

Design Infrastructure: Australian Developments

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Abstract: The paper reports preliminary findings from research into Australia's design infrastructure. Design infrastructure comprises the systems, institutions and expertise that enables design activity to be undertaken. Design activity is an essential aspect of the innovation and knowledge processes central to national and local economic and social development.

The research indicated that there exist significant weaknesses in Australia's design infrastructure. By implication and observation, these weaknesses compromise Australian investments in innovation, research, education and business process change.

The paper maps out several dimensions of these weaknesses and their causes and implications. It concludes with suggestions for organisational and funding initiatives to improve Australia's design infrastructure in ways that will enable Australia to realise and advance national and local programs for economic and social development.

Keywords: *Design infrastructure, innovation, Australia, knowledge economy, strategy*

Introduction

This paper outlines findings from recent research that investigated and compared design infrastructures of Australia, Norway, the UK, Finland and Korea.

Developed nations' strategies for economic and social development depend on innovation and the building of knowledge-based economies [see, for example, 1; 2-4; 5, p. 3; 6-10; 11 p. ii]. Design is important to innovation because it creates specifications for real world outcomes from knowledge and ideas [11]. The definition of design used in the research and in this paper is that of Nobel laureate Herbert Simon [12 p. 129], who defined design as to "[devise] courses of action aimed at changing existing situations into preferred ones". This broad definition describes an activity at the heart of around 650 sub-fields of design activity, that is central to all forms of professional practice, and that provides the foundation of national, regional and local innovation and economic and social development. The characteristics of a nation's design infrastructure directly influence the quality and volume of design activity and the subsequent economic and social outcomes.

The research method combined desk-based review of country data with depth interviews of CEOs of design firms, design managers, senior civil servants and senior design academics.

This paper focuses on Australia's design infrastructure. Preliminary findings are of weakness in Australia's design infrastructure that reduces the effectiveness of Australian approaches in:

- Innovation
- Reshaping Australia as a knowledge economy
- Attracting international investment
- Strategic management of Australia in relation to East, South, and Southeast Asian and Pacific Rim countries.

In this paper, the term *innovation* follows the definition of the Webster Comprehensive dictionary, i.e. *innovate* 'to make changes or alteration to anything established, bring in new ideas, methods, etc, and *innovation* 'the making of a change in something established [13 p. 654].

Background

Design, as the conversion of ideas and new knowledge into real world products, systems, services and organisations, offers a powerful and effective strategy for developing an innovation driven knowledge-based economy. Design is important in knowledge-based economies because it is central to successful business outcomes, to national and local economic and social development, and gaining economic and social benefits from investment in research [see, for example, 3-5; 14]. Business, industry, education, government and not-for-profit sectors depend on the efficiency and effectiveness of design processes [15, p. 24] and design infrastructure [15-17] because these impact directly on the success or otherwise of governments' economic and social plans:

- They result in innovative designs (new practical knowledge) for real products, services, systems, programs, policies etc.
- They provide the means to create designed outcomes that use the theories, new information and findings produced as a result of research activities, thus, realising the economic and social benefits created in potentia by investment in research
- They generate a need for 'design-focused applied research' that of itself results in new knowledge. Historically, this has shown to be of importance as a significant catalyst for identifying new avenues of basic research and knowledge production.

Nations can use effective design processes to multiply the value of such hard-won resource advantages as higher aggregate levels of education. Effective design process enhances competitive advantage by converting knowledge into specifications. This is important for the new knowledge that emerges in research. It is equally important in finding way to extend and increase the value of accumulated knowledge. Design shapes knowledge into the products, services, and systems that create value for

societies and nations. This work requires experts. These experts include trained design professionals, design researchers and intermediary professionals such as marketing specialists. This, in turn, requires a strong design infrastructure, and robust design and design research in the tertiary education sector.

Many nations such as the US, the UK, Norway, Finland, Germany, Korea, and Thailand have recognised that design infrastructure contributes strongly to GDP, and have invested heavily in design infrastructure to improve the contribution to economic outcomes of research-derived knowledge [see, for example, 15; 17-21].

Design-focused research is an essential component of design infrastructure because it provides the knowledge and understanding for improving the efficiency and effectiveness of design processes, the quality of designed outputs, and the levels of subsequent economic and social benefits. Design research requires funding. The success of design-focused research to improve innovation and economic and social development outcomes is directly dependent on the funding allocated to it and to its dissemination.

Nationally, design infrastructure is a shared resource comprising multiple components, multiple actors, and owned and managed in a variety of ways. To maintain and improve economic and social development, levels of innovation and transitions from old economy to new economy requires that governments, local and national, manage, coordinate and support the evolution of appropriate design infrastructure. As a preliminary, this requires national design strategies and design policies.

Australian Design Infrastructure: Case Study

The Australian government has policies to support national economic and social development, and to encourage the development of a knowledge economy [see, for example, 3; 4; 5; 22]. These policy directions are similar to those of other nations [see, for examples, 1; 6; 17; 23-30]. The Australian literature shows, however, a lack of awareness of the design infrastructure needed to fulfil these aims, and of the weaknesses in Australia's design infrastructure. These are reflected in:

- Absence from government literature on innovation any apparent awareness of, and support for, professional product design. Searching for the term 'design' on government innovation websites indicates that the concept of design and its central role in innovation is missing from government agencies' conceptualisation of innovation activity.
- Almost complete absence of product and other forms of design from Australian business consultants' models of innovation, and hence from their advice to businesses to improve outcomes.
- Lack of awareness of design issues in major Australian organisations
- Confusion and mal-investment in research sectors due culturally-based and erroneous assumptions that researchers will produce designs for products as well as research findings. This is in spite of researchers lack of training in design skills and associated lack of awareness of best practices in design

- Confusion and mal-investment in entrepreneurial sectors due to expectations that entrepreneurs will convert research findings into products. This is in spite of entrepreneurs lack of training in design skills and associated lack of awareness of best practices in design.
- Emphasis on advertising and selling image and brand, rather than designing and developing products. This reflects an expectation typical of island economies that technology and goods are imported.
- Almost complete absence of Design Research Centres in Australia.
- Almost complete absence of Design Centres in Australia, and of promotion of design awareness, good design practices and optimising the role of design in business activities.
- Absence of a government agency similar to the Design Policy Unit in the UK, whose role is solely to direct and manage the development of design infrastructure and government programs in, for example, design research, design education, industry awareness of design issues and Australian export promotion.
- Lack of a government agency similar to the Design Council in the UK and the Design Forum in Finland, whose roles are to advise other government policy-making bodies on design issues, to act as a focal point for the collection of findings from design-focused research and to promote the use and best practice in design activity to industry and society

Australian organisations have to date relied mainly on ad-hoc processes of invention and ‘trial and error’ linked to single innovation outcomes, mostly without the participation of design professionals [see, for example, 2; 15; 31]. The term *invention* is here taken to align with Webster Comprehensive Dictionary [13, p. 669]. Two factors, distinguish between invention and design. Invention typically refers to discovery of new *types* of thing. Its root is *invenire* which means ‘to come upon’ or ‘discover’. This contrasts with most design activity, which utilises what is already known. Hence, to say, ‘one *designs* a house’ makes more sense than to say, ‘one *invents* a house’. Invention typically results in a single patentable outcome. Design activity, in contrast, is a production process for producing specifications of real world outcomes from existing knowledge, and hence provides a multiplicity of outputs from any given knowledge.

In Australia, there exists an unusually strong cultural emphasis on individual acts of invention. The dominant focus has been on unpredictable single-shot *invention* activity and IP protectionism as a means of gaining commercial advantage. This emphasis on invention rather than design is widespread in the Australian innovation literature [see, for example, 32; 36]. It contrasts with the use of *design* as a process for ongoing production of multiple innovative outcomes. Australian innovation policy continues down this ad-hoc invention-focused path [see, for example, 3; 4; 5; 32-35]. Focusing on invention is the opposite of what is required for a knowledge economy based on the rich and broad-based generation of designs for multiple economically and socially valuable products, systems and services. This problematic focus on single inventions is, hence, associated with the relatively low levels of new Australian designed products and innovation outcomes, an insubstantial design infrastructure, lack of manufacturing infrastructure, weaknesses in urban and industrial planning relating to public participation in planning processes, and, because of its impact on the

need for design sub-fields, has resulted in a relative imbalance of visual design education over other forms of design education. The Australian invention-based approach is problematic because:

The number and type of outcomes are restricted compared to those produced by design processes

Initiation of entrepreneurial businesses is restricted because of the need to obtain substantial venture capital early in the business development process. This presents a more difficult business pathway than design-based routes to entrepreneurship and innovation as found for example in the UK, which can be initiated from relatively capital-less micro-business units.

Reduced development of design infrastructure because the skills of invention, as practiced in Australia, are a limited subset of the skills needed for designing.

In summary, the invention-based model, with its associated high start-up capital costs, and associated long time to market, handicaps Australian entrepreneurship.

Some of the weakness in Australia's design infrastructure echoes Australia's history as a British colony, which limited the development of design and technology that would enable Australia to compete directly with Britain. In wool research, for example, design of new wool products and manufacturing processes was undertaken only in Britain with Australian research aimed at wool production [2]. Other historical factors that adversely influenced design infrastructure include its economic dependence on selling resources, its high landmass/population, technological isolation, and its technological dependence on nations such as US, UK, China, Japan, Scandinavia, and Korea. These have resulted in:

- Low levels of design expertise and design infrastructure and its substitution by a culture of individual inventors and inventions
- Partial design based on compositions of components designed elsewhere
- Overemphasis on research
- Overemphasis on gaining benefits from research derived intellectual property (IP) via protectionism
- Reduced attention to effectiveness of design processes
- Over-dependence on visual design for increased marketing and advertising effort to sell goods, services, and systems that have been designed and manufactured overseas

Design and R&D are closely related processes that both contribute to economic and social development. The relationship between them is that design activity is the process of producing specifications (designs) for innovative outcomes based on R & D processes that provide information to the design process. In Australia, the design and R&D relationship has been redefined such that design activity is overlooked. Instead, the traditional model of the design and R&D relationship has been replaced by a model of R&D dominated by research, IP protection and entrepreneurship. Hegemonic analysis of power relationships suggests this may be the result of research-based stakeholders shaping the current discourse to privilege research and

strengthen their control of access to investment and research funding. This is implicit in Boardman's [2] analysis of the history of development of research in Australia.

Another weakness of Australia's design infrastructure is due to the fragmentation of design activity into discipline-based silos with low levels of inter-communication. This is significant and problematic in current contexts because design projects increasingly depend on well-integrated multidisciplinary access across design infrastructure. Examples include the design of complex physical systems that have social, environmental and ethical implications, and in the increasing amounts of design activity whose focus is non-physical outcomes with multi-disciplinary aspects, e.g. design of services, processes, systems and organisations. These often also involve design of documentation, image, branding, manufacturing systems and business process redesign.

Evidence of the fragmentation of the Australian design infrastructure is found in several dimensions:

- Lack of attention and funding for design infrastructure development has led to a small range of 'acceptable' areas of design infrastructure being developed (graphic design, engineering design, interior design, multimedia design), whilst less acceptable areas have been neglected.
- Bureaucratic separation of design infrastructure considerations between Federal parliament (international issues, export and international standards) and State / Territory parliaments (local economic development)
- Gaps and barriers between design disciplines, e.g. between technical design disciplines represented by e.g. the Institution of Engineers Australia (IEAust), software design institutions such as the Australian Computer Society (ACS)), and design disciplines aligned with 'Art and Design' traditions represented in part by the Design Institute of Australia.
- Friction between different 'Art and Design' sub- fields evident in the failure of the integration initiatives of the Design Institute of Australia over the last 30 years

Fragmentation and other weaknesses of design infrastructure together impact adversely on the formation of new subfields of design that are necessary to make use of new research findings, technologies, social, environmental, technological and political contexts, and new areas of opportunity. Supporting the emergence of new design sub-fields was identified as important by the Australian National Design Review in 1995 [15].

Where design infrastructure is supportive, new design subfields emerge within and across:

- 'Technical' design sub-fields (e.g. engineering, software design)
- 'Art and Design' sub-fields (e.g. graphics, fashion)
- 'Other' design fields (e.g. business process design, government policy design)

Typically, internationally there is more rapid evolution occurring in the 'Technical' and 'Other' groups.

Design infrastructure problems in Australia that act against the emergence of new design sub-fields include:

- Australia-wide emphasis on 'niche businesses' conflicts with the emergence of cross/multidisciplinary design sub-fields.
- Tertiary design education lags rather than leads industry practice. This results in a conservative culture that resists change and the emergence of new forms of design activity.
- Government funding preferentially supports new sub-fields of research and new sub-fields of business practice rather than new design sub-fields. (E.g., initiatives supporting creative industries focus on research into the creative industries and support for new creative industries businesses rather than improving creative industries design processes.
- Emerging design fields are typically hidden and subsumed within other fields of practice. E.g., the emerging design sub-field Government Policy Design is currently hidden and subsumed in Policy Analysis.

Suggestions for Change

Other nations have faced design infrastructure problems successfully [see, for example, 11; 17; 21] and together their histories suggest suitable strategies for Australia might include:

- Reviews of design infrastructure and design policy at Federal and State levels
- Establishment of Design Centres in major cities
- Establishment of government design policy units
- Funding to increase quantity and quality of design-focused research
- Funding and guidance to raise the standard of graduate design education programs to benchmarks of other nations, especially where this involves integrating design across technical, 'art and design' and business-related arenas
- Establishment of design services centres in innovation-focused locations such as technology parks.
- Improving the post-graduate education of designers and the establishment of a critical mass of world-class design researchers. Doctoral and postdoctoral design researchers undertake the basic research to improve efficiency and effectiveness of design teams and organisations in knowledge conversion.

The significant gap between Australian design infrastructure and the benchmarks set by other nations suggests that this will require urgent, large and continuing funding investment in design infrastructure is needed.

Summary and Conclusions

The research has identified that:

A strong design infrastructure is an essential component of national innovation strategy, economic and social development, and building a knowledge-based economy.

There are significant weaknesses in Australia's design infrastructure.

Weaknesses in Australia's design infrastructure adversely impact on Australian efforts in:

- Innovation
- Economic and social development
- Gaining benefits from investment in research
- Building a knowledge economy
- Design activity has been problematically conflated with research and entrepreneurship.
- Substantial investment in radical redevelopment of Australia's design infrastructure is necessary to support Australian initiatives in innovation, economic and social development, and building a knowledge-based economy.

Key components of successful strategies are likely to involve:

- Funding for design infrastructure development
- Review and development of Federal and State design policies and design infrastructure
- Establishment of new design-focused institutions to promote improved use of design in industry, business, universities, and Federal and State government agencies involved creating and fulfilling agendas for innovation, economic and social development and the transition of Australia to a knowledge-based economy
- Funding to improve the quantity, quality and breadth of design-focused research
- Improvements to the education of multidisciplinary designers, design researchers and design managers.

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