale enterprises to grow into medium sized ones' (Hackett *et al* 2000: 10).

Figure 6: Firm size in the content industries



(Source: Hackett *et al* 2000)

A major issue is the undeveloped linkages between large and established firms and SMEs, as is the issue of linkages across related markets (supplying or using inputs). The industry fragmentation, production specialisation, and the small domestic market all act to reinforce weaknesses in collaboration, clustering and resource pooling. Remoteness from international deal-making centres and time-zone factors contribute to marginalisation within the global value chain.

The market focus of firms varies widely. Games is a "born global" business with a strong focus on the youth market, whilst many multimedia web services are more domestically focused as input services in areas such as education, advertising and marketing. An export orientation appears to foster firm collaboration and clustering influences the "mindset" and development of firm capabilities. The question is how strategies can be developed that enhance the capacity and propensity of firms to compete in global markets. The following figure gives a sense of the content industry's participation in Australia's major SME export facilitation scheme, Austrade's Export Market Development Grants. (Austrade is the Australian Government's statutory trade promotion body.)

Figure 7: Digital content share of Austrade's export grants scheme

EMDG scheme	**2000/1**	**2001/2**	**2002/3**
Total Funding (Sm)	150	150	150
Total number of companies receiving a grant	3214	3018	3795
No of Digital Content companies	143	136	151
as % of total	4.5	4.5	4
Total Digital Content funding (Sm)	7.1	8.3	6.7
as % of total funding	4.7	5.5	4.5

Source: Austrade; QUT and Cutler & Company analysis.

While the industry's share of export support funding is roughly commensurate with its share of GDP, the base is soberingly low for a sector characterized by high growth

and increasing trade deficits in intellectual property. In addition, the bulk of sector applications come from one segment, the export oriented games industry. If the contribution of games companies is discounted, it is clear that most digital content activity pursued in conjunction with Austrade is incremental to domestic market turnover.

The domestic market focus in most segments of the industry creates barriers to collaboration because firms are competing for share within a small market. There is little sharing of infrastructural resources, reflecting a lack of maturity, or trust, in inter-firm relationships and transactions. Emerging firms are commonly staying in one niche rather than venturing into related fields (such as digital content producers moving into education and e-learning). There are widespread weaknesses in vertical and horizontal linkages. In particular, technology spin offs or technology by-products often risk becoming stranded assets because of the lack of horizontal market linkages or paths to technology diffusion.

Universities and R&D

The creative industries appear to be marginal within university-based research. University research strategies do not embrace content readily (in contrast to their emphasis on ICT and biotechnology). The many different research fields involved with creative industries do not relate to each other well and the potential linkages are seldom articulated into an R&D strategy involving the linkages between ICT, creative content, and educational and services industry content. University research assessment systems rarely specifically reward industry collaboration or inter-disciplinary and multi-institutional activity.

Digital content and applications appear underweight in national competitive research funding under the Australian Research Council's (ARC's) industry 'Linkage' programme, receiving funding of only 5% of projects funded under the Humanities and Creative Arts category (9 out of 172 projects) for the period 1998 to 2003. (The ARC is the Australian Government's statutory research funding body. This finding is based on estimates derived from data supplied by the ARC to the ARC Learned Academies Special Projects grant 'Partnerships in the Humanities', based at the University of Western Sydney. For a general orientation to Humanities and Creative Arts ARC Linkage outcomes, see the report by Ang and Cassity 2004).

Australia's National Research Priorities, announced first in December 2002, included 'Frontier technologies for building and transforming Australian industries'. In this priority area there are key statements such as 'research is needed to exploit the huge potential of the digital media industry', and a number of examples of content applications such as e-commerce, multimedia, content generation and imaging are mentioned for priority research and development. This has been strengthened by the more recent inclusion of a related priority goal of 'maximising Australia's creative and technological capability by understanding the factors conducive to innovation and its acceptance'. We must wait and trust that these new priority areas will be 'cashed in', as the research culture and administration frameworks continue to marginalize research into content and related interdisciplinary research.

R&D in content involves a shift in research focus from the supply to the demand side environment, consistent with the feedback systems characterizing an effective innovation system. Within a consumption-driven, innovation-led new economy, R&D into the contexts, meanings and effects of *cultural consumption* could be as important as *creative production*. Major international content growth areas, such as online education, interactive television, multi-platform entertainment, computer games, web design for business-to-consumer applications, or virtual tourism and heritage, need *research* that seeks to understand how complex systems involving entertainment, information, education, technological literacy, integrated marketing, lifestyle and aspirational psychographics and cultural capital interrelate. They also need *development* through trialing and prototyping supported by test beds and infrastructure provision in R&D-style laboratories. They need these in the context of ever shortening innovation cycles and greater competition in rapidly expanding global markets. The centrality of consumption is one of the realities of the new economy that brings the research traditions of cultural and communication studies into mainstream and sharp relief. An innovation agenda would seek to facilitate hallmark work such as *Accounting for tastes: Australian everyday cultures* (Bennett, Emmison, and Frow, 1999), and depth industry intelligence such as Saatchi & Saatchi's report to the Australia Council (the Australian Government's statutory arts funding body) *Australians and the arts: what do the arts mean to Australians* (Australia Council 2000) being regularly updated.

The creative industries are supported by a mix of fields of study based in the ARC discipline cluster of Humanities and Creative Arts, but crossing over to the Information Sciences discipline cluster as well as into the business disciplines in the Social Sciences. Many of these are typically young academic disciplines with marginal to negligible profile within the wider research community. The ARC could more actively support the creative arts disciplinary array at the intersection of the information sciences and the creative arts through new incentives for cross-disciplinary activity and strategic investment in emerging industry innovation.

A clear example of how current models penalize digital content and creative industry outputs in university research is the Higher Education Research Data Collection (HERDC) process administered by the Department of Education, Science and Training (DEST) which measures – and rewards – research outputs. Research output data is collected in only four 'proxy' categories out of more than two dozen recognized research output categories. These four are authored research monographs, book chapters, refereed journal articles, and refereed conference proceedings. Designs, patents, major creative works and contributions to professional communication are not included and are thus subject to informal discounting as academic behaviour 'follows the framework' of recognition. An innovation system more supportive of the creative industries would seek to weight these discounted outputs differently.

Universities and postgraduate research

Current higher education research policy, administered by DEST, discriminates against digital content in terms of the Research Training Scheme (RTS) which awards funding for research and funded places for research training based on the dollar value for grants won (rather than, for instance, valuing them on the basis of numbers of

grants won or weighting them to take account of the much higher dollar amounts required to conduct research in traditional science and technology areas) and thus creates significant differences between high cost and low cost higher degrees in terms of the dollar value for their completion to the university from which the student graduates. This formula produces a regressive outcome whereby it is impossible for digital content and the wider humanities, creative arts and social sciences disciplines to advance their funding base no matter how hard they try and, indeed, succeed in their own terms. Universities may be constrained to focus RTS places into areas which perform well in terms of the DEST formula, none of which are digital content areas. Unfortunately, this is not necessarily into areas that will, in turn, drive innovation.

The Cooperative Multimedia Centre (CMC) scheme from the mid-1990s was one initiative aimed specifically at a development and training focus on digital content. Six centres were funded at $1.375m per annum over the period 1996-1998, and this funding was extended in 1998 to 2002. This scheme notably failed to achieve sustainable linkages between the higher education sector and industry. Instead of paralleling Cooperative Research Centre (CRC) processes which enjoy significant public funding triggered by industry involvement, the scheme became in effect a localised vocational education and training service for those few CMCs that remain standing.

The ARC, through its Networks, Centres and Projects programs, could seek to address key lacunae in the innovation system for DCA by connecting early career researchers with industry skill sets to the research and development system through cross-disciplinary initiatives and encouraging research mentorship whereby a major advance in the R&D credibility and competence of next generation emerging talent in the digital content supporting disciplines is achieved.

Universities and careers

Placement and role of creative industry graduates in “out of field” jobs tends not to be captured by higher education employment surveys, thus discounting the market value attributable to career paths outside the sectors which creatives are traditionally employed in. There appears to be real data gaps about the career and vocational choices increasingly available to creative workers and talent in the broader service industries as creative solutions are now increasingly sought in domains such as government and financial services, education, tourism and health. Some jurisdictions, notably the UK, have implemented national initiatives to promote the wide and innovative career options arising from a background in the creative industries (for example, the National Advisory Committee on Creative and Cultural Education’s report, *All Our Futures*, published in 1999, and the UK Goverment's statement of progress made following the original recommendations of the NACCCE Report, in January 2000, at www.dfes.gov.uk/naccce/). Of course, much excellent research is done to track the career prospects and actualities of creatives (eg., www.ifacca.org/files/040527ResearchingArtists.pdf for a good international literature survey). However, it tends to focus on employment in the creative sectors as such. There is evidence that there are at least as many (and, given the problematic status of

much of the data, probably many more) 'creatively skilled' people outside the actual sectors recognized as creative industries as inside them.

Co-operative Research Centers

The key university-industry-research agency linkage program, the Co-operative Research Centers (CRC) program, has been running for over a decade and more than 70 CRCs have been awarded. Despite this program being a lynchpin of R&D linkages between university and industry sectors, it has programmatically excluded from its purview the DCA and related sectors, permitting only science, engineering and technology disciplines and related industry sectors to apply. While a few CRCs (Smart Internet, Sustainable Tourism) have contained slivers of the social sciences, and Interaction Design was funded in the last round, it remains the case that CRC support for digital content and applications is extremely limited. In addition, the focus of CRCs does not appear conducive to the three way linkage between universities, industry and cultural institutions that appears highly desirable in the field of digital content and the creative industries.

Industry associations

There has been a untoward balkanisation of collective association within the content industries. The digital content industry is specifically addressed in two industry associations, the Australian Interactive Media Industry Association (AIMIA) and the Games Developers Association of Australia (GDAA). The ICT industry is variously represented by the Australian Information Industry Association, Internet Industry Association, the Australian Computer Society, and numerous professional bodies. There is little connection between the content and technology bodies. The potential role of AIMIA is limited by the lack of participation by large players and the parochial interests of its small enterprise membership base. It tends to be a meeting place for emerging SMEs and a platform for entrepreneurial individuals. The GDAA on the other hand has been an effective and tightly-knit group with a strong focus on industry development activities, reflecting its strong state (or provincial) government funding and support base.

Traditional content industries are represented by numerous associations, usually representing fields of practice and including the Australian Society of Authors, the Screen Producers Association, the Federations of Commercial Television and Radio Broadcasters, the collection agencies which act as industry organisers, as well as the industry trade union, the Media and Entertainment and Arts Alliance. These bodies are paralleled by numerous special interest (for example Arts Law) or guild-like organizations.

There is little integration of digital content activities in established content industry associations, limiting the impact and agenda on both sides. There is a general fragmentation along lines of special interests, and a lack of national co-ordination.

Government support agencies

There are numerous government agencies with specific industry support and funding

charters involving digital content at national, state and local levels. Apart from main agencies with specific charters relating to content industries sectors, a range of other government programmes could be relevant to support of the sector. These include various 'Sustainable Regions' programmes (2001); the already-mentioned Austrade; the federal Department of Foreign Affairs and Trade (through bilateral cultural exchanges); the main national industry development agency, AusIndustry. As a general observation, available data appears to support the finding that digital content is systematically under-represented in generic industry support schemes run by such bodies – that is, industry support not specifically targeted at a particular sector. We have already cited the example of Austrade's EMDG scheme; Figure 8 shows that it is also the case with the key tax concession scheme for R&D as well.

Figure 8: Registrants for R&D Tax Concession

ANZSIC sector	**1998-99**		**1999- 00**		**2000 - 01**	
	No of registrants	%of total	No of registrants	%of total	No of registrants	%of total
Printing, Publishing & Recorded media	35	0.2	38	0.3	31	0.3
Cultural sporting etc	42	0.5	36	0.7	30	0.6

Source: AusIndustry, IR&D Board *Annual Reports*; Note: Reporting by industry code is in aggregated categories. Separate and specific tax concessions apply in the film industry.

Government support funding

There is evidence of a variety of support for digital content over the past decade by government agencies administering funding programs. However, it should be noted that, apart from specific programs (such as the Cooperative Multimedia Centres, the Australian Multimedia Enterprise, and the Learning Federation) which have delivered one-off surges of funding into the sector, the base level funding remains extremely low when compared to the funding allocated to so-called 'critical infrastructure' (telecommunications infrastructure, digital television conversion) and mainstream R&D like biotechnology.

Government procurement

A fundamental issue for innovation systems is that of government and agency approaches to the administration of intellectual property (IP) and Crown Copyright. Unlike the UK and Australia, the US Copyright Act explicitly excludes coverage of works produced by government. In the UK there were detailed reviews of Crown Copyright in 1998, resulting in a White Paper (*The future management of Crown copyright*, HMSO, March 1999) which sets out a new policy to open up access to government content and to streamline administrative processes for access. A good Australian example of how treating government content as a public domain resource

supports digital content development is in the area of legal resources. Following the shaky beginnings of digital legal databases in the early 1980s, subsequent relaxation of access and re-use rules applying to statutes and case law across Australian jurisdictions has led to a very successful online service called AUSTLII. In other areas, digital content producers continue to complain that policies on Crown Copyright within government procurement practices creates barriers to the commercialisation of sector innovation.

Customers and users- intermediate use

Preliminary analysis of national industry input:output tables suggests that there is increasing use of digital content and applications as intermediate inputs by traditional content and creative industries and especially by the wider service sector industries. Lags in statistical publications limit dynamic trend analysis. For example, the latest published input:output tables are for 1996/97, with the following year's data released only in mid-2004. Against this several-year lag in the relevant data, it is hypothesised that the emerging trends identified will have strengthened significantly in the subsequent period of major development for the content industries.

Intermediate industry use of content industry outputs outweighs final consumption in each broad segment of the content industries – as captured by ANZSIC statistical codes – except in the case of the more traditional arts and cultural institutions.

Figure 9: Use of sector outputs (1996/7)

ANZSIC code	Supplying industry sector	Total industry use as % of total supply	Total final consumption as % of total supply
2401	Printing; services to printing	89	11
2402	Publishing; recorded media	65	35
9101	Motion picture; radio etc.	65	35
9201	Libraries; museums; arts	27	73

Source: ABS Input Output Tables, 1996/7 (ABS 2003)

The following table highlights the main industry sectors reliant on content industry outputs. The Australian data is consistent with findings in other jurisdictions (Singapore Ministry of Trade and Industry 2003).

Figure 10: Utilisation of Creative Products by Major Industry Users

User Industry	1996/7
(I-O Sector)	%
Wholesale trade	2.4
Retail trade	6.7
Hotels & restaurants	1.8
Communications	6.6
Other Property	2.6
Scientific Research	2.5
Legal & Accounting	5.6
Other business services	6.2
Government	2.5
Education	10.7

Sport; gambling	3.3

Source: ABS Input Output Tables, 1996/7 (ABS 2003)

In addition, the *intra*-sectoral patterns of intermediate use within the creative industries themselves reinforces observations about the important of cluster development for the creative industries and digital content. The emerging statistical evidence of growing intermediate use, supported by qualitative evidence, should put an increased spotlight on the way digital content is becoming an important enabler across the economy, and especially in the services sector. This observation highlights the growing importance of digital content within the wider context of national innovation systems.

Components: Assets

Technologies

The chronic lack of venture capital for commercialisation in the content sector restricts invention. The finance sector's wariness of content investment is compounded, in Australia, by the smallness of the domestic market and the lack of a critical industry mass to justify investor attention. Other impediments include the high cost of access to broadband and other equipment inputs, which limit the capacity to nurture R&D at the SME level where it is most productive.

Digital content firms are underweight in government industry R&D support. Analysis of Industry Research and Development Board *Annual Reports* show that they represented 2% of the main federal scheme, the R&D Start Grant, in 2000/1 and 1% in 2001/2, and received 3% and 0.5% respectively of total funding for each year. This situation largely results from the fact that standard definitions of R&D used in grant guidelines and for tax concessions discriminate against "soft" technologies, and this has been raised as an issue to be addressed in several jurisdictions, including the UK and New Zealand[2].

Intellectual Property

Intellectual property issues go the heart of the sector's business models and value chains, and the hotly contested issue of which parties capture disproportionate shares of the value added. It is often bundled – unnecessarily or inappropriately – with the matter of the protection of corporate or commercial information. The Australian government has shown an awareness of copyright and digital-rights issues (as evidenced in copyright reviews and the Department of Communications, Information technology and the Arts' release of a Digital Rights Management Guide). There remains an inherent risk that established interests – not innovators – will capture the agenda in reviews of IP regimes. There continues to be a lack of robust policy debate around this crucial topic.

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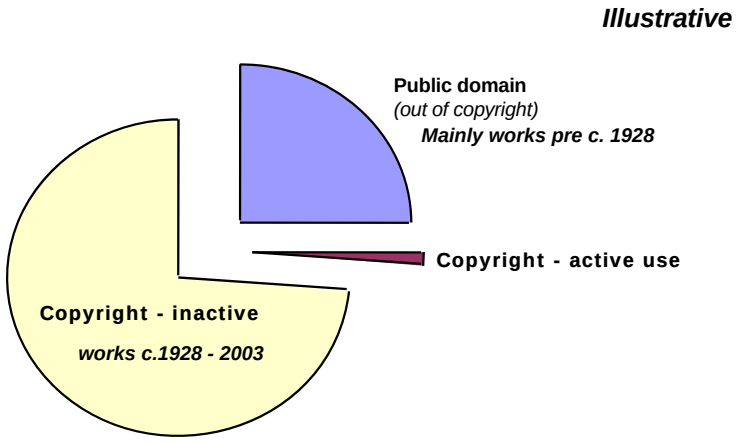
[2] *Defining innovation: a consultation on the definition of R&D for tax purposes*, HM Treasury, Department of Trade and Industry and Inland Revenue, UK, July 2003

R&D Strategy for creative industries – a discussion paper, Foundation for Research, Science, and Technology New Zealand, 2003

At the heart of this debate is the imbalance of market power between distributors and publishers on the one hand, and content creators and users – and re-users – on the other. The fundamental debate is over the balance of private and public rights and interests in the control of copyright content, particularly that 98% of copyright content estimated to be not under active commercialisation or use.

Figure 11: The access lock out of inactive copyrights



Source: author's (*Cutler & Company*) analysis 2003

The availability of "source content" is a powerful innovation and industry driver; its lack a major inhibitor. There has been but limited attention to the issue of possible licensing regimes for more open content repositories. Whatever the licensing models, there needs to be a system of digital rights management that is flexible, transparent, secure and allows user customisation and micro-management of content. In general, the lack of clear and certain IP parameters adds to transaction costs and discourages innovation and development.

Human and creative capital

Richard Florida's (2002) work on creative workers has recently highlighted the wider economic significance of creative capital, especially in under-pinning high technology industry development. An overall creativity index comparing Australia and the United States on the parameters of population diversity, high-tech output, innovation and human capital was prepared by National Economics (2002), with the following results*:*

Figure 12: Creativity Index: Top Ten Regions – US and Australia

Region - Australia	Score	Region - USA	Score
Global Sydney	***992***	San Francisco	1057
Melbourne Inner	***985***	Austin	1028
ACT	831	San Diego	1015
Perth Central	744	Boston	1015
Adelaide central	735	Seattle	1008
Sydney inner West	733	Raleigh-Durham	996
Brisbane City	720	Houston	980
Melbourne South	606	Washington-Baltimore	964
Sydney Outer North	535	New York	962

	Melbourne East	519	Dallas	960

Thus, ranked against US cities, Sydney and Melbourne would have come in at 7th and 8th places.

As a percentage of the population, Australia's 'super creatives' are out ranked by the US by about 2 percentage points, but the reverse holds for the second tier creative professionals in business services, health and education. Australia also out-performs the US on the "Bohemian" Index of arts workers as a proportion of population, and also on the Diversity Index. Where we lag significantly in this comparative study is in Innovation (patents per capita), human capital talent (% of population with a higher degree) and high technology production.

Whilst the Australian survey confirms and replicates Florida's US findings about the correlation between concentrations of creative populations and the location of high tech industries, it is also apparent that Australia is not successfully leveraging its creative capital into economic outcomes as successfully as the US. This suggests there are significant points of failure in Australia's national innovation system.

Skills

Most of the people working in the sector are highly skilled with a high proportion of youthful energy. It has been observed at an industry level that university graduates often lack industry readiness, indicating a lack of career preparation pathways. A widespread industry view is that universities cannot structure research and teaching around a multi-disciplinary focus, limiting the competencies of graduates.

The skills requirement in this sector is not straightforward. The skills typically needed in digital content sectors include creativity, a risk taking and innovative mindset, integrative problem solving abilities, high levels of technical knowledge and applications ability, and entrepreneurial business acumen. The split between higher and further education, between mass undergraduate, boutique coursework postgraduate, and R&D postgraduate, and the deep silos representing the discipline clusters from which these skill sets might be nurtured (ICT, creative arts, and social science disciplines) makes planning for skill development for the digital content sector a particularly difficult feat. This inherent challenge is compounded by the embryonic nature of some of the sector, and its inherently volatile nature.

Despite a somewhat negative public image of entrepreneurial activity in mainstream business culture, the 'creative entrepreneur' is a different class of actor than the corporate buccaneer. As Leadbeater and Oakley (2001) point out in their study of knowledge entrepreneurship in Britain, the knowledge entrepreneur acts collectively and is data - and evidence - driven in order to sense new opportunities in extremely volatile emerging fields based on new knowledge.

Lack of critical linkages between the education and training sector and the digital content industry sector needs means that skills development is not yet fully coordinated for maximum value. There is but patchy support for a suite of suitable and widely accepted credentials in the industry analogous to the situation with nursing

prior to the development of a nationally accepted and coordinated credentialing system.

CONCLUSION: IMPROVING THE SYSTEM

The preceding gives some sense of the components of a content industry innovation system. There are many *elements* of such an innovation system in place. There is a very large education and training sector providing skilled graduates and trainees into the sector. There are large market organisers and industry players, both in the public sector (broadcasters, funding agencies, and cultural institutions such as museums and galleries) and in the private sector (commercial broadcasters, publishing houses, telecommunications firms, and advertising). There is strong and growing demand, both in retail consumer demand and in the role of digital content as an enabler across a growing range of industries, particularly in the services sector.

However, the *quality of linkages* and the *lack of clear public policy signals and frameworks*, together with a number of other critical issues mark the innovation system as embryonic at best. Public policy needs to address the significant framework shifts required to capture the innovation potential of digital content industries by moving, for example, from a situation of unrelated cultural policy and higher education policy to a more fluid, dynamic but more challenging mix of more coordinated program initiatives.

In particular, the scale of investment in innovation in and through digital content appears significantly underweight relative to the funding of other industries. Given the growing economic importance of the creative industries, increased investment in innovation through digital content initiatives is key to capturing future national benefits.

There are several possible strategies for improving the innovation system for content industries (see QUT CIRAC and Cutler & Co 2003). There is clearly a need to develop an industry action agenda to establish a framework for alignment of existing policy regimes with digital content industries and an emerging agenda. A primary focus of the innovation agenda is better to align cultural policies with industry development and R&D policies. Nationally-funded centers of research designed to promote university and industry linkages need to encompass *tripartite* interfaces between cultural institutions, universities and content industries. This initiative would create incentives for, and legitimize the role of, cultural institutions in research collaborations. Such an R&D initiative might invite participating industry sectors to pay levies to fund innovation, which would then trigger government funding. The industry levy could be limited to content industry firms with turnover above a floor level, to exempt emerging SMEs. The levy might apply to broadcasters, publishers and distributors. Levy contributions could offset, or replace some or all of existing broadcasting licence and other imposts. The scheme could be extended in the event of any major changes to cross-media or ownership rules, offsetting any windback of existing local production requirements which might become obsolescent. An essential element of such a centre (or R&D corporation) would be a national information and resource brokerage centre for the sector addressing the serious and endemic information asymmetries and structural weakness in the innovation system.

A suite of reforms to research and higher education policies to accommodate digital content and the creative industries is necessary; as are educational and PR campaigns targeting school-age young people with the message that knowledge entrepreneurship - a 'creative career' – is a viable and attractive option. Supporting and promoting an export orientation is important as the only way the sector can scale to realize sustainable growth. Equally important, only evidence of sustainability and scalability will make the sector investable over the long term, breaking the vicious cycle of underinvestment.

Broadcasting and broadband's role in the innovation system is crucial, as the gateway between established and emergent *content creation* (major popular entertainment and informational formats transmigration to interactivity and mass customization) and *industry structure* (highly centralized distributional models to more networked and distributed models). Understanding the interaction between the potent legacy of broadcasting and the potential of convergent broadband media is the key to positioning innovative opportunities in content creation if they are to remain close to the mainstream of popular cultural consumption rather than being siphoned off into science or art alone.

Major technology-related reforms such as national investment in content and metadata standards and supporting systems (thus limiting the huge transaction costs for both producers and users created by the current "bottom up" approach to standards) and tax credits for R&D investment in technology infrastructure in emerging content areas, are crucial pieces in the innovation jigsaw.

Open content repositories, or public domain digital content, are the content industries equivalent of open source software. They *selectively* addresses barriers to production and unintended cultural outcomes of prevailing copyright and IP regimes through an alternative *opt in* model which can operate in parallel with existing regimes. As such it can be a powerful structural mechanism to support a rich "digital sand pit" for creative content producers. The measure facilitates the active re-purposing and re-use of digital content assets. Misuse of this public domain material would be protected under the provisions of a general non-exclusive Public Licence scheme.

An innovation systems approach to the content industries is important for two reasons: such an approach opens up dynamic and central policy territory which has been the preserve of science, engineering and technology worldwide; and it asks new questions, complementary to contemporary notions of cultural citizenship and cultural capital, which may precipitate a more holistic approach to these industries. Both a cultural citizenship approach and an innovation systems approach seek to move culture into mainstream policy calculation – the former by emphasizing the central role that cultural literacy and diversity play in undergirding inclusive participation in contemporary society, the latter by connecting culture to the most trenchant current rationale for active government involvement in industry shaping.

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