The Value of Spatial Information

The impact of modern spatial information technologies on the Australian economy

Executive Summary

Prepared for the **CRC for Spatial Information**
& **ANZLIC – the Spatial Information Council**

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ACIL Tasman
Economics Policy Strategy

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Executive summary

The Cooperative Research Centre for Spatial Information (CRCSI) commissioned this study with the following terms of reference:

1. to establish the verified and quantified economic impact of spatial information to the Australian economy in 2006-07 year
2. to estimate the cost of inefficient access to data and identify the factors operating to create these inefficiencies
3. to consider the future prospects for spatial data to contribute to Australia's economic, social and environmental development goals.

We gratefully acknowledge the assistance of the Australian Government Department of Finance and Administration – Consultative Committee on Knowledge Capital – and the Queensland Department of Treasury – Office of Statistical Research – for reviewing the original brief.

Key findings

Aggregate economic impacts

The National Accounts do not capture the full extent of the spatial information industry.

- However it is conservatively estimated that industry revenue in 2006-07 could have been of the order of $1.37 billion annually and industry gross value added around $682 million.

The economic footprint of the spatial information industry is considered to be larger than this. Spatial information is increasingly being used in most sectors of the economy where it is having a direct impact on productivity.

This study found that in 2006-07 the accumulated impact of these direct impacts:

- contributed to a cumulative gain of between $6.43 billion and $12.57 billion in Gross Domestic Product (GDP)
  - equivalent to 0.6% and 1.2% of GDP respectively
- increased household consumption by between $3.57 billion and $6.87 billion on a cumulative basis
- increased investment by between $1.73 billion and $3.69 billion on a cumulative basis
- had a positive impact on the trade balance
  - exports were between $1.26 billion and $2.30 billion higher than they would otherwise have been

  - imports were between \$1.18 billion and \$2.23 billion higher than they would otherwise have been
- real wages by were between 0.60% and 1.12% than they would otherwise have been.

Other impacts

Beyond these results the spatial information industry also contributes to a range of public impacts, including biosecurity, environment and social benefits.

The case studies undertaken for this report revealed that spatial information has an important and increasing role in biosecurity. A recent example was the role that spatial information played in managing the spread of equine influenza virus in Australia in 2007.

The Department of Agriculture Fisheries and Forestry has estimated that costs of control and reduced production from pests and diseases could be as high as \$8 billion per year. The Productivity Commission estimated that the impact of an outbreak of Foot and Mouth Disease on GDP could be between \$2 billion and \$13 billion in the first year. The contribution of spatial information to implementing biosecurity programs could be in the order of hundreds of millions of dollars in some years.

The current and potential value of spatial information systems in natural resources management, water and carbon markets was not assessed for this report. However it is likely that this value is large both in economic terms as well as in terms of sustainability of natural systems.

The transport case studies in this report suggest that the use of intelligent transport systems could reduce greenhouse emissions by between 0.5 percent and 1.5 per cent estimated to be worth between \$50 million and \$150 million per annum assuming a carbon price of \$15 per tonne CO_2-e. These systems are heavily reliant on spatial information.

The spatially enabled National Carbon Accounting Scheme will provide significant support towards reducing net emissions of greenhouse gases. In terms of overall reduction in greenhouse gas emissions, the value of reducing emissions to 108% of Australia's emission levels in 1990 (Australia's Kyoto target) would be valued at around \$1.4 billion at current carbon prices.

There is therefore a sufficient body of evidence to suggest that the spatial information industry is delivering significant environmental and social benefits in addition to the economic benefits identified above. These benefits can be expected to increase significantly as spatial information systems are further integrated into the operation of water markets, carbon markets, natural resources management and environmental management and monitoring programmes more generally.

Cost of inefficient access to data

Constraints on access to data are estimated to have reduced the direct productivity impacts in certain sectors by between 5% and 15%. It is estimated that this could have resulted in GDP and consumption being around 7% lower in 2006-07 (around $0.5 billion) than it might otherwise have been.

Future potential

The contribution of spatial information is likely to increase as spatial information becomes a mainstream enterprise resource in government and business organisations and as it penetrates mainstream consumer markets.

Increased adoption and new applications in existing sectors could increase the direct impacts in some sectors by up to 50% over the medium term. However a larger impact is likely to be in new applications in a wider range of industries.

The scale of the future contribution will be driven by the policy environment in respect of data access and skills development, further innovation in existing and new applications, increased awareness in government and industry and, most importantly, future application of new innovations in business systems.

The report

This report is based on research and case studies in twenty two sectors of the Australian economy augmented by a literature review of international and Australian studies. For each sector, the direct impact of spatial information has been estimated under two scenarios.

In each sector, care has been taken to develop a realistic "counterfactual" to ensure that the direct impacts of spatial information are not overstated. These direct impacts have been applied to a general equilibrium model to calculate the aggregate impact of spatial information on the Australian economy.

Literature review of past research

There is a growing body of literature, both Australian and international documenting how business and government use spatial information, and the impacts it has had in specific sectors. The literature recognises the need for a systematic assessment of its overall impacts (Alexander, 2003). ACIL Tasman is not aware of any studies that have assessed the aggregate impact of spatial information on national economies.

Case studies and reviews

In the case study analysis, ACIL Tasman explored the level of impacts and extent of adoption of spatial information in the private and public sectors. These indicators, together with evidence from literature reviews and industry interviews, contributed to the estimates of the accumulated direct impact in each sector under two scenarios:

- a quantifiable 'lower bound' scenario (scenario 1) which reflects the impacts we have been able to *confidently* and *verifiably* quantify through the use of reliable statistics, existing literature, expert opinion and through our case studies
- a 'realistic' estimated scenario (scenario 2) which comes closer to what we believe to be the reality (as distinct from that which we can confidently quantify).

Some of the sectors and the basis for the estimates of the direct impacts are discussed below. The accumulated direct impacts are summarised in Table 1 at the end of this discussion.

Agriculture

Increases in productivity in broad acre agriculture of 10% can be attributed to controlled traffic farming using geospatial information systems (GIS), augmented global navigation satellite systems (GNSS) and automated steering. Adoption in Australia is estimated to be around 10% in 2006-07. These parameters were used to estimate the impact of spatial information in agriculture for scenario 1.

Use of spatial information in variable rate application, yield monitoring, whole farm planning, natural resources management and pest and disease management were taken into account in scenario 2.

Forestry

Spatial information systems are increasingly being used in both public and private forestry. Applications include inventory management, remote assessment of forest attributes yield estimation, canopy health mapping and operations management.

The integration of a spatial information system developed by NGIS – ForMS- into Great Southern Plantations' corporate systems has created a centrally located system for capturing, storing and tracking plantation activities. This has increased the area that can be managed by each manager by 50%.

It was estimated that there is 100% adoption of these technologies in hardwood plantations and around 2.5% of the area managed by the public forestry sector in both scenarios.

Fisheries

Spatial information is used for recording fishing tracks, fisheries management and habitat mapping. A case study of the commercial fishing industry indicated that GPS plotters had improved productivity of commercial fishing operations by around 12%. Allowing for levels of adoption and limiting this to the fin fishing industry this is estimated to have produced a 4% improvement in total factor productivity in the fishing industry in scenario 1.

The additional benefits in improved fisheries management and productivity improvements in the non fin fish industry are taken into account in arriving at the estimate of 5.14% improvement in total factor productivity for scenario 2.

Mining and resources

The mining and petroleum sectors have been using spatial information in exploration and in planning, developing and managing operations for many years.

In the coal industry spatially enabled robotic mining is delivering around 37% improvements in productivity at around a 9 % adoption rate in 2006-07.

Use of the spatial information application "Millmapper" in precious metals mining is estimated to have improved milling operations and generated costs savings of around 2.4% with an adoption rate of around 11%.

Spatial information also assists in the operation and upgrade of mines with 3D techniques improving management of faulting problems in coal mines and off-site fabrication of new equipment and in bulk commodities handling.

In the upstream petroleum industry, spatial information is improving site selection and management of infrastructure, lowering environmental compliance costs and supporting deep water off-shore oil and gas operations.

The geoscience and exploration communities were early adopters of spatial information using techniques such as 3D seismic and later airborne geophysics to identify and characterise potential commercial resources. A significant proportion of the major new minerals and petroleum projects established since the late 1970s were discovered with the aid of spatially enabled exploration techniques.

The additional production from oil (mainly condensate), gas and minerals (excluding coal) realised as a result of these technologies is estimated to be 3%, 5% and 7% respectively for the general equilibrium modelling in this report.

Property and services

This sector includes a key part of the 'core' spatial industry i.e. the surveying industry. However, there are also many other businesses that use new spatial information systems including advertising and market research (which now routinely use GIS packages), property, planning, engineering, architecture, retail and trade.

Spatial information has the potential to significantly enhance the speed of urban land and infrastructure development.

A case study based on the production of the land industry in WA indicated a productivity increase of around 61% arising from the use of new spatial information technologies by the surveying profession. This was the basis for estimating the 0.5% impact in scenario 1.

The impact of other applications, including technologies such terrestrial laser scanning for 3D surveying and improvements in route and site selection, has been taken into account in the 0.7% impact estimate in scenario 2.

Construction

Spatial information technologies are routinely applied in the construction industry to accelerate planning and design, coordinate contractors and sub-contractors, manage projects over multiple sites, and aid architects, engineers, fabricators during construction and in the maintenance phase.

Several case studies demonstrated the power of spatial information. Spatial information is reported to have delivered savings of around 10% in the East Link road project in Melbourne with 50% faster map production and 80% faster access to information. In another example, GNSS-enabled surveying and design when combined with automated machine guidance delivered costs savings to the Forbes Shire Council road works. Maintenance is also assisted by GPS and GIS mapping systems for recording repair requirements and managing maintenance.

A 10% improvement in productivity is estimated in the construction sector with and adoption rate of the order of 2.5% in scenario 1 and 5% in scenario 2.

Transport and storage

The transport and storage sector was one of the earlier adopters of spatial information technologies. The use of GIS and GNSS technologies has been steadily growing for about a decade and it is now one of the fastest growing areas of GIS deployment.

Productivity gains in this sector are attributed to improvements in logistics, route selection and itinerary planning, transport planning, vehicle tracking, traffic and congestion management, transport operations in rail and air and intelligent transport systems.

The estimate of 1.4% productivity improvement in scenario 1 is based on the observed applications in intelligent transport systems, including route planning and GNSS enabled freight management. The estimate of 1.58% in scenario 2 is based on observations of applications in GNSS in taxi location services, lower congestion and road hazard management, improved supply chain transport planning and in air navigation.

Utilities

The utilities sector – electricity, gas and water – are significant users of spatial information. The main benefits to this sector are in improved asset management, better management of supply and demand and in the planning and construction of new pipelines, power lines, generators and storages. The case studies of Melbourne Water and Ergon Energy confirmed that savings in asset management and planning are being realised.

The case study of a Hazwatch application illustrated the potential for innovation in the use of spatial data to improve the management of natural hazards by utilities managers.

In scenario 1, the 0.73% impact is based on improved asset management in the electricity and water sectors. In scenario 2, the 1.25% impact takes account of wider applications in water, gas and electricity including asset and operations management, market planning and hazard management.

Communications

Spatial information is used in the communications sector for network planning, asset management and address management and route planning in the case of postal services.

The productivity improvements in scenario 1 are based on estimates of improvements in asset management and network planning in telecommunications and GIS use in address management (0.98%). In scenario

2, the impacts of improvements in GNSS use in postal and courier services, telecommunications market analysis and targeted marketing (1.32%) is taken into account.

Government

Government is a major user of spatial information. Areas of application include geoscience, bathymetry, natural resources and environmental management, biosecurity, defence and security, air and sea navigation safety, search and rescue, land development administration, development approvals, environment protection, program management and administration, and policy formulation.

Spatial information is improving service delivery in all jurisdictions although there are only limited economic studies of the broader economic benefits. An economic assessment of the Western Australian Land Information System, demonstrated a benefit cost ratio of 9 to 1 to investment in coordination, capture and management of spatial data in Western Australia.

Case studies of the National Carbon Accounting Scheme and the National Water Audit undertaken for this report confirmed the importance of spatial information to policy formulation and management for climate change and water resources.

The case studies identify productivity improvements in administration of development approvals of around 7% in labour costs. The literature and case studies suggest that this is a conservative indicator of the improvement in administration in government services more broadly. A 50% adoption rate was assumed across all levels of government, leading to an estimate of a 0.34% productivity improvement in scenario 1.

In scenario 2, the 1.05% productivity improvement is based on observed – but not measured – improvements in asset management, service delivery more generally, infrastructure planning, defence, emergency services, risk management, biosecurity, compliance and regulation.

Other areas

ACIL Tasman's research also examined retail and trade, tourism and manufacturing. The take-up of spatial information in these areas is occurring but not as fast as in the sectors discussed above. No productivity shocks are included in scenario 1 while small productivity improvements are included in scenario 2.

Results

The accumulated direct impacts are summarised in Table 1.

Table 1 **Direct impact of spatial information on productivity and resource availability**

	Type of shock applied	Quantifiable scenario 1	Estimated scenario 2
Productivity shocks			
Grains (specialist growers)	Total productivity	0.93%	1.08%
Mixed (grain & sheep/cattle)	Total productivity	1.35%	1.50%
Sugar cane	Total productivity	0.11%	0.26%
Cotton	Total productivity	0.07%	0.22%
Other agriculture	Total productivity	0.00%	0.15%
Forestry	Total productivity	1.93%	1.93%
Fisheries	Total factor productivity	4.00%	5.14%
Construction	Total productivity	0.25%	0.50%
Business services	Labour productivity	0.50%	0.70%
Coal	Total factor productivity	0.21%	0.36%
Metal ores	Total factor productivity	0.16%	0.31%
Oil & Gas	Total factor productivity	0.15%	0.27%
Government	Labour productivity	0.34%	1.05%
Road Transport	Total productivity	1.40%	1.58%
Rail Transport	Total productivity	0.00%	0.45%
Air Transport	Total productivity	0.55%	1.04%
Other transport	Total productivity	0.00%	0.30%
Electricity/gas/water	Total productivity	0.73%	1.25%
Communications	Total productivity	0.98%	1.32%
Trade	Total productivity	0.00%	0.08%
Manufacturing	Total productivity	0.00%	0.02%
Other	Total productivity	0.00%	0.02%
Resource availability shocks			
Oil	Resource availability	3%	6%
Gas	Resource availability	5%	10%
Minerals nec	Resource availability	7%	14%

Data source: ACIL Tasman calculations and estimates

The aggregate model results are summarised in Table 2.

Table 2 **Aggregate impact of spatial information in 2006-07**

	Scenario 1				Scenario 2			
	Productivity only		Productivity plus resources		Productivity only		Productivity plus resources	
	%	$ billion	%	$ billion	%	$ billion	%	$ billion
GDP	0.51%	5.31	0.61%	6.43	0.99%	10.31	1.20%	12.57
Household consumption	0.50%	2.89	0.61%	3.57	0.93%	5.39	1.16%	6.78
Investment	0.51%	1.43	0.61%	1.73	0.98%	2.78	1.20%	3.39
Capital stock	0.56%	-	0.72%	-	1.05%	-	1.38%	-
Exports	0.45%	0.98	0.58%	1.26	0.80%	1.73	1.07%	2.30
Imports	0.39%	0.89	0.52%	1.18	0.72%	1.64	1.98%	2.23
Wages	0.50%	-	0.60%	-	0.92%	-	1.12%	-

Note: Scenario 1 is a 'lower bound' scenario which reflects the impacts ACIL Tasman has been able to confidently and verifiably quantify through the use of reliable statistics, existing literature, expert opinion and through case studies

Scenario 2 is considered a 'realistic' estimated scenario which is considered to be closer to the situation in 2006-07.

Data source: ACIL Tasman

Cost of inefficient access to data

In 2001, the Spatial Information Industry Action Agenda launched an ambitious program of policy reform for government and industry. The research undertaken for this report suggests that while progress has been made in some areas, success has been mixed.

Availability of fundamental data

Fundamental data includes data that is collected by agencies under public interest programmes and also data that is collected by agencies to meet specific agency purposes but may be made more widely available in the public interest (ANZLIC, 2001). Some fundamental data is created by the private sector (such as cadastral and some minerals exploration data) but captured by the public sector.

Some businesses consulted in the course of preparing this report, expressed a concern that Australia's competitiveness in this areas is being hampered by gaps in fundamental data relative to the quantity and quality of information available to some of their overseas competitors.

The consequences of gaps in fundamental data include:

- inefficiencies in planning for future infrastructure and redoing surveys to collect data that may have been captured previously at a low marginal cost
- less well informed policy formulation in natural resources management, environment and climate change adaptation

- lost opportunities for innovation and development of new products by the private sector
- less efficient planning and responses to emergencies such as bush fires and flooding
- lower efficiencies in developing faster development approvals and land management
- less opportunity for new approaches to asset management.

State governments are attempting to address fundamental data sets such as cadastre, topography, property, roads and geo-referenced imagery. Examples include the Shared Land Information Platform (SLIP) in Western Australia and the Spatial Information Exchange in NSW. However gaps in fundamental data remain.

Spatial data infrastructure

An essential component of a spatially enabled economy is the enabling infrastructure. With current technology, such infrastructure can be a virtual system that does not require the centralised storage of data. However, to work effectively, this requires interoperable architecture, based on distributed custodial spatial information management and open standards.

Consistent with this, one of the goals of the Spatial Information Action Agenda was the development of the Australian Spatial Date Infrastructure (ASDI). However many businesses, consulted in the course of preparing this report, consider that the ASDI – as it is currently implemented – falls short of providing ready and seamless access to spatial data. Although progress has been made in some important areas, spatial data collected, managed and disseminated at each level of government remains somewhat fragmented. For example, an independent study into the accuracy and currency of the metadata records of the Australian Spatial Data Dictionary (ASDD) found that the metadata was out of date and could not be used to convert to the new ANZLIC profile.

There are specific examples of world's best practice applications in spatial information management systems. The Queensland Spatial Industry Strategy (QSIIS), the Western Australian Land Information System (WALIS) and the Shared Land Information Platform (SLIP), the NSW Government Community Access to Natural Resources Information (CANRI) and the NSW Spatial Information Exchange (SIX), and the Victorian land and property information systems are good examples. However, overall progress towards whole-of-government approaches and engaging industry at state government levels has been mixed.

Australia's vision for the ASDI was built on the idea of multi-agency co-operation which in itself is difficult, as well as collaboration across different levels of government and between government and industry.

The lack of a consistent whole-of-government approach and the inadequate engagement between governments and industry has consequences for the growth of the spatial information industry.

Access to data

Consistency in access arrangement to fundamental data is crucial for its efficient use. ANZLIC has promulgated guidelines for best practice in enabling access to spatial information and hence spatially enabling the economy these guidelines are not being uniformly implemented across Australia.

Simple and effective access

An access arrangement should provide a simple, effective means of locating and obtaining spatial information.

For the widest possible access, custodians should offer a multi-faceted approach to delivery of information, catering for all types of users. This is not yet being achieved uniformly. On another front, digital rights management (DRM) is an area of interest, as the internet has become the centre of distribution for digital goods of all sorts, including spatial information.

Fitness for purpose

Users of spatial data must be able to easily ascertain the quality of their information and its ability to meet their requirements. In 2003 ANZLIC nominated the topic of 'data quality' as being one of five core issues still needing to be addressed as part of the ASDI development. In 2007, the study of NSW metadata found issues with the accuracy and currency of records surveyed. A major project is underway to update its records to comply with the ANZLIC modified implementation profile.

Spatial information quality has progressed considerably in recent decades in line with data transfer standards, with the introduction of international geographic data quality-related standards and the widespread adoption of metadata entry tools for the production of metadata for entry in searchable, web-based directories. However, the metadata remains in many formats and are currently not totally valid.

A national licensing framework

Custodians of spatial information must ensure that its distribution and use is in accordance with licences, agreements or other appropriate mechanisms that effectively manage the risks associated with the use of the information. The organisation acting as a data custodian is responsible for maintaining copyright provisions and ensuring that use of the information does not infringe any privacy or confidentiality requirements.

However current licensing practices have not kept up with the pace of technology.

An important development that is gaining widespread support in government is the development of a Government Information Licensing Framework (GILF). The GILF would be a standardised legal environment of terms and conditions within which all information transactions would occur.

A possible avenue of facilitating information sharing across jurisdictions is the Creative Commons licensing regime. Creative commons licenses are designed to facilitate and encourage more versatility and flexibility in copyright. The Queensland government, in consultation with other governments, has been developing a draft access regime based on this principle. An important feature of the proposed approach is its capability to enable licences to be executed at the time of data transfer. This will increase the efficiency of user access while at the same time achieving the above aims.

Pricing

Across and within levels of government there are differences in pricing and cost recovery policies. While governments adhere to the principles of cost recovery and competitive neutrality, individual agencies may interpret these principles in different ways.

Principles for pricing for fundamental data were set out by the Productivity Commission in a report released in 2001. The Australian Government implemented pricing principles in line with these recommendations in 2001. The impact on the dissemination of fundamental data from the Commonwealth was a dramatic increase over the following years.

However not all jurisdictions have implemented these policies and fundamental data is often issued at above the cost of its distribution. It is apparent that, in some cases, over-recovery of costs is occurring through the sale of value added spatial information by some government agencies.

Overall cost of inefficient access to data in 2006-07

Lack of completeness in policies relating to simple and effective access, fitness for purpose and development of a whole-of-government licensing framework are creating concern for spatial some information users.

The cost is in slower development of applications and less than optimal levels of application and innovation among users.

This is likely to have had an impact in the property and services, construction, government, transport and agricultural sectors. It is likely to have reduced the extension of spatial information into areas such as asset management in utilities, transport and storage applications and in emerging areas of consumer markets and applications in other industries.

The interviews and case studies in this report indicate that the biggest negative impact on productivity occurs in the areas of agriculture, transport, asset management and property and services. Productivity impacts in these sectors might have been between 5% and 15% lower as a result of these constraints.

This could have resulted in the impact on GDP and consumption being around 7% lower than it might otherwise have been under scenario 1 (Table 3).

Table 3 **Effect of constraints on Scenario 1 outcomes**

	Scenario 1 ex constraints		Scenario 1 with existing constraints		Effect of constraints on impacts
	%	**$ billion**	**%**	**$ billion**	%
GDP	0.61%	6.43	0.66%	6.91	7.5%
Household cons	0.61%	3.57	0.66%	3.83	7.3%
Investment	0.61%	1.73	0.66%	1.87	7.8%
Exports	0.58%	1.26	0.62%	1.34	6.3%
Imports	0.52%	1.18	0.55%	1.25	6.3%
Real wages	0.6%		0.64%		7.1%

Note: Based on impacts adjusted by the estimate of the effect of constraints on increased productivity shocks.
Data source: ACIL Tasman modelling using Tasman Global

These are broad estimates of the economic welfare loss arising from inefficient access to data. Policy formulation may benefit from more specific estimates of welfare losses from current arrangements, particularly pricing policies. This would assist agencies when building the business case for funding of future maintenance and dissemination of fundamental data sets.

Future prospects

The future prospects for the spatial information industry are promising both in the medium term (five years) and the longer term (ten years).

Medium term

The contribution of spatial information to future economic activity will continue to grow as awareness of its potential grows. Medium term growth is expected to be driven by the following factors:

- increased adoption in existing applications
- introduction of new applications
- increased penetration into non traditional sectors and new markets
- increased use by government in delivery of services.

It would not be unreasonable to expect that the adoption levels in some sectors would increase by up to 50% over the next five years with current policies in place.

It is also certain that adoption in low using sectors will also increase over the next five years – although the level and nature of the applications is hard to predict.

The importance to Australia in managing the challenges of climate change, water, energy, natural resources management and biosecurity are outlined in this report. Maintenance of defence, security and emergency management services is also highly valued by the community.

While it is not possible to quantify the value of the contribution that spatial information make to areas, this report suggests that the value of the contribution is as significant in as the economic impacts discussed in this report.

Spatial information technology is crucial for effective and better management of these challenges. There are many examples cited in this report that show how spatial information is now crucial to many important government services. This report shows that that the application of spatial technologies in these areas is increasing.

Overall, it is possible that with the right policies the contribution of the spatial information sector to the economic aggregates over the medium term could be up to 50% higher than in 2006-07.

Longer term

Important future developments in spatial information that are likely to further enhance its economic impacts in the longer term are:

- the falling cost of acquiring data
- continuing developments of computing power making more applications and richer data analysis possible
- the arrival of spatial technologies into the consumer mainstream.

These developments are likely to lead to:

- a transition from spatial information as project based applications to mainstream enterprise systems
- The emergence of a new phase in the evolution of spatial information into mainstream consumer markets and business systems.

This will be a step up in the role that the spatial information plays in the Australian economy. It is likely to significantly increase in the value of its contribution to economic, social and environmental outcomes.

This evolution of the spatial information industry is likely to enhance the transformation from information based industries to knowledge based industries in Australia. This will be a crucial development for sustaining the international competitiveness of Australian industries.

The spatial information industry is creating valuable options for Australian society – in economic, environmental and social terms. The risk is that some of these options could be extinguished through non optimal policies and programs.

Implications for research priorities

The contribution of spatial information could be increased by addressing research priorities in the following categories

- technologies to improve availability and access of data
  - fundamental data
  - data infrastructure
  - data access
- increasing the effectiveness of spatial technologies and addressing determinants of adoption rates in traditional areas including
  - agriculture
  - property and services
  - construction
  - utilities and asset management

  - transport
  - communications
  - biosecurity
  - environment
  - carbon and water trading
  - defence, security and emergency services
- developing technologies and techniques to support the move of spatial information into mainstream enterprise applications
  - integrating with management systems
  - exploring social and economic research applications
- developing technologies and techniques to support mainstream consumer applications
  - personal applications
  - locational systems
  - property and consumer information
  - public transport and infrastructure use.

These observations are a starting point for consideration of the research priorities.

A Terms of Reference

The Cooperative Research Centre for Spatial Information (CRCSI) commissioned ACIL Tasman in 2007 to conduct an independent quantifiable analysis of the value of spatial information to the Australian economy in the 2006-07 financial year.

The study had three objectives:

1. to establish the verified and quantified economic impact of spatial information to the Australian economy in 2006-7 year
2. to estimate the cost of inefficient access to data and identify the factors operating to create these inefficiencies
3. to consider the future prospects for the spatial data to contribute to Australia's economic, social and environmental development goals.

Several issues were relevant to this study:

- The study was to provide a firm figure for the total value of spatial information to the Australian economy.
- The study aimed to identify the key factors that are operating to prevent SI making an even larger contribution to the Australian economy and will therefore help provide a fundamental basis for the programs of the CRCSI rebid in 2008.
- The study needed to be conducted with the full rigour of a federal treasury study.
- The study was supported by ANZLIC, and the ASIBA Board. Its conduct in all phases was coordinated with each of these organisations. At the same time ASIBA conducted a parallel study with ACIL Tasman to explore a range of sector-specific case studies to demonstrate the impact of spatial information and technology (SI&T) on the national economy. It also identified constraints on the industry, such as skills shortage, privacy, data pricing and property rights, as well as a general unawareness about SI&T's diverse potential. The ASIBA report has been published as "Spatially Enabling Australia."

B Glossary

43pl	A consortium of some 50 companies working with the CRCI to foster spatial information innovation and learning
ANZLIC	Australian and New Zealand Land information Council aka “ANZLIC - the Spatial Information Council”
ASDD	Australian Spatial Data Directory
ASDI	Australian Spatial Data Infrastructure
ASIBA	Australian Spatial Information Business Association
CANRI	Community Access to Natural Resource Information (NSW)
CO_2-e	CO_2-equivalent : the equivalent in CO_2 of all greenhouse gasses
Competitive neutrality principles	Competitive neutrality principles ensure Government businesses face the same costs and commercial pressures that face their private sector competitors. National Competition Policy (NCP) competitive neutrality principles aim to remove the unfair advantage government agencies have when competing in the market place. The principles also remove the impediment to efficient resource allocation that had arisen from the regulatory advantage of government owned businesses.
CRCSI	Cooperative Research Centre for Spatial Information
Creative commons	Creative commons licenses are designed to facilitate and encourage more versatility and flexibility in copyright
DRM	Digital rights management
Fundamental data	Data that is collected by agencies under public interest programmes and also data that is collected by agencies to meet specific agency purposes but may be made more widely available in the public interest

GILF	Government Information Licensing Framework
Interoperability	Interoperability describes the ability to work together to deliver services in a seamless, uniform and efficient manner across multiple organisations and information technology systems.
Metadata	Metadata is structured data which describes the detailed characteristics of a data set.
NLWRA	National Land and Water Resources Audit
OCC	Online and Communications Council
Satellite account	An ABS method for measuring the contribution of industries that are defined by the demand for a service, in particular tourism and information and communication technologies
SDI	State and territory and local government spatial data infrastructure
SEAC	Spatial Education Advisory Committee
SIAA	Spatial Information Action Agenda, 2001
SLIP	Shared Land Information Platform, Western Australia
Spatial Information	Spatial information (SI) describes the physical location of objects and the metric relationships between objects
Spatial Information industry	The modern spatial information industry acquires, integrates, manages, analyses, maps, distributes, and uses geographic, temporal and spatial information and knowledge. The industry includes basic and applied research, technology development, education, and applications to address the policy, planning, decision-making, and operational needs of people and organizations of all types
SSI	Spatial Sciences Institute
WALIS	Western Australian Land Information System