Trends in the Development of the Australian Spatial Information Industry

Report to the

The Cooperative Research Centre for Spatial Information

The John Curtin Institute of Public Policy
Curtin University of Technology

Centre for Strategic Economic Studies
Victoria University

October 2009

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Executive Summary

This study reports on research undertaken by Curtin University of Technology and Victoria University on behalf of the CRC for Spatial Information (CRCSI). This involved:

- An examination of trends in the Australian spatial information industry; and
- An overview of industry perceptions of the present 'state of play' in the spatial industry in the context of technology developments and emerging issues in research and development.

The Australian Spatial Industry Survey

A survey of the Australian spatial industry was conducted by Curtin University of Technology and Victoria University on behalf of the CRCSI during November and December 2008. The respondents to the survey were from 43pl, the select group of research minded companies who are partners (and owners) of the CRCSI, and members of the Spatial Industries Business Association (SIBA).

By and large, this study focused on technology originators and providers in the private sector rather than on the public sector as key users. Responses were received from 65 companies which is a response rate of 13.6%. 43pl members comprised one-third of the respondents and SIBA two-thirds.

The survey asked organisations to respond to questions on activity, turnover, staffing, research and linkages. A summary of findings is as follows:

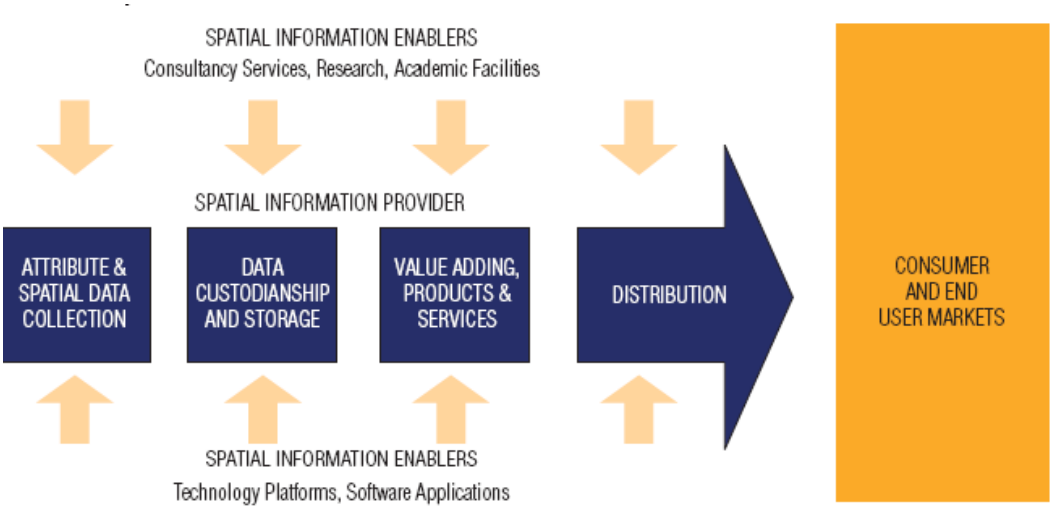
- Most firms surveyed were still involved in the core applications of spatial information, such as "Surveying" (60% of all firms) and "Cartography" (31% of all firms). However, the survey also confirmed the emergence of contemporary applications of spatial data systems in areas such as "Spatial data management" (34%) and "Spatial/Geomatics consulting services" (45%).
- Organisations surveyed operated across a number of market or industry segments, with 66% reporting activity in "Civil and Building Construction and Urban Planning and Land Development", followed by "Utilities – Electricity, Gas and Water" (46%) and "Land Titling and Administration" (42%).
- The median firm employed between 6 to 25 employees, with five organisations in the final sample employing over 200 people directly.
- Around 40% of firms reported total revenue of less than $1 million, while 30% of the sample had revenues between $1 to $5 million.
- The typical organisation had experienced growth in revenue of at least 20% in the previous years with 7.5% of the sample reporting growth in excess of 40%.
- Around 58% of all organisations surveyed spent less than $100,000 per annum on research and development, with a further 23% of organisations spending between $100,000 to $250,000 on research and development. A number of firms with revenue greater than $10 million spent over $1 million on research and development.

- Around 34% of respondents reported collaborating with the CRCSI on research and development issues, 26% collaborated with universities and around 26% reported collaborations with other Australian companies.
- Expenditure on research and development and collaboration on research was spread across a number of areas, including "Surveying" (43% of respondents), "Spatial Software Development" (28%) and "Spatial Data Management" (23%).

An analysis of this data in terms of product clusters was undertaken. In particular, the Research Team examined the output and research performance of organisations in view of the model of the industry developed as part of the ANZLIC Action Agenda.

This is outlined in Chart 1 below.

Chart 1 Spatial Information Value Chain



Source: ANZLIC Industry Development Standing Committee

Respondents were grouped into two categories that correlate with the Spatial Information Value Chain – *Data Acquisition* which included surveying, geodesy, navigation and positioning, precise positioning and remote sensing and *GIS/IT* firms which provide value adding products and services to the industry including cartography, the development of spatial software, spatial data management and web services. The findings from this analytical framework are outlined below:

- A clear majority of respondents (68%) were classified into data acquisition while the remaining 32% were classified into GIS/IT.
- The GIS/IT firms are on average slightly smaller than the data acquisition firms when measured by employment and wages and salaries. However, there are also a number of very large GIS/IT firms with 15% having more than 200 employees compared with only 5% of data acquisition firms.
- This comparison is most marked when comparing revenue, where 25% of GIS/IT firms have revenue greater than $10 million compared with only 16% of data acquisition firms. If the range mid point is used to approximate average

revenue then the average for GIS/IT firms is $4.2 million compared with $3.5 million for data acquisition firms.

- When the range mid point is used to approximate research and development expenditure the average for GIS/IT firms is nearly twice that of the data acquisition firms - $1.2 million compared to $666,000.
- Nearly 75% of all data acquisition firms indicated that the primary focus of the business was surveying. The predominant market segment occupied by the data acquisition firms is that of civil and building construction, urban planning and land development (81%).
- Two thirds of GIS/IT firms indicated that their primary focus of research is the development of spatial software (including customised software). Nearly half of all GIS/IT firms each indicated Government administration, asset and facilities management and utilities (electricity, water and gas) as their main market segments. Across all GIS/IT firms every market segment was included.

As a final adjunct to the above analysis, the Research Team compared these findings for the Australian industry with those from a 2004 survey of the Canadian geomatics industry. The key findings of this analysis is that the Canadian industry is: (i) larger than the Australian industry, (ii) dominated by more firms with greater scales and global business than their Australian counterparts and (iii) less reliant on a few key sectors than was the case in Australia. This comparison strengthens the case for the CRCSI in terms of its ability to build scale in the Australian industry and also provide a springboard for the conduct of linked research and product development.

Qualitative Research with Industry Participants

The Research Team also undertook 17 interviews with organisations in the spatial industry across Australia. This was done to provide an adjunct source of material to that collected through the survey questionnaire.

The key findings from this research were:

Current Industry

- Current firms largely emerged from traditional areas of land and mining surveying, although this was changing as the importance of spatial data in software applications across other market segments (e.g., energy, communications, constructions etc.) increased.

- Interviewees generally noted that the spatial information industry in Australia is still relatively small and fragmented. As a consequence, while Australians were good “early adopters” (“we buy stuff and put it together”), investment tends to be focused on single projects and “one-offs”.

- There is a growing rationalisation of the industry at the international level which affects Australian companies. It is expected that smaller players will begin to fall away or be bought out, with larger companies and emerging

firms increasingly relying on research and development, driven by customer demand, as a means of establishing competitiveness.

Technological Involvement and Applications

- Driving current industry trends is the emergence of spatial information technology as a cost-effective, ubiquitous and timely resource. Original GIS used to be very resource-intensive in terms of computing power and costs, requiring specialised systems, local computers and highly trained users. As computing performance has increased and costs decrease, GIS is now converging with general ICT. As an interviewee commented, "it's just one facet of a database now."

- Increasingly, this revolution is becoming "consumer-driven" as the emerging technology doesn't necessarily require specialist users — just general users who happen to use spatial systems. The most commonly cited example is the emergence of Google Maps/Google Earth, which was often cited as a good example of how the technology was being merged into applications. Apple's iPhone is another contemporary example being cited.

- These trends are driven by technological responses in the three key areas identified by the CRCSI:

    - **Location and Positioning:** The broad technological trend in location and positioning is "increased precision at reduced cost", not only in terms of the volume of spatial data now being generated but in reductions in the cost of data network start-up costs and advances in the rate at which data collection can take place. The interviewees emphasised that in the future, location and positioning underpins all spatial applications at the very fundamental level. This drives the need for an emphasis on improving the accuracy of GPS coded maps through investment in ground stations to allow more precise mapping.

    - **Data Capture and Feature Extraction:** Automatic feature extraction is a key trend. Typically, this task was once a very labour-intensive exercise. Scanners and other automatic remote capture devices will increasingly improve access and reduce costs. This trend continues to take place in conjunction with an improvement in image capture and data acquisition and the joining of this data to other data sets (e.g., infrastructure data) and the better utilisation of more accurate sensors in the real-time capture of spatial data. Data capture and feature extraction is now likely to become almost wholly 3D and very likely 4D (capturing changes in time).

    - **Spatial Infrastructure:** Spatial information is increasingly being treated like other data, that is, as a 'core' part of the business process.

The general perception was one of a growing convergence between spatial and general IT and business database processes.

Implications for industry

- The broad trends in the spatial information sector indicate an increasingly sophisticated array of data collection techniques and software applications for integrating spatial data into existing information systems. Several broad implications are identified for industry:

    - **Digitisation of Data Increases Competition and Reduces Costs:** Spatial data is increasingly collected using automated processes and vehicles (e.g., UAVs) and is now more often than not, digitised, thereby reducing costs.

    - **Convergence with IT Systems has Arrived:** Increasingly, Australian spatial information companies are managing the "embedding" of spatial information into existing business systems. As a result, spatial information will increasingly be managed by 'off-the-shelf' solutions provided by US and European companies with Australian-produced positioning and feature extraction technologies.

    - **Spatial Data Processes will Continue to Reduce Other Business Costs:** As spatial data becomes a common feature of business reporting, its impact on business costs will be increasingly felt.

    - **Business Processes are Being Revolutionised:** Spatial information also acts as an enabler for the emergence of new business processes, and indeed, the growing convergence of different types of processes. A good example of this is the development and rollout of Building Information Modelling (BIM), where the operational phase of a building is considered prior to its planning and construction in close alignment with the development of BIM, thus allowing companies to optimise not only over the period of construction, but also over a building's operational life.

    - **Increasing Importance of Applications:** Interviewees continually referred to Google Maps as being an important development in the next phase of development for the spatial information sector, namely, the development of applications arising from the use of spatial technology, rather than just the re-sale of traditional spatial data.

    - **Local Knowledge is Still Essential:** While becoming more prevalent, the complete automation of collection, analysis and presentation of spatial information in IT systems is unlikely to emerge in most applications soon. IT systems still often require a diverse range of spatial data sets (e.g., road and electricity network data) which require local knowledge and expertise to collate and finalise.

Policy Issues

Several key policy issues emerged from the interviews:

- **Government Data Access:** The spatial information industry still relies on government for the majority of its data, as one interviewee notes: "Eighty per cent of data originates in government, and only twenty per cent from a small group of large private businesses, mostly in the Oil & Gas and Mining sectors." Other interviewees noted that this mix is likely to change over the coming decade as spatial data systems become increasingly integrated with existing applications. It is critical that this data be of the highest quality, be easily accessible and be priced correctly.

- **Government Data Pricing:** A common view amongst interviewees was that government data had already been funded, and as the fixed cost of collection was incurred, it made sense for the Commonwealth and state governments to provide data for free, where pricing impeded use of the data.

- **Private Data and Intellectual Property Ownership and Protection are Concerns:** A recent High Court decision is seen by several interviewees as being significant. The Court found that the State Government could not use surveyors' plans without fairly remunerating copyright owners, in this case, consulting surveyors. However, the problem of collecting royalties on such material remains. This issue continually presents itself in the new digitalised industry, with private companies often receiving little protection against re-use of mapping or spatial data presented to government, even if a third party uses this data at a later date.

- **Coordination is Critical:** From a policy perspective, technology development is not this issue in this spatial information industry. However, agreements on standardisation are needed, as well as policy agreements to share data between agencies and with business. Australia should ensure that it plays a role in the emergence of global standards on spatial information, as these will facilitate the export of software and services.

- **Education is Important:** A number of interviewees stated that the relatively healthy condition of the Australian economy implied that there was great competition for students that are graduating from Australian universities with the right skill set and that as a result of shortages, a lot of the work is being exported overseas. Graduates in technical areas are often competing with much cheaper labour elsewhere; their real value should come from "problem solving using

spatial applications" and "value-adding" through the creation of new business models.

Industry Perspectives on the CRCSI

- The commonly held view amongst interviewees was that the CRCSI does a good job of advertising the industry's capacity and selling policy to government and has made a contribution to research and development in the industry. Interviewees stated that the CRCSI had succeeded in funding a series of smaller research projects over its life and through its 43 PL partners.

- Two critical issues for the CRCSI, as identified by industry included:

    - **The Need for a Research Focus:** Some noted that perhaps the CRCSI's research agenda would be better served through the sponsorship of fewer, larger projects that either focused on key technologies for data collection and feature extraction (e.g., the DEM project on coastal mapping) or on applications in specific sectors, notably mining and petroleum resources and utilities.

    - Interviewees were aware of the emerging 'five' industry focus of the CRCSI's re-bid: Health; Defence; Energy & Utilities; Agriculture, Natural Resource Management & Climate Change; and Sustainable Urban Development. Industry was generally supportive of this group, although areas such as Transport and Logistics and Construction and Facilities Management were also viewed as having potential.

    - **The CRCSI as a Coordinating Body:** One of the implications and for that matter, contributing factors, of the Australian spatial industry's fragmentation was that it tended to be "risk averse" when compared to companies in Europe and the US in terms of data management and research and development. The Australian industry instead depends upon government and universities for much of its large-scale R&D, with other development tending to be smaller scale and dependent upon projects.

Key Findings

The analysis in this report has several key findings for the CRCSI.

Key Trends

- The application of spatial information technology has the potential to continue to be hugely transformative in Australia. This can be gleaned from the work undertaken by ACIL Tasman and the Allens Consulting Group.

- The industry is being globalised. International companies, which provide completely new products and services, have emerged as new multi billion dollar companies in the space of only a few years.

- Spatial information is increasingly being packaged with other IT data. However, this should not imply that the study of spatial information systems and technology is not a corpus of knowledge in itself, but rather that this investigation is now taking place in the context of other developments in information systems and as part of a convergence of IS where data from related functions can be shared across a common platform.

Australian Industry Overview

- The Australian industry has remained in the business–to– business market segment, largely building on established surveying and engineering platforms. They are almost all professional services firms, providing spatial information services for a range of clients.

- The core area of surveying continues to thrive, business, having adopted aspects of the new SI technology to improve the services they have traditionally provided.

- Some firms have taken the process further by marrying data management tools to their knowledge of surveying and engineering to establish 'blended businesses' in which IT services account for half or more of total revenues.

- There is a group of companies which commenced with the proposition that specialist information held by government utilities or departments such as in the form of hard copy maps could form the basis of new businesses that provided this information in digital form, generally integrated with other geo–coded information, to a range of clients. The founders of these companies had a deep knowledge of the specialist information either from engineering or IT perspective. These businesses have developed in a number of directions.

- Another, although much smaller, group of companies is devoted to specialist positioning services such a control traffic farming and remote sensing. This includes a company which uses drones for remote controlled aerial photography.

- A key opportunity for the CRCSI in the expansion of a wide variety of GIS based decision support systems. This can be expected to be particularly the case for network owners, from utilities to transport and other disaggregated systems. The increasing technological ability to deliver corporate GIS tools to remotely located staff is an important part of this value proposition.

Interaction with the CRCSI

- There was broad support for the operations of the CRCSI, its research programs and its proposed re-bid.

- The survey results and reports from qualitative interviews indicated that companies had views on three critical elements of the function of the CRCSI:

  - ***Research:*** Companies were generally impressed with the research track record of the CRCSI. The CRCSI was seen to act as something of a 'force multiplier' where commonalities could be established and exploited. Respondents indicated a view of the technology and industry in general that reflects well on the CRCSI's proposed research plan of five key areas: Health, Defence, Energy & Utilities, Agriculture, NRM and Climate Change, and Sustainable Urban Development. There was an indication that other areas may also be worth emphasising, including Logistics and Architectural Design Facilities Management, given their well established connection to spatial technologies and applications.

  - ***A Broader Role for the CRCSI:*** Companies stated that the CRCSI could conceivably exercise a much broader role in connecting with industry. For instance, industry viewed the CRCSI as playing a critical role in the debate about property rights to spatial information. Essentially, industry requested a 'deeper' involvement of the CRCSI at all stages of the research/product cycle, including, in the context of the global financial crisis, assistance with planning for sourcing external funding for product development.

  - ***An Education and Training Role for the CRCSI:*** One theme to emerge in recent years for all CRCs is the need for research and intellectual property transfer to take place via training and education programs. Interviews with industry identified this as a potential area for the CRCSI in further promoting its research agenda. In particular, two opportunities were identified: (1) the incorporation of spatial information processes into existing course and (2) a stronger linkage to business information systems.

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1. Introduction

The CRCSI for Spatial Information (CRCSI) was created as an unincorporated joint venture business with a partnership of over 50 organisations from the corporate, government and university sectors from around Australia. It works in close partnership with peak organisations such as the Spatial Industries Business Association (SIBA), Australia and New Zealand Land Information Council (ANZLIC), PSMA Australia Ltd and the Spatial Sciences Institute.

The CRCSI facilitates the collection of knowledge from a broad base of participants to accelerate the growth of industry–generated intellectual property and to better position the research and education programs of universities.

As part of its mission, CRCSI has already commissioned a number of studies into the impact of the spatial information sector on Australia. Most recently, it appointed ACIL Tasman (2008) to undertake a study into the economic impact of the spatial information industry in Australia.[1] That study finds that the current economic impact of the spatial industry in Australia is equal to a cumulative gain of between $6.43 billion and $12.57 billion in Gross Domestic Product (GDP), equivalent to between 0.6% and 1.2% of GDP. The study uses quite conservative estimates for the value of the industry, based on proposed productivity shocks to various sectors of the economy.

A 2008 report by Allens Consulting finds the benefits from improvements in just one aspect of spatial information collection and delivery – global navigation satellite systems (GNSS) – would deliver benefits in three key industries (Agriculture, Mining and Construction) equal to between $829 and $1486 million in 2008, with potential gains of between $6,675 to $12,636 million by 2030.[2]

ACIL Tasman uses various data sources from the middle of this decade to arrive at a series of scenarios for key sectors. Their report also notes that there is potential for spatial information to be used to unlock further benefits (an additional 50% in some cases) in its existing applications as well as future returns from the development of new applications. They identify four priority areas through which research would provide benefit to the Australian economy:

- Generic issues: fundamental data, data infrastructure, positioning infrastructure, data access.
- Increasing adoption of established technologies
- New applications and mainstream enterprise systems
- Mainstream consumer markets

[1] ACIL Tasman (2008) *The Value of Spatial Information*, Prepared for the CRCSI for Spatial Information and ANZLIC– the Spatial Information Council, retrieved from: http://www.CRCSI.com.au/UPLOADS/PUBLICATIONS/PUBLICATION_324.pdf

[2] Allens Consulting Group (2008) *Economic Benefits of High Resolution Positioning Services,* A report prepared for the Victorian Department of Sustainability and Environment and the Cooperative Research Centre for Spatial Information, retrieved from: http://www.crcsi.com.au/UPLOADS/PUBLICATIONS/PUBLICATION_348.pdf

This report examines the role that research and development will play in maximising these benefits.

Objective of the Present Study

Following the ACIL Tasman research, the CRCSI commissioned the present study to:

- Examine trends in the Australian spatial information industry; and
- Provide an overview of industry perceptions of the present 'state of play' in the spatial industry in the context of technology developments and emerging issues in research and development.

This study provides an overview of recent global developments in the spatial information industry, presents a 'snapshot' of the Australian industry in late-2008 and reports findings from interviews with key stakeholders in the Australian industry. Finally, this report provides findings on the implications of this research for the CRCSI.

The report details the breadth and capabilities of the Australian geospatial industry and its potential to realise the full gains obtainable from the use of this technology.

The authors would like to thank the CRCSI for the opportunity to conduct this research, in particular. Peter Woodgate, Mike Ridout and Phil Collier for their advice and support. Special thanks should also go to SIBA (especially Jack de Lange) for their assistance with the survey and to all the survey companies and interviewees for participating in the research.

Specifically, the report provides a better understanding of the fundamentals of the Australian spatial information industry, including:

- **Data on the Australian Industry through a Survey:** Chapter 2 reports on a survey of companies that operate within the industry and provides statistics on: turnover; employee numbers; skill levels; demographics; management structure and styles; and industrial relations systems. This section also reports on the research activities of companies in the sector.
- **Industry Perceptions:** Chapter 3 provides evidence from interviews with key personnel from 17 organisations across Australia on trends in technology applications and research and development in the spatial information sector.
- **Key Findings:** Chapter 4 comments on the overall thrust of R&D management in the spatial information sector in Australia in view of the CRCSI's proposed research structure.

2 The Australian Spatial Information Industry Survey

2.1 Introduction

The survey was conducted by Curtin University of Technology and Victoria University on behalf of the CRCSI during November and December 2008. The respondents to the survey were drawn from either 43pl, which is a select group of research minded companies who are partners (and owners) of the CRCSI, and or, members of the Spatial Industries Business Association (SIBA). By and large, this study focused on technology originators and providers in the private sector rather than on the public sector as key users.

Responses were received from 65 companies which is a response rate of 13.6%. 43pl members comprised one third of the respondents and SIBA two thirds.

The aim of the survey was to gain a current profile of the spatial industry in Australia in terms of company size, revenue, revenue growth, core business products and services, major market segments, research collaborations and the focus of research. A copy of the survey questionnaire is available in Appendix A.

This chapter has three parts. The first provides a broad overview of the industry based on the survey results. In the second the results of the survey are further analysed by clustering the respondents according to their core spatial products and services and also examines this clustering in view of work undertaken by ANZLIC. The final part provides a comparison between the results of the Australian survey with that for Canada conducted in 2004 by Statistics Canada.

2.2 Overview

Core spatial information products and services

Respondents were able to indicate more than one option for the core spatial information products and services offered by their firms. These product areas were determined using industry standards and in consultation with the CRCSI.

Surveying is the prevailing service as it is being offered by 60% of firms responding to the survey. Cartography is offered by 31% of firms which shows the predominance of these two core areas of the spatial industry. The majority of firms who do not offer surveying services offer software development and spatial data management services and include firms with revenue greater than $10 Million. The information technology (IT) aspect of the industry is shown by the percentage of firms offering spatial data management (34%), spatial software development (28%) and web services (24%). Consulting services were offered by 45% of firms while the technically complex areas of geodesy, navigation and positioning and precise positioning (incl. controlled track farming) were offered by only 9% of firms.

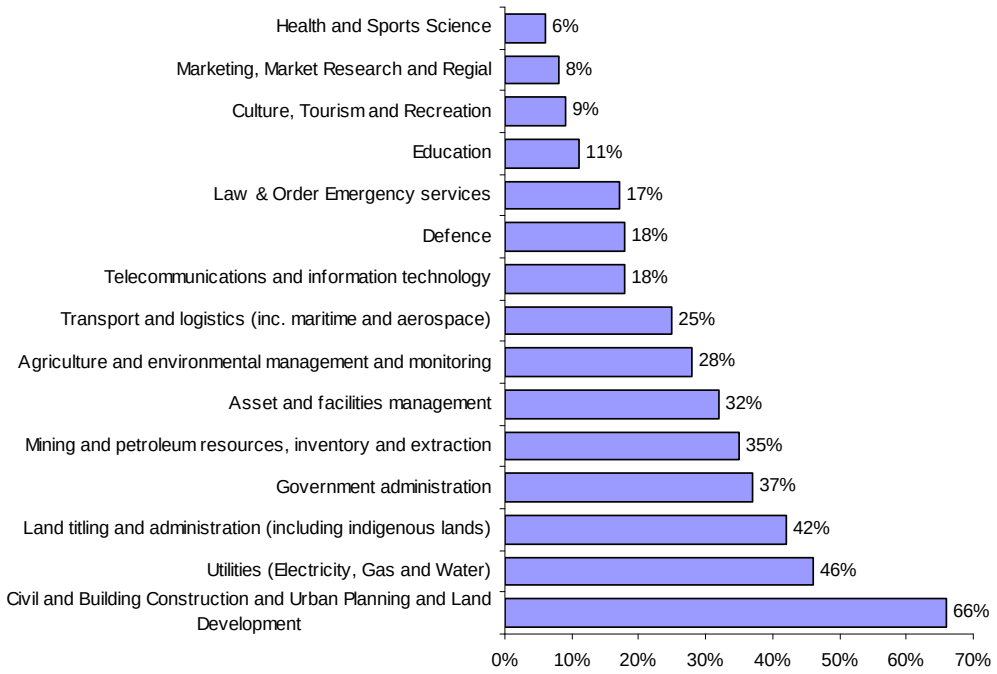
Table 2.1: Core Spatial Information Products and Services

Core Spatial Information Products and Services	Percentage of Firms
Surveying	60%
Cartography	31%
Geodesy navigation and positioning	9%
Precise positioning (including controlled traffic farming)	9%
Remote sensing (airborne and satellite)	15%
Development of spatial software (inc. customised software)	28%
Spatial data management	34%
Web services	24%
Spatial/Geomatics consulting services	45%
Other	15%

Market segments for core spatial products and services

Again, respondents were able to indicate more than one option for the market segments for the spatial information products and services offered by their firms. The largest market segment is civil and building construction and urban planning and land development with 66% of respondents operating in the segment.

Chart 2.1: Market Segments for Core Spatial Products and Services

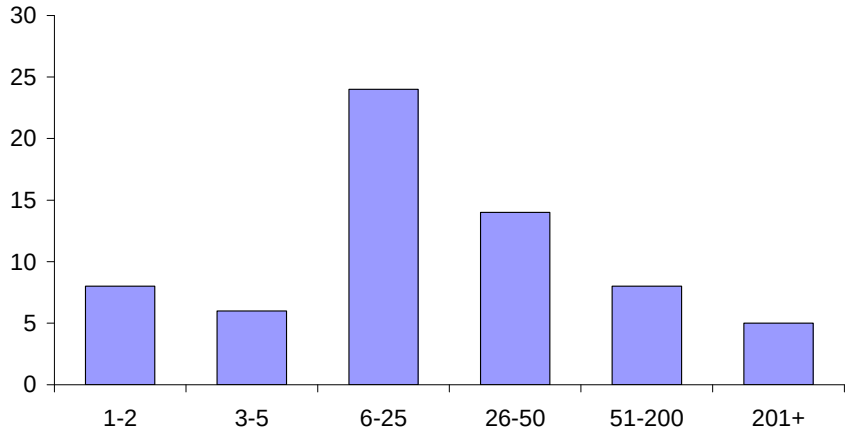


Nearly half of respondents (46%) work with the gas, electricity and water utilities and 42% with land titling and administration (including indigenous lands). The market segments with least number of respondents were health & sports science, marketing, market research & retail and culture, tourism & recreation.

Average number of full-time employees

During the previous financial or calendar year 21% of respondents indicated that there were between 1 and 5 full-time equivalent employees or contractors working at their firm and a further 37% had between 6 and 25 employees. Therefore, 58% of firms would be classified as small, which is having 25 or less employees, while 34% would be medium sized firms with between 26 and 200 employees and the remaining 8% are large firms with more than 200 employees.

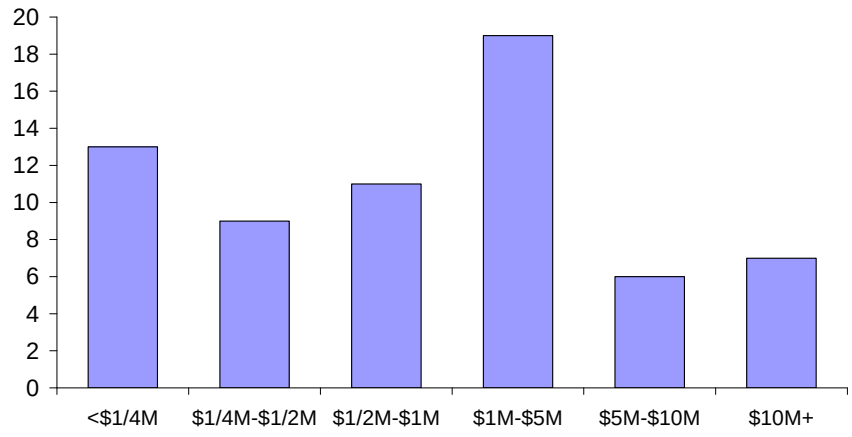
Chart 2.2: Firm Size by Employee Numbers



Total salary costs

Total salary costs, including on-costs were between $1 million and $5 million for 29% of firms. Nine per cent of firms reported salary costs of $5 million to $10 million and 7 firms had salary costs of over $10 million. At the other end of the scale 20% of firms reported salary costs of less than $250,000 and a further 31% had salary costs of between $250,000 and less than $1 million.

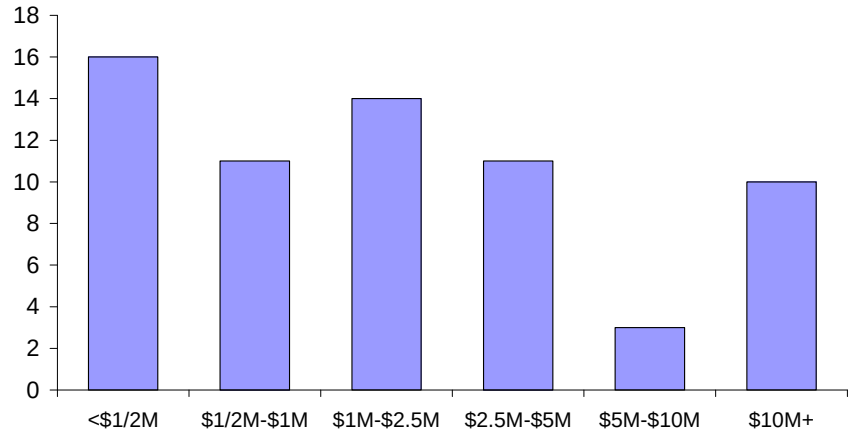
Chart 2.3: Wages and Salaries Costs



Total operating expenses

More than forty percent of firms reported that their total operating expenses were less than a million dollars and 32% between $1 million and $5 million. In fact 80% of firms had operating expenses of less than $5 million. Conversely there were 10 firms that reported operating expenses greater than $10 million.

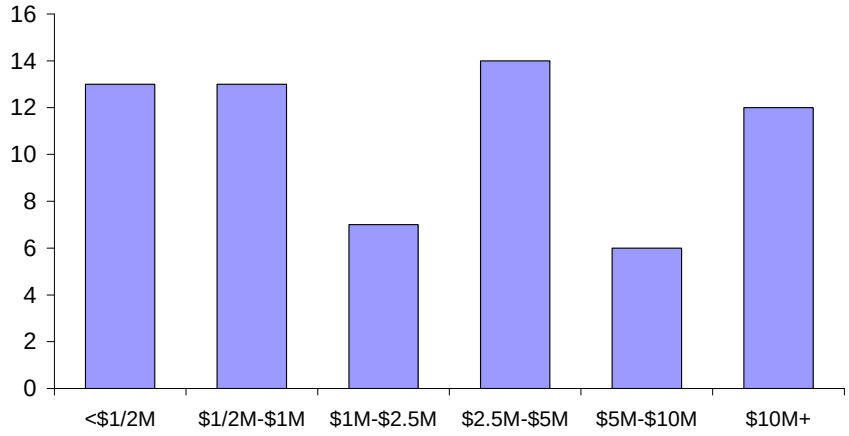
Chart 2.4: Expenses



Total revenue

Forty percent of firms reported total revenue of less than $1 million and over 30% of firms had revenue of between $1 million and $5 million. However, 18% of firms reported revenue greater than $10 million which indicates that the spatial information industry is highly diverse with many small and medium size participants and several larger players in terms of revenue.

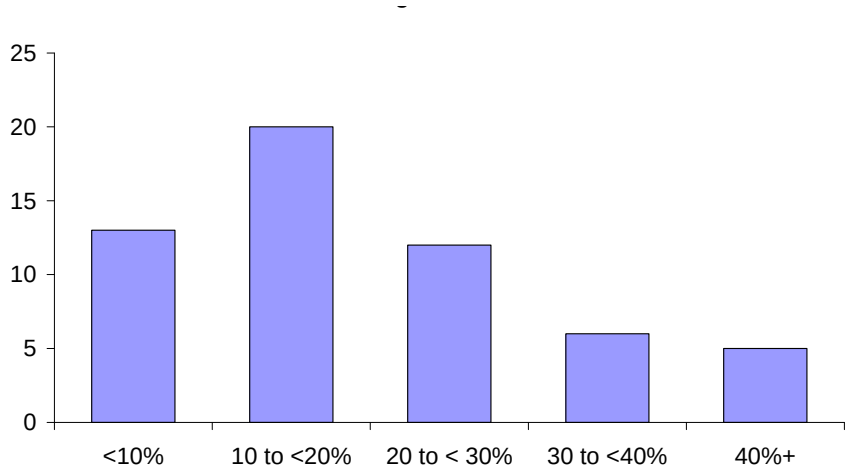
Chart 2.5: Revenue



Average revenue growth

The chart below shows the average annual revenue growth over the last three years. The industry has been performing well with annual average revenue growth greater than 10% for the majority of firms (77%). Thirty six percent of firms reported average revenue growth of between 10% and 20%, with a small number (5 firms or around 7.5%) reporting growth of over 40%. These very high growth firms typically had 6 to 25 employees and revenue of less than $1 million. It should be noted that not all firms supplied an estimate of the revenue growth.

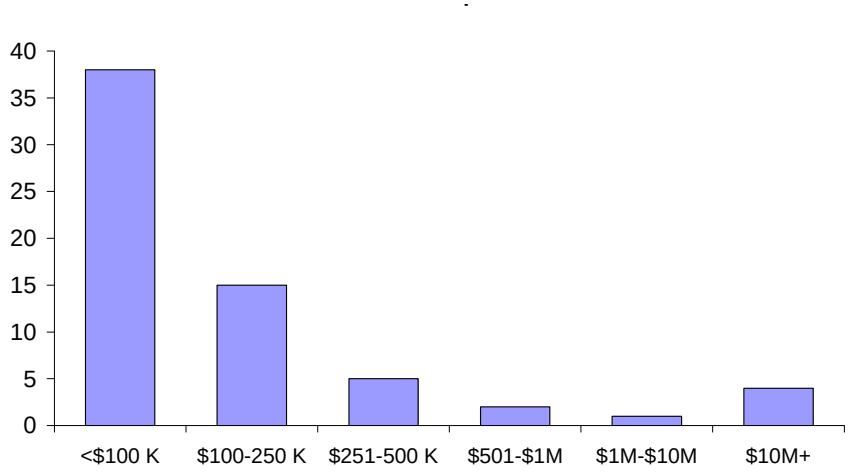
Chart 2.6: Average Revenue Growth



Expenditure on research and development

Expenditure on Research & Development (R&D) was less than $100,000 per annum for the majority of firms in this survey (58%) and a further 23% of firms spent between $100,000 and $250,000. There were however, a few firms that spent more than $1 million on R&D. These firms typically had more than 200 employees, revenue greater than $10 million and included software development as a core service.

Chart 2.7: R&D Expenditure



Research and development collaboration

Respondents to the question of which organisations they had collaborated with on R&D were able to indicate more than one option. Table 3.2 shows that 34% of firms had collaborated with the CRCSI whilst 36% of firms did no collaborative research or no research. Universities and an Australian company were the second most popular research partner (26%) followed by an overseas company (11%). Eleven per cent of firms indicated that they had R&D collaborations with State and Territory Government Departments, such as Victoria's Department of Primary Industries, while the Federal Government and the CSIRO were collaborators with 6% and 3% of firms respectively. This indicates that firms within the spatial industry prefer collaborations with universities, both in Australia and overseas, or within the CRCSI which has distinct and particular industry expertise.

Table 2.2: Organisations with which the Spatial Industry Collaborates on R&D

Collaborator	Percentage of Firms
CRCSI	34%
University	26%
CSIRO	3%
Federal Government Department	6%
State and Territory Government Department	11%
Australian Company	26%
Overseas Company	11%
Overseas research agency (e.g. University)	9%
None	36%

Focus of research and development

Respondents were able to indicate more than one option for the areas of focus of their research and development. Over half of all firms indicated that their main areas of research and development were surveying and cartography. The majority of firms that focus on surveying did so within the civil and building construction, urban

planning and land development and land titling segments of the market. Up to one third of firms indicated that their research had an IT focus in the areas of spatial software development, spatial data management and web services.

Table 2.3: Focus of Spatial Industry Research and Development

Focus of Research & Development	Percentage of Firms
Surveying	43%
Cartography	12%
Geodesy navigation and positioning	6%
Precise positioning (including controlled track farming)	6%
Remote sensing (airborne and satellite)	12%
Development of spatial software (including customised software)	28%
Spatial data management	23%
Web services	17%
Spatial/Geomatics consulting services	14%
Other	14%

Summary

In summary, over half of all respondents' core products and services originate in the traditional area of surveying. The major market segments are civil and building construction; electricity, gas and water utilities; and land titling and administration. Over 50% of all firms have 25 or less employees and an annual wages and salaries bill of less than $1 million. Forty percent of firms have annual revenue of less than $1 million and a further 11% less than $2.5 million. Annual revenue growth has been strong with 57% of firms experiencing growth of between 10% and 30% over the last three years.

The impact of the global financial crisis on Australian firms is uncertain, but promising, given the Australian economy's resilience and early recovery. This gives cause for cautious optimism. Two factors which may shape the industry in coming years are the pace of the global recovery from the financial and economic crisis and the impact of this development on the value of the Australian dollar (valued at 92 US cent at writing), whose recovery makes Australian 'off-the-shelf' products relevatively expensive compared to their international competitors.

The majority of firms (58%) spend less than $100,000 on research and development which is primarily focused on surveying as well as spatial software development and data management. The main collaborators for R&D are the CRCSI, universities, both in Australia and overseas, and Australian companies.

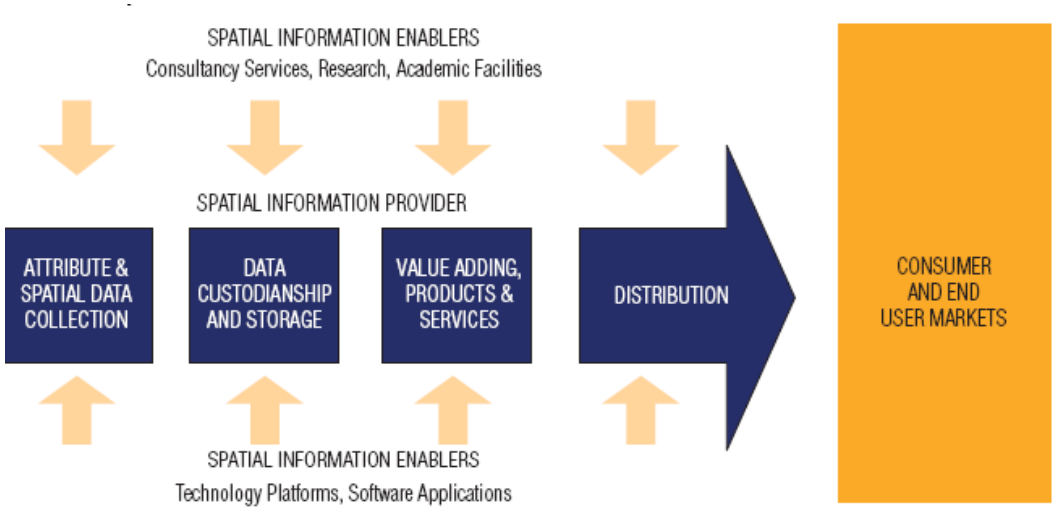
2.3 Sector Cluster Analysis

The ANZLIC Action Agenda divided the spatial industry between the core of surveying services and a broader industry which included specialist equipment and software:

> "The core of the spatial information industry is still the *Surveying Services* industry class (ANZSIC 7822), which also includes aerial photography, satellite imaging and mapping. The broader industry also includes firms that develop and market specialist equipment and software for use by the rest of the industry, and firms that integrate spatial technologies with communications and information technology." (ANZLIC Action Agenda 2001)

ANZLIC use this distinction in its presentation of the spatial information value chain (see Chart 2.8 below). The first stage of the value chain is 'attribute and spatial data collection', then 'data custodianship and storage' followed by 'value adding, products and services'. These stages of the value chain reflect a focus in the firms surveyed on the first and third, 'data acquisition' and 'products and services', with most of the former in surveying and the latter largely in software and other IT services. Accordingly in order to further analyse the data, the respondents were grouped into two categories that correlate with the Spatial Information Value Chain – *Data Acquisition* which included surveying, geodesy, navigation and positioning, precise positioning and remote sensing and *GIS/IT* firms which provide value adding products and services to the industry including cartography, the development of spatial software, spatial data management and web services.[3]

Chart 2.8 Spatial Information Value Chain



Source: ANZLIC Industry Development Standing Committee

The clear majority of respondents (68%) were classified into data acquisition and the remaining 32% were classified into GIS/IT.

The table below provides a comparison of the size characteristics of the major sectors. The GIS/IT firms are on average slightly smaller than the data acquisition firms when measured by employment and wages and salaries. However, there are

[3] The product categories which respondents were asked about are listed in question 2 of the industry survey. See Appendix A below. Companies providing "spatial/geomatics consulting services" were classified to "data acquisition" or "GIS/IT" according to the nature of their specialisation.

also a number of very large GIS/IT firms with 15% having more than 200 employees compared with only 5% of data acquisition firms.

This comparison is most marked when comparing revenue, where 25% of GIS/IT firms have revenue greater than $10 million compared with only 16% of data acquisition firms. If the range mid point is used to approximate average revenue then the average for GIS/IT firms is $4.2 million compared with $3.5 million for data acquisition firms. Similarly, when the range mid point is used to approximate research and development expenditure the average for GIS/IT firms is nearly twice that of the data acquisition firms - $1.2 million compared to $666,000.

Table 2.4: Firm Characteristics

	Data Acquisition	GIS/IT
Number of firms	63	20
Employment size		
25 or less	58%	60%
26 to 200	37%	25%
200+	5%	15%
Wages & Salaries		
<$1 million	49%	55%
$1 million to $10 million	44%	25%
$10 million +	7%	25%
Revenue		
<$2.5 million	49%	55%
$2.5 million to $10 million	35%	20%
$10 million +	16%	25%
R&D		
<$100,000	70%	30%
$100,000 to $1 million	23%	60%
$10 million +	7%	10%

The following section discusses each of the sectors in turn.

Data Acquisition Firms

Nearly 75% of all data acquisition firms indicated that the primary focus of the business was surveying. Twenty-one per cent of firms also indicated that remote sensing (airborne and satellite) was the focus of their business followed by precise positioning (including controlled track farming), geodesy navigation and positioning, and cartography at 14%.

Further analysis of the data show that 58% of data acquisition firms would be classified as small, that is having 25 or less employees, while 37% would be medium sized firms with between 26 and 200 employees and the remaining 5% are large firms with more than 200 employees. This is also reflected in the wages and salaries paid over the last year. Forty nine per cent of firms had wages and salaries of less

than $1 million, 44% were between $1 million and $10 million and 7% were more than $10 million.

Given the large number of firms with less than 25 employees it is not surprising that 49% of firms had revenue of less than $2.5 million while a further 35% had revenue of between $2.5 million and $10 million. The 5% of large firms accounted for 16% of revenue amongst the data acquisition firms. Average revenue growth over the last three years was 17% but this ranged between a low of 1% and a high of 50%.

Sixty per cent of data acquisition firms indicated that their primary focus of research is surveying, 17% remote sensing and 10% precise positioning (including controlled track farming). Several firms also indicated that they had an interest in the development of spatial software and spatial data management. However, expenditure on R&D is low but this is not surprising given the average size of data acquisition firms. Seventy per cent of firms spend less than $100,000 on R&D. The large firms spend more than $10 million on R&D and a further 23% of firms spend between $100,000 and $500,000. Forty three per cent of the data acquisition firms indicated that they did not collaborate with any other parties for R&D. The most frequently noted collaboration partners were other Australian companies, the CRC for Spatial Information and universities.

The predominant market segment occupied by the data acquisition firms is that of civil and building construction, urban planning and land development (81%). One third of firms worked within the land titling and administration (including indigenous lands) segment, 24% with agriculture and environmental management and monitoring and 19% with asset and facilities management and utilities (Electricity Gas and Water).

GIS/IT Firms

The vast majority (80%) of GIS/IT firms indicated that the primary focus of their business is spatial data management. Development of spatial software (including customised software) and web services were the focus for 65% of GIS/IT respondents.

There is a higher proportion of both larger and smaller GIS/IT firms than data acquisition firms. Data for the GIS/IT firms show that 60% of firms would be classified as small, that is having 25 or less employees, while 25% would be medium sized firms with between 26 and 200 employees and the remaining 15% are large firms with more than 200 employees. This is also reflected in the wages and salaries paid over the last year. Fifty five per cent of firms had wages and salaries of less than $1 million, 25% were between $1 million and $10 million and 25% were more than $10 million.

Given the large number of firms with less than 25 employees, as expected 55% of firms had revenue of less than $2.5 million while a further 25% had revenue of between $2.5 million and $10 million. The 15% of large firms accounted for 25% of

revenue amongst the GIS/IT firms. Average revenue growth over the last three years was 21% but this ranged between a low of 5% and a high of 50%.

Two thirds of GIS/IT firms indicated that their primary focus of research is the development of spatial software (including customised software). Half of the firms expressed an interest in spatial data management and 28% in web services. However, expenditure on R&D is higher than that spent by the data acquisition firms. The large firms spend more than $10 million on R&D and a further 60% of firms spend between $100,000 and $1 million. Thirty per cent of firms spend less than $100,000 on R&D.

The most frequently noted collaboration partners were the CRC for Spatial Information, other Australian companies and Universities. About one quarter of the GIS/IT firms indicated that they did not collaborate with any other parties for R&D.

Unlike the data acquisition firms, the GIS/IT sector does not primarily focus on one market segment but rather on multiple segments. Nearly half of all GIS/IT firms each indicated Government administration, asset and facilities management and utilities (electricity, water and gas) as their main market segments. Across all GIS/IT firms every market segment was included.

2.4 Comparison with Canadian Spatial information Survey

Canada and Australia generally provide good comparators. As countries, Canada and Australia have much in common. There is a shared cultural heritage and similar governmental institutions, living conditions, and levels of technology. Australia's population of about 21 million is about 60% of Canada's. Both have high living standards although Canada's GDP per capita is marginally higher than Australia's.

However in the context of spatial information the challenges and drivers have even more in common. Both are lands of vast distances and rich natural resources. Each country is sparsely populated with a population density (population per square kilometre) of only three. Exports of agriculture and mining products account for about 35% of total exports of goods in both countries. The need to accurately map remote locations and infrastructure is similar as is the demand from natural resource companies for spatial information services. Differences in industry characteristics may be pointers to future directions.

In 2004 Statistics Canada conducted a survey of the Canadian Geomatic Industry in conjunction with Natural Resources Canada (NRCan).[4]

The target population for this survey was all Canadian establishments involved in the production of geomatics products or the delivery of geomatics services. The frame

[4] Natural Resources Canada 2006, *2004 Geomatics Industry Census Survey Results,* Canada: Natural Resources Canada.

constructed for the survey included all establishments on the Business Register (BR) coded to either NAICS 541360 (Geophysical Surveying and Mapping Services) or NAICS 541370 (Surveying and Mapping (except Geophysical) Services). The questionnaire was sent to 4,202 establishments and 1,249 (30%) completed the questionnaire (Statistics Canada 2004). The data from the survey is to be used by NRCan to determine the competitive position of the industry and its needs in terms of federal government policies and programs.[5]

By comparison the survey conducted by Curtin University of Technology and Victoria University on behalf of the CRCSI during November and December 2008 was forwarded to about 480 companies of which 65 completed the questionnaire (a response rate of 13.6%). The respondents to the survey were from the 43pl (one-third of all respondents) and members of the SIBA (two thirds of all respondents).

The larger sample and response rate in the Canadian survey reflects the advantages of "official" data collection in terms of both sample sizes and response rates.

A basic summary and comparison between the two studies can be found below:

Summary of the Canadian Geomatics Industry 2004

- 2,221 geomatics establishments
- 67% of establishments are engaged in surveying and 35% in mapping and cartography
- 70% of firms have less than 10 employees
- There are bout 23,200 employees primarily located in Alberta (31.6%), Ontario (24.2), Quebec (21.2%) and BC (13.6%)
- 55% of employees are engaged in surveying and 12% in mapping and cartography
- In 2004 revenue reached CAD$2.8 billion which was an increase of 16% from the previous year
- About CAD$1 billion of revenue was from the oil and gas sector
- 400 geomatics firms exported goods and services worth CAD$442 million in 2004
- The geomatics industry contributed CAD$2 billion to GDP in 2004
- Total R&D expenditure was $97 million, approximately 3.5% of total turnover per annum
- Obstacles to R&D include; cost of technology, lack of skilled personnel, access to capital/financing, lack of market demand and lack of marketing capabilities

Summary of the Australian Spatial Industry

- Over half of all respondents' core products and services is the core area of surveying

[5] Statistics Canada, 2004, *Methodology Report on the Geomatics Industry survey, 2004*, Canada: Statistics Canada.

- The major market segments are civil and building construction, electricity, gas and water utilities and land titling and administration
- Over 50% of all firms have 25 or less employees and an annual wages and salaries bill of less than $1 million
- About 29% of employees are in New South Wales, 20% in Queensland, 18.7% in Western Australia and 17.3% in Victoria (SEAC 2007).[6]
- Forty percent of firms have annual revenue of less than $1 million and a further 11% less than $2.5 million
- 57% of firms have experienced revenue growth of between 10% and 30% over the last three years
- The majority of firms (58%) spend less than $100,000 on research and development which is primarily focused on surveying as well as spatial software development and data management
- The main collaborators for R&D are the CRCSI, universities, both in Australia and overseas and Australian companies.

The primary purpose of this section is to explore the similarities and differences between the results of the two surveys. The two classifications NAICS 541360 (Geophysical Surveying and Mapping Services) or NAICS 541370 (Surveying and Mapping (except Geophysical) Services) used by Statistics Canada appear to be compatible with the general membership of 43pl and SIBA for the Australian survey. It should be noted that some of the differences in responses may be due to the fact that the surveys were conducted in different years – Canada in 2004 and Australia in 2008.

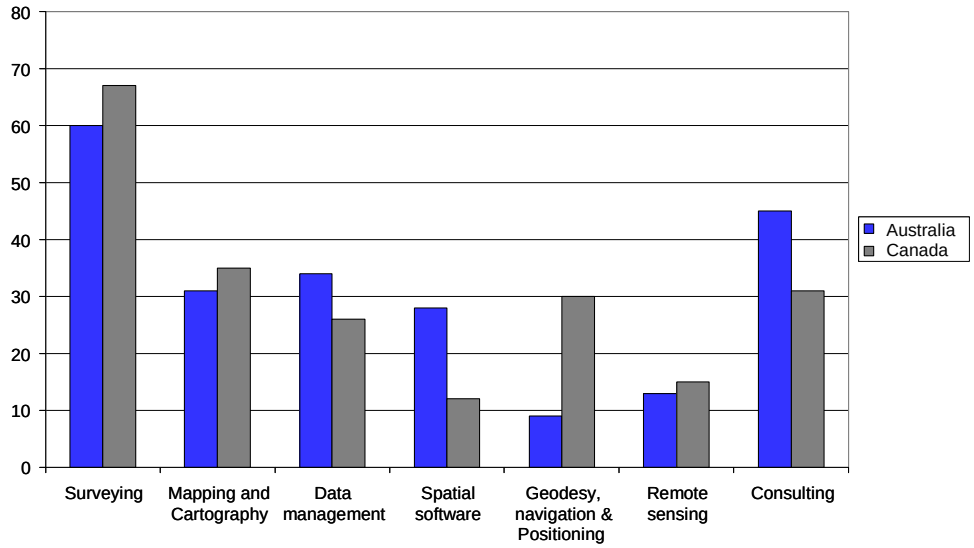
The geomatics industry in Canada is composed mainly of small firms with 97% of establishments having less than 100 employees (Natural Resources Canada). The Australian survey shows that 80% of firms had less than 50 employees indicating that the spatial industry is also mainly composed of small establishments. In Australia 7% of firms had more than 200 employees and in Canada 3% of establishments had more than 100 employees.

Chart 2.9 shows that the main products and services offered by both countries have a similar profile. In Canada 67% of establishments are engaged in surveying and 35% in mapping and cartography. 26% per cent of Canadian establishments are engaged in geospatial data management and 12% in the development of geospatial software. The Australian survey shows that 60% of firms indicated that surveying is a core product or service. Cartography is offered by 31% of firms which also shows the predominance of these two core/traditional areas of the spatial industry in Australia. The information technology (IT) aspect of the industry is shown by the percentage of firms offering spatial data management (34%), spatial software development (28%) and web services (24%). The two countries differ in the number firms that offer geodesy, navigation and positioning and consulting services. Only 9% of firms in Australia offer geodesy, navigation and positioning compared with 30% of Canadian

[6] SEAC, 2007, *The Spatial Information Industry in Australia,* Canberra: SEAC

establishments while 45% of Australian firms offer consulting services only 31% of Canadian establishments do. Some of the differences in responses may be due to the fact that the surveys were conducted in different years – Canada in 2004 and Australia in 2008, and that the higher proportions in data management and spatial software in Australia may reflect a trend over time for spatial information firms to be more engaged in IT.

Chart 2.9: Main products and services offered by Australian and Canadian firms



The Canadian survey provides information on revenue by market segment where as the Australian survey asks the participants to indicate their main market segments. Oil and gas is by far the largest market segment in Canada accounting for 36% of revenue. If geology and mining is added it is 45% of revenue. This is followed by property (including housing) and engineering and construction at 26%. While mining and petroleum resources, inventory and extraction is a market segment for 35% of Australian firms the largest is civil and building construction and urban planning and land development at 66%. Utilities (electricity gas and water), and land titling and administration (including indigenous lands) are market segments for over 40% of Australian firms, but utilities account for only 3.5% of Canadian revenue. Health has the least number of respondents in Australia and the least revenue in Canada.

Total industry revenue growth was substantial for Canadian establishments. Revenue is estimated to have increased by 13% in 2003 and 16% in 2004 to CAD $2.8 billion. The Australian industry has been performing well with annual average revenue growth greater than 10% for the majority for firms (77%). Around 36% of firms reported average revenue growth of between 10% and 20%. Five firms reported growth of over 40%.

On a per firm basis, large establishments (100 or more employees) spend the most on research and development (R&D) with about CAD $300,000 per firm in Canada. Smaller firms spend less on a per firm basis and are less inclined to be innovative. In

Australia expenditure on R&D was less than $100,000 per annum for the majority of firms in this survey (58%) and a further 23% of firms spent between $100,000 and $250,000. There were however, a few firms that spent more than $1 million on R&D. These firms typically had more than 200 employees, revenue greater than $10 million and included software development as a core service.

Most of the funding for R&D in Canada was from a parent, affiliated or subsidiary firm. In Australia, the main collaborators for R&D are the CRCSI, universities, both in Australia and overseas, and Australian companies.

3. Interviews with the Australian Spatial Information Industry

3.1 Introduction

As an adjunct to the Australia-wide survey of 480 companies in the spatial information industry, the Project Team conducted interviews with managers from 17 organisations across Australia.

This exercise was undertaken to gauge industry perceptions of trends within the current context and its assessment of future trends in both technology and the shape of the industry. The interviews also examined other key issues relating to the overall policy environment in Australia, and finally, also dealt with companies' views of the activities, and desired future direction, of the CRCSI.

The list of interviewees can be found in Appendix B.

This section outlines the findings of this research, while ensuring that all comments are cited anonymously.

3.2 The Current Industry

By and large, the surveyed companies reflected the overall composition of the industry within Australia. Typically they emerged from an historic surveying or resources background, although companies were also pursuing applications of spatial information technology in areas as diverse as energy infrastructure control and facilities management. This latter group reflects the other emerging trend within the industry, namely the emergence of companies who specialise in managing publicly available data on infrastructure and utilities.

This cross-section tends to correspond to the findings of the survey which indicate that the Australian industry is still emerging from the core survey and cartographical areas, albeit at an increasingly rapid pace. Interviewees tended to focus on the application of "well-established spatial technologies to a dedicated problem" or through their role in the consulting area.

Interviewees generally noted that the spatial information industry in Australia is still relatively small and fragmented. As a consequence, while Australians were good "early adopters" ("we buy stuff and put it together"), investment tends to be focused on single projects and "one-offs", with little long-term research and development taking place outside of firms with niche products or in the context of the CRCSI. As a consequence, the global market tends to dictate trends in Australia, aside from niches of strength such as Mining and Petroleum Resources.

According to interviewees, there is a growing rationalisation of the industry at the international level which affects Australian companies. It is expected that smaller players will begin to fall away or be bought out, with larger companies and emerging firms increasingly relying on research and development, driven by customer demand, as a means of establishing competitiveness.

3.3 Technological Involvement and Applications

Driving current industry trends is the emergence of spatial information technology as a cost-effective, ubiquitous and timely resource. The original GIS used to be very resource intensive in terms of computing power and costs, requiring specialised systems, local computers and highly trained users. As computing performance has increased and costs decrease, GIS is now converging with general ICT. As an interviewee commented, "it's just one facet of a database now."

The price for spatial data today is at "20 per cent of what it was five years ago", mainly driven by technology changes that allow for more rapid handling of larger volumes of data. Skills that before were "man-made" have today been built into the software packages.

Increasingly, this revolution is becoming 'consumer-driven' as the emerging technology doesn't necessarily require specialist users — just general users who happen to use spatial systems. The most commonly cited example is the emergence of Google Maps/Google Earth, which was often cited as a good example of how the technology was being merged into applications, with Apple's iPhone being another contemporary example being cited. At present however, the cost of mapping/feature extraction and therefore the requirement for specialised mapping services has precluded the emergence of Google from being a key threat. Rather, the industry has benefited from the attention now being paid to spatial data. Nevertheless, Google is often held up as an example of the type of platform that could emerge in the industry — "remote mapping/feature extraction (via satellite) coupled with centralised search and correspondence with related data sets."

These trends are driven by technological responses in the three key areas identified by the CRCSI: Location & Positioning; Data Capture & Feature Extraction; and Spatial Infrastructure.

Location and Positioning: The broad technological trend in location and positioning is "increased precision at reduced cost", not only in terms of the volume of spatial data now being generated but in reductions in the cost of data network start-up costs and advances in the rate at which data collection can take place.

Examples of this trend include the deployment of precise positioning services in sparsely populated regional areas, where the available technology can be characterised as "thin infrastructure." This has application to regionally located industries such as Mining and Agriculture. To some extent, this followed the tele-

communications boom of the mid-1990s, which saw the widespread adoption of mobile technology after a decade of development. This enabled the development of logistics systems which allowed for "equipment and products to be located and potentially monitored over computer networks."

The interviewees emphasised that in the future, location and positioning will underpin all spatial applications at the very fundamental level. This drives the need for an emphasis on improving the accuracy of GPS–coded maps through investment in ground stations to allow more precise mapping.

Increased precision in location and positioning, ultimately coupled with other sources of spatial data, allow for "'real-time tracking at the micro-scale" – in other words, "more data, more of the time."

Data Capture and Feature Extraction: Automatic feature extraction is a key trend. Typically, this task was once a very labour-intensive exercise. Scanners and other automatic remote capture devices will increasingly improve access and reduce costs.

This trend continues to take place in conjunction with an "improvement in image capture and data acquisition and the joining of this data to other data sets (e.g., infrastructure data)." Another emerging feature is that of the better utilisation of more accurate sensors in the 'real-time' capture of spatial data, possibly through satellite technology, but in the meantime through the use of UAV.

Data capture and feature extraction is now likely to become almost wholly 3D and very likely 4D (capturing changes in time). The upshot of this improvement in technology is: better quality images; greater access to corresponding data sets; and real-time updating of spatial data.

Spatial Infrastructure: Spatial information is increasingly being treated like other data, that is, as a 'core' part of the business process. As one interviewee put it:

> GIS is essential to business decision making. Business decisions tend to be based on the presentation of material which is generally enhanced by the inclusion of geographically-based information. This requires business information to be geo-coded, integrated with other data sources and accessible. The key processes are: data → access → integration → presentation.

This observation highlights again, the nature of convergence of spatial and general IT and business database processes. All in all, integration among all the fields and different areas is where spatial information is likely to be heading.

3.4 Implications for Industry

The broad trends in the spatial information sector indicate an increasingly sophisticated array of data collection techniques and software applications for integrating spatial data into existing information systems. Several broad implications are identified for industry:

Digitisation of Data Increases Competition and Reduces Costs: Spatial data is increasingly collected using automated processes and vehicles (e.g., UAVs) and is now more often than not, digitised. These improvements in technology, together with the "globalisation" of data coding, have dramatically reduced the cost of handling spatial data.

One interviewee cites the example of a recent contract in Australia for spatial information production for an 'orthophoto' of a regional area in New South Wales was awarded at a price of $55,000 (2008), or just 40 per cent of the 2004 equivalent price of $140,000. The principal reason for this cost reduction was the use of relatively cheap labour in India at the image development and rendering stage. The concern is that having sourced Indian expertise to overcome skill shortages in Australia during the mining and resources boom, Australian companies will now be increasingly forced to continue to use Indian resources to remain price competitive.

A similar story can also be told for software and applications development, where coding tasks are increasingly being outsourced to other centres, such as India, Indonesia and Malaysia.

Convergence with IT Systems has Arrived: Increasingly, Australian spatial information companies are managing the "embedding" of spatial information into existing business systems. As one interviewee stated:

> …my view has changed over the past 4 years. Spatial is no longer 'special'. Just like the 'voice' industry — it is not an industry — it is just a subset of IT.

A common analogy is that of the "melting pot" of IT fields, where spatial is no longer viewed as being a separate, exclusive business process. Again, Google Maps/Google Earth is the cited example of how IT companies are emerging as players in the spatial sector, with other examples including Oracle's incorporation of spatial analytics into its suite of programs. The other commonly cited example is the role played by engineering consultancies in integrating spatial data into other IT/IS analysis.

Increasingly, spatial information will be managed by 'off-the-shelf' solutions provided by US and European companies such as Autodesk and often, domestically-produced positioning and feature extraction technologies, that together, result in the "commoditification" of spatial information. Facilitating this change is the integration of spatial data with other IT systems. There is also a growing role for the creation of 'middle-ware' and consultancy/training by Australian companies that

provide customised solutions for spatial information collection and management in conjunction with an overall data management program.

Spatial Data Processes Will Continue to Reduce Other Business Costs: As spatial data becomes a common feature of business reporting, its impact on business costs will be increasingly felt. The ACIL Tasman study[7] provided a broad overview of the likely impact of spatial data on business processes. The interviews for this study provided a number of pertinent examples of how surveyed firms are delivering value for their customers:

- The use of 3D spatial data in identifying utility infrastructure indicated that this approach allowed for easier identification of underground structures than traditional survey techniques. The example provided was an underground power line that was missed under conventional surveys, but which was correctly identified using 3D surveys;
- The use of spatial systems in facilities management has significant implications for cost control and cost reduction in this area. By way of example, one interviewee highlighted its involvement with a tenant, where work on facilities using spatial data had resulted in a $3m saving on their lease of $30m – in other words, 10% savings from the use of spatial information in this instance.

Business Processes are Being Revolutionised: Spatial information also acts as an enabler for the emergence of new business processes, and indeed, the growing convergence of different types of processes. The interviews provided a good example of this in the development and rollout of Building Information Modelling (BIM), where the operational phase of a building is considered prior to its planning and construction in close alignment with the development of BIM. BIM will allow companies to model and even prototype work settings before construction even begins, thus allowing them to optimise not only over the period of construction, but also over a building's operational life. This will ensure that the industry benefits from not only a reduction in wastage in construction (often 5% of costs) but also 'slimmer' operating costs from buildings designed with good facilities management practice in mind.

Increasing Importance of Applications: Interviewees continually referred to Google Maps as being an important development in the next phase of development for the spatial information sector, namely, the development of applications arising from the use of spatial technology, rather than just the re-sale of traditional spatial data. As one interviewee stated:

> …end-consumers are not buying GIS solutions, they are buying solutions to their problems. Too often, remote sensing and GIS are solutions looking for problems. The real litmus test for the 'industry' will now come: What happens when the money dries up? How important is spatial to companies?

[7] See ACIL Tasman (2008), *op cit.*

> The current mining boom hasn't had the impact on spatial that it did in the past – mining companies are often using Google or Virtual Earth — for free: they are asking why they should pay for GIS.

This captures an important feature of the competitive landscape facing spatial information technology companies. The issue is magnified further in areas where demand is driven by the retail consumer, where technology interface becomes an essential part of the application's capacity to generate revenue.

Local Knowledge is Still Essential: While becoming more prevalent, the complete automation of collection, analysis and presentation of spatial information in IT systems is unlikely to emerge in most applications soon. IT systems still often require a diverse range of spatial data sets (e.g., road and electricity network data) which require local knowledge and expertise to collate and finalise.

3.5 Policy Issues

Several key policy issues emerged from the interviews.

Government Data Access: The spatial information industry still relies on government for the majority of its data, as one interviewee notes: "Eighty per cent of data originates in government, and only twenty per cent from a small group of large private businesses, mostly in the Oil & Gas and Mining sectors." Other interviewees noted that this mix is likely to change over the coming decade as spatial data systems become increasingly integrated with existing applications.

It is critical that this data be of the highest quality, be easily accessible and be priced correctly. So governments have to increasingly think about not only the collection of data but also the 'platform' on which it is released to the public and the pricing policy that determines public access. In this context, interviewees were generally appreciative of the Western Australian Government's initiative in developing the SLIP system.

Data security is emerging as a key issue in spatial information. It is critical for all types of infrastructure data, even for social infrastructure such as schools and TAFEs. To some extent these concerns are typical of most types of digital data, but given the very extensive and in cases, sensitive, nature of spatial data, they are emerging as key issues in the way customers deploy these systems.

Government Data Pricing: A common view amongst interviewees was that government data had already been funded, and as the fixed cost of collection was incurred, it made sense for the Commonwealth and State governments to provide data for free, where pricing impeded use of the data. Often it is the case that governments are still the largest users of spatial data sets and there had been instances where a government department had paid for access to data sets collected by another department.

Private Data and Intellectual Property Ownership and Protection are Concerns: A recent High Court decision (NSW vs. Copyright Agency Ltd) is seen by several interviewees as being significant. The Court found that the State Government couldn't use surveyors' plans without fairly remunerating copyright owners, in this case, consulting surveyors. However, the problem of collecting royalties on such material remains. This issue continually presents itself in the new digitalised industry, with private companies often receiving little protection against re-use of mapping or spatial data presented to government, even if a third party uses this data at a later date.

One interviewee also noted that this may extend to the data collection phase, given a recent NSW government decision to purchase an airborne LIDAR system with a view to capturing data directly. A related issue is that of IP development and commercialisation, especially in regard to the financing of start-up technology. The problems in global credit markets at the moment make this a particularly pressing issue and a lack of funding can undermine IP protection.

Coordination is Critical: From a policy perspective, technology development is not the main issue in this spatial information industry as "it is built around engineers and that's what they do." However, agreements on standardisation do need to be addressed as well as policy agreements to share data between agencies and with business. Australia should ensure that it plays a role in the emergence of global standards on spatial information, as these will facilitate the export of software and services.

Education is Important: An issue for the Australian industry until recently has been the lack of the "right" educated people. A number of interviewees stated that the relatively healthy condition of the Australian economy ment that there was great competition for students that are graduating from Australian universities with the right skill set and that as a result of shortages, a lot of the work is being exported overseas. Graduates in technical areas are often competing with much cheaper labour elsewhere; their real value should come from "problem solving using spatial applications" and "value-adding" through the creation of new business models.

3.6 Some Industry Perspectives of the CRCSI

The commonly held view amongst interviewees was that the CRCSI does a good job of advertising the industry's capacity and selling policy to government and has made a contribution to research and development in the industry. Interviewees stated that the CRCSI had succeeded in funding a series of smaller research projects over its life and through its 43 PL partners.

Two critical issues for the CRCSI re-bid, as identified by industry included:

The Need for a Research Focus: Some noted that perhaps the CRCSI's research agenda would be better served through the sponsorship of fewer, larger projects

that either focused on key technologies for data collection and feature extraction (e.g., the DEM project on coastal mapping) or on applications in specific sectors, notably mining and petroleum resources and utilities.

Interviewees were aware of the emerging 'five' industry focus of the CRCSI's re-bid: Health; Defence; Energy & Utilities; Agriculture, Natural Resource Management & Climate Change; and Sustainable Urban Development. They were generally supportive of this selection, although areas such as Transport and Logistics and Construction and Facilities Management were also viewed as having potential.

An alternative view, provided by several interviewees, warned against the creation of research 'silos', with the CRCSI needing to accentuate the importance of technological application across a wide range of areas.

The CRCSI as a Coordinating Body: One of the implications and for that matter, contributing factors, of the Australian spatial industry's fragmentation was that it tended to be "risk averse" when compared to companies in Europe and the US in terms of data management and research and development. The Australian industry instead depends upon government and universities for much of its large-scale R&D, with other development tending to be smaller scale and dependent upon projects.

Interviewees saw potential for the CRCSI to act as a platform to assist in the management of spatial information directly. They noted that the CRCSI has an important role in being a "collaborating institute" for the industry, and to facilitate integration and cooperation, it should emphasise research projects and innovation that boost collaboration. They considered that there was probably scope for the CRCSI to enable larger projects with multiple companies where the CRCSI's role was one of providing leadership. For instance, there is still a need in Australia for a central system of data collection: "there are four water networks and multiple sets of road network information. We need to stop everyone doing the same thing and 'reinventing the wheel' over and over again."

4. Key Findings for the CRCSI Spatial Information

The analysis in this report has several key findings for the CRCSI.

Key Trends

The first observation that can be made is that the application of spatial information technology has the potential to continue to be hugely transformative in Australia. This can be gleaned from the work undertaken by ACIL Tasman and the Allens Consulting Group. Global companies, which provide completely new products and services, have emerged new multi-billion dollar companies over the last few years.

A key emerging trend is that spatial information is increasingly being packaged with other IT data. For example applications such as Google Maps have broadened community perception of the possibilities for integrated data sources, while Microsoft's Virtual Earth also has technologies in the mass market

However, this should not imply that the study of spatial information systems and technology is not a corpus of knowledge in itself, but rather that this investigation is now taking place in the context of other developments in information systems and as part of a convergence of IS where data from related functions can be shared across a common platform.

Australian Industry Overview

In the midst of this trend, the Australian industry has remained in the business–to–business market segment, largely building on established surveying and engineering platforms. They are almost all professional services firms, providing spatial information services for a range of clients. Few, if any, produce a product for sale to a consumer market, although some of the specialist atlases are available to the public.

About half of the firms surveyed remain predominately in the surveying business, having adopted aspects of the new SI technology to improve the services they have traditionally provided. Some firms have taken the process further by marrying data management tools to their knowledge of surveying and engineering to establish 'blended businesses' in which IT services account for half or more of total revenues.

There is a group of companies which commenced with the proposition that specialist information held by government utilities or departments such as in the form of hard copy maps could form the basis of new businesses that provided this information in digital form, generally integrated with other geo–coded information, to a range of clients. The founders of these companies had a deep knowledge of the specialist information either from an engineering or IT perspective. These businesses have developed in a number of directions.

A third, although much smaller, group of companies is devoted to specialist positioning services such a control traffic farming and remote sensing. This includes a company which uses drones for remote controlled aerial photography.

Leaving aside the specialist positioning companies, the big question is, 'Where to from here?' for the surveying and IT firms. A number of companies have reached much the same place from different directions. For instance, there are a number of IT–companies based on a core knowledge of a physical infrastructure data set. They have moved increasingly into data management. Broadly their proposition is that corporate decision support systems need to be geographically based and this encompasses financial and other systems as well as information about the status of physical networks. They see their businesses expanding by improving the breadth and functionality of their GIS services. The evidence available from the survey and interviews suggests that these types of services have been rapidly growing.

The more traditional surveying firms, employing the much improved accuracy available from GPS, have also been doing well. Some however have not moved very far towards integrating advanced GIS technology into their surveying services. For instance, an aerial photography specialist company with a sizeable on-the-ground surveying capacity fits in this category. Although it uses some digital techniques, traditional film remains a superior technology. It also uses planes (and helicopters) not the more experimental unmanned aircraft. With the mining and infrastructure boom, demand for its services has remained strong. Some companies are worried nonetheless about the threat of new technology undermining their businesses.

A key opportunity for the CRCSI in the expansion of a wide variety of GIS based decision support systems. This can be expected to be particularly the case for network owners, from utilities to transport and other disaggregated systems. The increasing technological ability to deliver corporate GIS tools to remotely located staff is an important part of this value proposition.

Interaction with the CRCSI

There was broad support for the operations of the CRCSI, its research programs and its proposed re-bid. The survey results and reports from interviews indicated that companies had views on three critical elements of the function of the CRCSI:

Research: Companies were generally impressed with the research track record of the CRCSI. There was an understanding that while much of the research was basic research, undertaken at the university-level, there was also an attempt by the CRCSI, through entities such as 43pl to encourage applications development. Respondents generally noted that the Australian industry lacked critical mass in research and tended to be focused on applications and services. A common observation in the interviews was that typically Australian firms had only limited resources to devote to research and development and so the CRCSI acted as something of a 'force multiplier' where commonalities could be established and exploited. However, there were some emerging success stories both independent of and connected to the research operations of the CRCSI. For this reason, companies viewed the CRCSI as a

welcome participant in the Australian spatial industry and research sector in particular.

Respondents indicated a view of the technology and industry in general that reflects well on the CRCSI's proposed research plan of five key areas: Health, Defence, Energy & Utilities, Agriculture, NRM and Climate Change, and Sustainable Urban Development. There was an indication that other areas may also be worth emphasising, including Logistics and Architectural Design Facilities Management, given their well established connection to spatial technologies and applications.

A Broader Role for the CRCSI: The second theme to emerge from this analysis, particularly from the interviews, was that the CRCSI could conceivably exercise a much broader role in connecting with industry.

Specifically, industry viewed the CRCSI as playing a critical role in the debate about property rights to spatial information, not only in terms of industry accessing government and utilities data but also through the management and protection of intellectual property generated through research and consultancy. Given the emergence of broad based (at this stage, still predominantly 'business–business') applications as the driver of activity, the emergence of larger Australian companies in the industry and eventually, private sector research, a unified response on this issue was seen as being critical.

Essentially, industry requested a 'deeper' involvement of the CRCSI at all stages of the research/product cycle, including, in the context of the global financial crisis, assistance with planning for sourcing external funding for product development.

An Education and Training Role for the CRCSI: One theme to emerge in recent years for all CRCs is the need for research and intellectual property transfer to take place via training and education programs. Interviews with industry identified this as a potential area for the CRCSI in further promoting its research agenda. In particular, two opportunities were identified.

First, the growing importance of spatial information and the introduction of technology into established fields have created the opportunity for an expansion in education in the area, either through standalone degrees or more likely, the incorporation of material related to spatial information in the course content of information systems and computer science courses.

The second suggestion on education is that there should be linkages to business information systems courses. Ultimately, spatial information systems require business cases rather than being 'solutions in search of problems.' Both at the industry and user level, it is the software development and service provision functions associated with spatial information which are becoming critical. The view is that much of the technology is already in place and what is now needed is the expertise to implement these comprehensive systems.

Appendix A: Survey Questionnaire: Survey of the Australian Spatial Industry

Australian Spatial Information Survey

The CRC for Spatial Information, in partnership with Curtin University of Technology and Victoria University, is conducting a survey of firms engaged in spatial information in Australia.

Data from this survey will be used by the CRCSI to better understand the business environment for spatial information and help determine the areas of focus for its future research program.

The Australian Spatial Industry Business Association (ASIBA) encourages its members to complete the survey.

Spatial information is defined to include: products and services involved in the collection, integration, interpretation, analysis and management of location based (geospatial) data and the development of tools to support these activities.

Please complete this survey if you offered spatial information products and services during the last financial or calendar year.

All data collected from this survey will be treated confidentially and only reported in aggregate.

Should you have any queries about this, could you please contact Alison Welsh on 03 9919 1346 or alison.welsh@vu.edu.au.

1. What is the name of your business? If you have a parent company where is it located?

2. In which of the following areas would you place your core spatial information products? More than one option is possible.

Surveying
Cartography
Geodesy, Navigation and Positioning
Precise positioning (including controlled track farming)
Remote Sensing (airborne and satellite)
Development of spatial software (including customised software)
Spatial data management
Spatial/Geomatics Consulting Services
Web services
Other

3. In which of the following market segments would you conduct your core spatial information business? More than one option is possible.

Agricultural and environmental management and monitoring, Asset and facilities management, Culture, tourism and recreation, Civil and building construction, Urban Planning and Land Development, Defence, Education, Government administration Health and sports science, Land titling and administration (including indigenous lands), Law & order and emergency services, Marketing, market research and retail, Mining and petroleum Resources: Inventory and Extraction, Telecommunications and information technology, Transport and logistics (inc. maritime and aerospace), Utilities (electricity, gas and water)

4. What was the average number of full-time equivalent persons employed during the last year by your business, including contractors? Circle one option.

1-2 3-5 6-25 26-50 51-200 201+

5. What was your business's total salary cost last year, including on-costs? Circle one option.

<$1/4 M $1/2M-$1M $5M-$10M $1/4M-$1/2M $1M-$5M $10M+

6. What was your business's total operating expense last year? Circle one option.

<$1/2 M $1M-$2.5M $5M-$10M $1/2M-$1M $2.5M-$5M $10M+

7. What was your business's total revenue last year? Circle one option.

<$1/2 M $1M-$2.5M $5M-$10M $1/2M-$1M $2.5M-$5M $10M+

8. What has been your average annual growth in revenue over the last three years?

%

9. What was your expenditure on research and development last year? Circle one option.

<$100 K $251-500 K $1M-$10M $100-250 K $501-$1M $10M+

10. What is the primary focus of your research and development? More than one option is possible.

Surveying Cartography Geodesy, Navigation and Positioning Precise positioning (including controlled track farming) Remote Sensing (airborne and satellite) Development of spatial software (including customised software) Spatial data management Spatial/Geomatics Consulting Services Web services Other

11. With whom do you collaborate on research and development? Circle any that are relevant.

CRCSI for Spatial Information University CSIRO Federal Government Department State and Territory Government Department Australian company Overseas company Overseas research agency (e.g. University) None

Appendix B: List of Interviewees

James Bangay	Ergon Energy	Queensland
Chris Earle	AAMHatch Pty Ltd	Western Australia
Glenn Cockerton	Spatial Vision	Victoria
Chris Doran	Industrea Ltd	Queensland
Paul Harris	NGIS Pty Ltd	Western Australia
Adam Hender	iintegrate Systems	Western Australia
Don Hitchcock	Advanced Spatial Technologies Pty Ltd	Western Australia
Mark Judd	Geomatic Technologies	Victoria
John Lazarus	Fugro Spatial Solutions Pty Ltd	Western Australia
Steve Lieblich	Amristar Solutions and Idelve	Western Australia
Peter Loughrey	ESRI	Victoria
Bruce Murnane	Logica	Victoria
Gerry Nolan	McMullen Nolan & Partners Pty Ltd/ Map Survey	Western Australia
David Purnell	Geoinfo Solutions/Whelans	Western Australia
Graeme Searle	Department of Housing	Western Australia
David Sinclair	Queensland Aerial Survey Company	Queensland
Mark Xavier	V-Tol Aerospace	Queensland