PRODUCTIVITY COMMISSION REVIEW OF ECONOMIC, SOCIAL AND ENVIRONMENTAL RETURNS ON PUBLIC SUPPORT FOR SCIENCE AND INNOVATION IN AUSTRALIA

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SUMMARY

This paper confines its comments to the role of public funds in assisting science research that is conducted between universities and small to medium enterprise companies for the purpose of growing Australia's economy. The paper argues that Australia currently has in place a fundamental structural weakness that provides little motivation for universities to engage in this form of research. This structural weakness operates at cross purposes to the Australian Government's policy that requires the Cooperative Research Programme to concentrate preferentially on assisting the SME sector. It also serves to reinforce the current practice of low investment in research development by Australia's private sector when compared with the OECD. The paper suggests a number of measures that could be put in place to overcome this problem.

BACKGROUND

The views in this paper are drawn from the experiences of the authors with the Cooperative Research Centre for Spatial Information, and extensive experience with the university sector and grant-giving bodies.

The Cooperative Research Centre for Spatial Information (CRCSI) was formed in June 2003. It is an unincorporated joint venture of 61 organisations. It has four universities, eight government agencies and 43 companies. This is an unprecedented number of companies for a CRC in the 16 year history of the program and has permitted us to draw some valuable conclusions about the nature of innovation in the small to medium enterprise sector in particular[1].

The CRCSI has systematically surveyed these companies since 2003. It has sought their views on their expectations of their engagement with the CRCSI, the factors that they feel impede their ability to be more innovative and the processes by which they manage their innovation.

In the three years since the CRCSI began, the CRCSI has successfully encouraged the 43 companies to meet their agreed cash contributions and to exceed their agreed in-kind contributions by 35 percent. Through industry studies the CRCSI has established that these 43 companies in aggregate have significantly exceeded the growth of their industry as a whole. Moreover the number of SMEs wishing to join the CRCSI as equity partners

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[1] For more information about the Spatial Information Industry please refer to the Appendix.

has recently grown to 47 reflecting a growing perception that the structured approach of the CRCSI (and the CRC Programme more generally) is a worthwhile investment.

ISSUES

1. Harnessing the research capabilities of the university sector for the benefit of small to medium enterprise (SME) companies

In recent years the CRC Programme has been asked to concentrate its efforts on the delivery of benefits to the SME sector. By definition this requires a close and effective partnership between the SMEs and the universities in collaborative research. Often an SME is stretched for resources and unused to carrying out a R&D programme or even formulating a research hypothesis. At best the SME's management often has identified only a general area in which it would like to see product or service improvement. From the university researcher's perspective, this collaboration requires individual researchers to allocate scarce time to speculative research activities that more often than not do not result in a successful commercial outcome for the SME, this being the nature of research of this kind. So the researcher is left with no commercial reward, some funds that have usually just covered expenses, and a possible paper for publication subject to the confidentiality arrangements in place. Compounding this situation is the fact that typically the university's employee reward system does not recognise or reward this speculative/research-assistive activity in its criteria for promotion thereby creating a disincentive for the researcher to engage in it in the first place.

Thus Australia operates with a reward structure for individual researchers at universities that works against engagement with SMEs. This is a fundamental structural impediment to collaboration with SMEs for the purposes of research. Moreover the university itself is not rewarded for permitting its staff to allocate this speculative time. For those universities that are capable of attracting highly-competitive peer-reviewed funding such as NHMRC and ARC[2] funds the opportunity cost of attempting to work with SMEs on a substantial scale is generally too high. And for those universities that are not able to attract significant ARC funds the alternative is usually a much lower level of investment in research in general (Australian Bureau of Statistics, 2004).

In our view this approach has resulted in the following generalised observations:

- the perception by university researchers that SMEs have little money and little desire to invest in collaborative university-based research
- the perception by SMEs that universities are disinterested in engaging with SMEs
- the observations by both the SMEs and the university researchers that even when SMEs do wish to collaborate it is time consuming and costly to source the most appropriate university researchers and to establish the administrative arrangements to permit this to occur

[2] Australia has implemented useful granting programs, such as 'Commercial Ready' and 'ARC Linkage'. One of the more successful of these has been the TechFast program run by the Australian Institute of Commercialisation. However Australia has over one million SME's and these programs at best may involve several dozen companies a year. For there to be a profound shift in our investment in innovation in the private sector we need to implement policy that will harness whole sectors.

However the CRCSI's experience has been that by establishing a sound working structure under the auspices of the CRC, the SMEs tell us that:

- they are comfortable working across the various organisations because the CRCSI has created a 'neutral space with common purpose'
- they have learnt that university researchers can be trained to handle commercial-in-confidence issues
- they can see that the CRC Programme is making good progress in helping researchers understand the commercial imperatives of the private sector

But further progress is being severely hampered by the structural impediments already discussed.

2. The need to refine the overall strategy for managing innovation in Australia

Major Government research statements such as 'Backing Australia's Ability 1 and 2' and the National Research Priorities have certainly given greater cohesion to the science programs in Australia. However what is lacking is a sense of the balance that should be established through the investment of public funds across the continuum of different types of collaborative research to ensure optimum national benefit. The disparate decision-making bodies that allocate funds do not report uniformly to an over-arching authority that is charged with responsibility for regularly reviewing the strategic and tactical merit of these investments.

3. Measuring the impact of investments in science innovation and research

Over the past year the CRC Association in collaboration with DEST have developed a program to measure the impact of Australia's investment in the Cooperative Research Centre Programme. The Allen Consulting Report Group Report (2005) comprehensively sets out the performance of the programme against a set of well established criteria.

Further work is now being undertaken to develop an agreed set of performance measures that can be used in the future to assess the potential benefit of bids for new CRCs as well as monitoring the performance of existing CRCs, both individually and in aggregate. These initiatives are welcome and the results from them should be aggregated across parallel programmes (e.g. NHMRC Program Grants, ARC Centres of Excellence) to facilitate comparisons on research assistance to SMEs. It will also help better establish the level of national benefit that has been achieved.

RECOMMENDATIONS

1. Australia needs to unlock the significant potential of the latent pool of researchers in universities by establishing within universities the appropriate reward mechanisms for individual researchers to engage in speculative research with SMEs. These mechanisms could include; recognition in the promotion criteria for research conducted with SMEs (measured by the amount of funding provided by the SME), explicit recognition of the role played by researchers in helping with start-ups and spin-outs, and strengthening of the arrangements for sharing licencing royalties and equity arrangements.

2. Australia's universities need to be preferentially rewarded for engaging in SMEs. This can be achieved in equal measure by continued support for the CRC Programme, and by allocating an additional premium payment to universities through the block grants scheme for allowable revenue raised by the university through SMEs.

3. Australia would be well served if it were to establish a peak body to oversee the investment of public funding of science and innovation. This body should have before it a set of national performance measures that benchmarks performance against the objectives of the national strategies, continually monitors and refines the emphasis of the funding, contributes to the development of strategic thinking and policies, and tracks the corresponding investments made by other countries.

APPENDIX: THE SPATIAL INFORMATION INDUSTRY

A1. Spatial Information

Spatial information is any information that can be geographically referenced, that is describing a location or any information that can be linked to a location (ANZLIC, 2005). It describes the location (in three dimensions) of objects in the real world and the virtual world and describes the relationship between those objects (that is who their neighbours are, how large they are, when they were created and so on). In the past spatial information was typically hard-copy and mapped-based but it is now increasingly found in electronic form. Typical examples today include satellite and aircraft images, global positioning system outputs, computer based records, and visualization systems that display images of objects and their attributes (the nature of the object) in three dimensions, four dimensions (when making forecasts of location into the future or reviewing historic trends about the prior location of objects in the past). Spatial information is increasingly dynamic (that is constantly moving such as video images unlike old static maps), available real-time and available in mobile form.

A2. The Spatial Information Industry

During the late 1990's and early 2000's the Australian government undertook a review of the spatial information industry in Australia. It did so under the national program of rolling reviews of various industries that were designed to seek ways to improve the competitiveness of those industries. This program was known as the Industry Action Agenda program. In September 2001 the Spatial Information Actions Agenda report was published (Department of Industry Science and Resources (2001)). The activity generated by the review galvanised the various segments of the industry in Australia that had been hitherto operating under a number of disparate guises (such as surveying, land planning, remote sensing, global positioning, cartography and others) and acted as the catalyst for all to come together under the 'spatial information' banner.

In the four years following the review Australia established in short order a peak industry body known as the Australian Spatial Information Business Association (ASIBA) which now has over 500 members, created a professional body known as the Spatial Sciences Institute (SSI) which has over 2000 members, a peak research body called the Cooperative Research Centre for Spatial Information (CRCSI) comprising over 50 equity partners (over 40 companies, four universities, and eight government agencies from the federal and state jurisdictions), and consolidated the role of the peak government body for spatial information known as the Australian and New Zealand Land Information Council (ANZLIC) which represents all federal, state and territory jurisdictions in Australia and New Zealand.

These various bodies represent an industry and a science that has traditionally been responsible for describing the location of objects and the relationship between those objects, maps being the most obvious example. However, today the concept of spatial information is far more embracing. It includes anything that has a geographic location, either in reality like a car, or in the future, like a model of the climate. It can be static or mobile. It describes the shape, size, construction, nature of any neighbours, history and attributes of the object or thing whose location we are studying. It includes any non-spatial or textual information that is relevant to that object such as it name, description of its properties and so on.

The discipline of spatial information now includes cartography (traditional preparation of maps on paper or more recently in electronic form), remote sensing (such as satellite imaging), photogrammetry (use of photography for mapping or imaging), global positioning systems, geographic information systems (which are software systems for storing and analysing the vast amounts of electronic, spatial and related non-spatial information), visualisation systems (that depict static or dynamic map-based images), and web-based and telecommunications-based delivery of spatial information.

To illustrate the use of spatial information it is useful to note some of the more well-known applications; meteorology (using global imaging satellites), mining exploration (using airborne and satellite imaging), defence (such as satellite observation systems, and missile guidance), land titling (tracking land titles and certificates of ownership using geographic information systems), land surveying (using total stations that incorporate laser technologies and global positioning systems), emergency services including bushfire detection and monitoring (using aircraft mounted infrared tracking cameras), transport logistics (tracking goods and vehicles from point of departure to point of destination using global positioning systems and geographic information systems), monitoring the environment for natural resources, biodiversity, salinity, soil loss and forest clearing amongst others using the full range of technologies previously mentioned. The outcome of the application of spatial information is usually some form of information product from which the user can make a decision for further action (such as where to fight the bushfire). It is self-evident that spatial information is widely used. In fact Tomlinson (1993) estimated that in the state of Victoria, for example, at least 90 percent of government activity relied on spatial information.

The previous discussion highlights at once both the ubiquitous nature of the spatial information industry and its somewhat ill-defined boundaries. Defining the size and growth of this industry therefore presents some problems. Nevertheless the Department of Industry Science and Resources (2001) estimated the global spatial information industry to be up to $34 billion per annum in size and growing at a rate of up to 20% per annum. These figures need to be viewed with some caution. More reliable estimates are obtained by breaking out the more obvious segments of the industry. For example Gewin (2004) identified 140,000 organisations globally that use geographic information systems (GIS) world-wide and estimated that global market for GIS to be about $5 billion.

The Australian industry is currently estimated to be about $1.2 billion per annum and growing at about 12% per annum (Corporate GIS Consultants, 2004). Per capita the Canadian spatial information industry, for example, is four times more productive (Department of Industry Science and Resources (2001)) suggesting that there is substantial room for Australia to grow. The reasons for this are varied but include the fact that the Canadian government has had a policy of technology transfer from the government sector to the private sector for nearly three decades, has supported a nationally cooperative research initiative called GEOIDE since 1997 with over $50 million of government support under its National Centres of Excellence program, and has encouraged the development of several multinational companies with government support. By contrast Australia's industry is characterised by a large number of small firms, no home grown multinationals and has only recently commenced its national research initiative, the Cooperative Research Centre for Spatial Information.

There are typically three classes of providers in Australia's spatial information industry (RMIT University, 2002): the technology providers who develop and supply software, hardware, database and firm-ware systems, a sector that is dominated by large national and multinational companies; the data providers that capture, maintain and supply the raw data most of whom are Commonwealth and state government agencies; and, service providers who are typically small to medium enterprises that are Australian-owned and who value-add the data using the software, hardware, databases and firm-ware supplied by others usually under licence to the data owners.

The spatial information industry is seen by some as part of the information communications technology industry. By others it is seen as a value-adding technology that is intimately part of the industry that uses it such as mining, forestry, agriculture, transport and so on. Whatever way it is viewed it is part of the information revolution that is contributing in un-precedented ways to the global increase in electronic data and information. Dearne (2002) reports that Dr William Lewis a senior analyst in storage networks and devices for JP Morgan estimates that digital information will grow at 61 percent compound annual rate between 2001 and 2005. Clarke (2001) quotes IBM estimates of the amount of corporate data is doubling every 12 to 18 months but that only 15 percent of this data is codified for future retrieval (Knowledge Business, 2000). Clarke (2001) goes on to quote the OECD (1996) as observing that "*knowledge and information tend to be abundant; what is scarce is the capacity to use them in meaningful ways*". This comment is particularly meaningful for the spatial information industry because it is one of the primary functions of geographic information systems to codify data, making it independent of the individual and thereby much more readily retrievable. Thus in practice there is a growing gap between the volume of electronic data and our ability to meaningfully re-use it.

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ABOUT THE AUTHORS

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Peter is currently the Chief Executive Officer of the Cooperative Research Centre for Spatial Information. He was previously the Chief Executive Officer of the Geospatial Science Initiative at RMIT University where he managed the creation of RMIT's first spin-off company Spatial Vision Innovation Pty Ltd in 2000, a company that has grown to 25 staff and is operating profitably out of Melbourne. Prior to that he was the Chief Executive Officer of Natural Resource Systems Corporation, a business that was created out of the Victorian Department of Natural Resources and Environment during the Kennett government era of the 1990's. He is currently completing a doctorate of business administration at RMIT University that is examining the factors that operate to assist and impede innovation in the small to medium enterprise sector.

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Mary O'Kane is a company director and Executive Chairman of Mary O'Kane & Associates Pty Ltd, a company established in 2001 that advises governments, universities and the private sector on innovation, research, education and development.

Professor O'Kane was Vice-Chancellor and President of the University of Adelaide from 1996-2001 and Deputy Vice-Chancellor (Research) from 1994-96. She was also Professor of Electrical and Electronic Engineering within the University and now holds the title of Professor Emeritus.

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