

**Geographic Information Systems and Geospatial Data
in New Zealand and Australian Academic Libraries**

by

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**Submitted to the School of Information Management,
Victoria University of Wellington
in partial fulfilment of the requirements for the degree of
Master of Information Studies**

February 2016

Abstract

Research problem

Geographic Information Systems (GIS) offer a means of gathering, viewing, managing and analysing spatial information. Technological changes are making GIS more widely accessible to researchers in many disciplines. Academic libraries have responded to growing demand by implementing GIS support services. Little research has been undertaken regarding GIS services provided by academic libraries in New Zealand and Australia. This research project aimed to discover the extent and nature of GIS services offered and librarians' perceptions regarding factors influencing implementation of library GIS services.

Methodology

A quantitative study was carried out of tertiary academic libraries in New Zealand and Australia. 78 academic libraries or library networks were invited to complete an online questionnaire regarding GIS services in their library and wider institution.

Results

17 libraries (22%) completed the survey. 59% of surveyed academic libraries offer one or more GIS services. These are primarily university libraries at larger institutions. Non-university libraries offer few GIS services. Services relating to geospatial data management and information literacy are the most frequently offered. The implementation of new GIS services is driven primarily by stakeholder demand, while lack of demand, library staff knowledge of GIS and funding are the main barriers to implementation of new GIS services.

Implications

Academic libraries in the region need to be aware of the growth of GIS in academia and responsive to the needs of GIS users by monitoring demand for GIS services and introducing tailored, relevant and sustainable GIS services.

Keywords

Geographic Information Systems; GIS; geospatial data; geodata; academic libraries; tertiary institutions

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1 Introduction and problem statement

The aim of the research project is to investigate and evaluate how academic libraries in New Zealand and Australia provide support for the use of Geographic Information Systems (GIS) and geospatial data (geodata). The project also aims to understand the reasons for libraries not offering support for GIS and geodata. GIS and geospatial support services include advisory services, instruction, hardware, software, and geospatial data access and curation.

1.1 Problem statement

Numerous studies regarding library GIS services have been published concerning North American libraries however no in-depth studies have been undertaken relating to New Zealand and Australian libraries, so there is a perceived gap in the research. The study addresses this gap through an investigation and analysis of support for GIS and geospatial data services provided by libraries in New Zealand and Australia and is informed by similar studies undertaken elsewhere. This focus will prove useful as the North American experience indicates that demand for library GIS services is likely to exist and to grow as the technologies become more widely known and used (Dodsworth, 2012; Kowal, 2002; Scaramozzino, White, Essic, Fullington, Mistry, Henley and Olivares, 2014; Weimer & Reehling, 2006).

1.2 Definition of GIS and geospatial data

GIS allow a researcher to gather, view, manage and analyse information that includes a spatial element (ESRI, 2014; McGlamery, 2008). A traditional GIS consists of five essential components:

- hardware
- software
- data
- people
- the methods or practices used to operate the GIS

(Dixon, 2006; Longley, Goodchild, Maguire & Rhind, 2011).

Additionally a network, usually the internet, is a critical component of a GIS (Longley et al., 2011).

GIS provide a powerful interdisciplinary tool for analysing spatial relationships and processes for virtually any academic discipline (Dodsworth, 2010; Kinikin & Hensch, 2005a). As a simple example, the locations of incidences of a particular disease, can be mapped and analysed using GIS to discover locations with a higher than expected rate of the disease, as well as the locations of potential causes for that disease (Longley et al., 2011).

The ability to visualise and map data for multiple variables of a research problem is driving the increase in interest in GIS (Kowal, 2002). The use of GIS has also proliferated and diversified in recent years due to the development of new technologies, the shift to digital formats, the wider availability and creation of geospatial datasets and the appearance of free online mapping tools, such as Google Earth, which have made GIS easily accessible to non-experts (Kowal, 2002; Scaramazzino, et al., 2014; Weimer & Reehling, 2006). Dodsworth (2012, pp.48-49) notes that “GIS has evolved into a multidisciplinary user-friendly technology... [that] offers solutions to both simple and complex problems”.

Geodata is a critical component of GIS. Geodata refers to data stored in a format usable with GIS that relates to geographic locations (ESRI, 2016). The creation, discovery, evaluation, manipulation, storage and archiving of geodata need to be managed carefully. Many different kinds of data can be geo-referenced to allow them to be used in a GIS, such as statistical data (Houser, 2006).

1.3 Glossary of terms

Academic library - for the purposes of this research, the term "academic library" includes university, polytechnic, technical and further education (TAFE) and institute of technology libraries. This definition has been chosen because subjects utilising GIS are commonly taught at these types of institution in New Zealand and Australia.

EFTS/EFTSU – Equivalent Full Time Student (New Zealand)/Equivalent Full Time Student Unit (Australia). This is a measurement of student numbers that may be used to determine the size of an academic institution.

Geodata (also Geospatial data, spatial data) – “Geodata is information about geographic locations that is stored in a format that can be used with a geographic information system (GIS)” (ESRI, 2016).

Geographic information system (GIS) - “An integrated collection of computer software and data used to view and manage information about geographic places, analyse spatial relationships, and model spatial processes. A GIS provides a framework for gathering and organizing spatial data and related information so that it can be displayed and analysed” (ESRI, n.d.).

2 Literature review

The literature relating to library GIS services began to appear in the 1990's as technological developments allowed for wider implementation of GIS as the technologies became more affordable, could be hosted on a personal computer and geospatial datasets became increasingly accessible via the World Wide Web (Argentati, 1997). In general, library GIS literature is strongly biased towards North America, but more recently a few surveys relating to other areas have been undertaken, such as those by Kelly (2013) concerning South Africa and Vardakosta and Kapidakis (2011) concerning non-United States libraries.

2.1 Proliferation of GIS technologies and impact on academic libraries

Growing demand, developing technology and individual circumstances are driving evolution in library GIS services, particularly in North America. Scaramozzino, White, Essic, Fullington, Mistry, Henley and Olivares (2014) found that opportunities arising from Web-based technology allow a wide range of disciplines to embrace geospatial technologies, and Kowal observed as early as 2002 that "customized digital mapping is no longer limited solely to GIS users" (Kowal, 2002, p.113). GIS are increasingly used in the media to visually convey data relating to events such as natural disasters and political elections (Scarletto, 2013). The emergence of effective, free, World Wide Web based "GIS-lite" tools such as Google Maps and Google Earth has been noted by Dodsworth and Nicholson (2012), Dodsworth (2012, p.47) and Dunn (2007). These tools are particularly useful for teaching spatial information literacy skills, for answering reference enquiries and more generally for "improved democratization of GIS and active participation" (Dunn, 2007, p.627). Dodsworth (2012, p.14) argues that academic librarians need to develop geoliteracy skills in order to support library users who are increasingly dependent on maps as "information and communication tools" since "spatial literacy and map communication are essential skills" for many.

The World Wide Web has also allowed for geospatial datasets to be freely shared and disseminated (Ferguson, 2006). This is particularly true for New Zealand, with sites such as Koordinates.com, Geodata.govt.nz, and LINZ data service (<https://data.linz.govt.nz/>) providing an extensive range of datasets openly. Longley et al. (2011, p.245) stress that "a major challenge of using data obtained from the Web is evaluation of fitness for purpose".

The fact that datasets are increasingly being shared openly does not discount the possibility that researchers may require their customised or sensitive geospatial data to be stored securely. This is a service many academic libraries can provide through their institutional repositories.

The evolution and proliferation of GIS technologies provides an opportunity for academic libraries to build on their strengths of providing diverse information services by introducing GIS and geodata services. Providing these services is an example of using innovation to maintain relevancy to the academic community (Aufmuth, 2006; Vardakosta & Kapidakis, 2011). The proliferation of Web-based GIS allows non-experts to use GIS technology, however there are still basic GIS skills and knowledge required by these users that librarians can provide instruction and guidance for, such as understanding the nature of spatial concepts, the intricacies of geodata and the limitations of web-based GIS (Dunn, 2007, p.626). Dodsworth (2012, p.98) notes that “Library professionals are not required to have advance GIS skills”, but “many elements of a GIS service can be offered by all liaison librarians and reference staff” which demonstrates the librarian’s prime role of introducing GIS technology and helping beginner users.

2.2 Models of academic library GIS services

Aufmuth (2006) describes different service delivery models for library GIS services. These are centralised, distributed and hybrid models. A library’s decision as to what kind of GIS service to provide is influenced by the GIS environment on campus. Aufmuth (2006) argues a centralised library GIS model requires a high level of trust from academic departments that their GIS needs will be met by the library service. A centralised service is also likely to be expensive to set-up and maintain, since the library functions as a campus-wide GIS hub. With a centralised model in place, university departments may look to set up their own GIS lab as they gain familiarity and expertise with the technology. A distributed GIS model consists of academic departments providing their own GIS lab and services, with library staff providing assistance and support to departmental users. In the distributed model the library may not necessarily provide any GIS space itself. The hybrid GIS model combines elements

of the distributed and centralised models, and often evolves from either the centralised or distributed model (Aufmuth, 2006).

Kowal (2002) describes three levels of library GIS services utilising Web mapping tools that can be offered, depending on the resources available to the library and the demands of the user. These are low-level, mid-level and high-level Web-based GIS services. Low-level services involve searching for static maps or images (such as aerial photographs) via the World Wide Web; mid-level services involve the use of online tools to create maps with more advanced functionality such as layering data for a particular research purpose; and high-level services involve creating maps with high functionality GIS software using in-depth analysis of data (frequently the user's own). As we move through the levels, the capabilities for research and analysis improve, however the amount of training, software and specialist knowledge required to use the tools increases. Kowal's model has been cited frequently in the North American setting as it provides a useful structure for analysing the types of GIS services libraries offer relating to mapping, and as examples of the models that libraries can implement (Dixon, 2006; Houser, 2006; Kinikin & Hench, 2005a).

2.3 Implementation of academic library GIS services

The development of interest in GIS among diverse academic fields can result in significant knowledge gaps that academic libraries may be well-placed to bridge. March's (2011) quantitative survey of the University of Tennessee Knoxville community found that there is a training gap for GIS, particularly for beginner users. March (2011) found that GIS technologies are used across a wide range of disciplines and 60% of respondents (153 of 257 faculty and postgraduate students at the University of Tennessee) wanted to use GIS but lacked the skills and knowledge to do so.

There have been numerous case studies relating to GIS services provided by a single library or small library network. The aim of many of these studies is to help inform libraries considering the implementation of a GIS service. For example, Houser (2006) identifies a key list of questions libraries should ask when deciding what kind of GIS services to offer, including as "do GIS users have access to necessary data, software, and hardware?" and "is

there a GIS lab open to anyone...?" (Houser, 2006, p.325). These questions inform the research topic by providing guidance to identify relevant GIS user needs to focus on, for instance, the types of GIS tools needed and data access issues.

Houser (2006) stresses the importance of investigating campus-wide GIS issues when implementing a library GIS service, particularly since campus departmental support is vital to providing a successful service. Similarly, Houser (2006), March (2011) and Scaramozzino et al. (2014) emphasise that every institution has different GIS needs depending on local circumstances, and these needs must inform the kind of service the library provides for it to be successful. For example, a university with multiple departments using GIS could benefit from a centralised, library based space providing GIS services to save space and money on equipment and software by avoiding duplication of services (Scaramozzino et al., 2014).

Dixon (2006) argues that libraries need to take advantage of their frequent role as a central campus hub and neutral space to build GIS services, primarily through engaging with faculty, students and others in collaborative projects that use GIS. Collaborative projects involving the library and researchers have also been cited by Houser (2006), Scaramozzino et al. (2014) as a critical strategy to set up a sustainable GIS library service.

Scaramozzino et al. (2014) describe GIS services at five academic libraries in the United States. The study notes the evolving needs of academic communities regarding established GIS services and how these needs are being responded to, unique challenges and opportunities that have arisen and future plans for GIS and data services. The five GIS services described use varied service models and systems to support their users, and all have experienced either high demand or rapid growth of their GIS services.

The studies reviewed offer possible service and implementation models for library GIS services in New Zealand and Australia, while discussing the relevance of offering these services. Conditions in the academic library context of New Zealand and Australia may differ from elsewhere, and therefore may require different strategies and needs than those outlined in the literature. However, these studies offer valuable insight into potential variables, and examples of service models.

2.4 Analyses of multiple GIS library services

There has been a limited number of surveys undertaken relating to library GIS services worldwide. Many of the surveys undertaken include only large, well-resourced North American institutions that can more easily afford the expense of implementing library GIS services (Kinikin & Hensch, 2005a). Library GIS surveys generally cover the presence of a GIS service, how a GIS service is offered, including variables such as staffing levels and knowledge, training and assistance offered to users, provision of hardware, software and geospatial data. User profiles and marketing are also commonly assessed.

Relevant surveys identified as informing this research project include Kinikin and Hensch's (2005a) quantitative survey regarding the implementation of academic library GIS services. This study is relatively unique since it analyses GIS services at multiple libraries, and particularly since these were not larger, better funded institutions. Kinikin and Hensch's survey had two aims: 1) to discover how many smaller academic libraries in the United States had begun offering, or were planning to offer GIS services; 2) to find out how libraries had implemented GIS services (Kinikin & Hensch, 2005a). The study was carried out in 2002 by sending a survey to 268 "smaller" institutions throughout the United States (as defined by the Carnegie Classification of Masters' Colleges and Universities I and II). The study focusses on the twenty-two responses that indicated their library currently provided GIS services. There were also twenty-seven responses that indicated plans to implement a GIS service in the future (Kinikin & Hensch, 2005a).

The study found that smaller libraries that had adopted GIS services struggled to provide a satisfactory service due to insufficient provision of GIS hardware, software and training for clients. Another common problem was a lack of staff training and staffing resources committed to GIS due to a lack of funding (Kinikin & Hensch, 2005a). This issue has also been identified by Ferguson (2006), Gabaldon and Replinger (2006), and Scaramozzino et al. (2014).

Kinikin and Hensch's survey offers a useful insight to the issues many smaller libraries have when setting up and running GIS services. These issues include a lack of resources and trained staff. The brevity of the questionnaire and write-up are partly compensated for by

the follow-up study conducted by the authors in 2004 of twenty-one libraries that had responded to their initial survey as providing GIS services. The objective here was to gather more detailed data regarding the successful implementation of library GIS services (Kinikin & Hench, 2005b). Of the eleven responses returned in the follow-up survey, two of the libraries no longer offered GIS services, citing lack of use and duplication of services offered elsewhere on campus as reasons for ending the service. These two libraries plus one that still offered GIS thought there was no need for in-library GIS services (Kinikin & Hench, 2005b). A range of low-level, mid-level and high level services were offered in the nine libraries still providing GIS support but overall use of these was low, with eight libraries having two or less users per week. Half of the libraries had experienced an increase in GIS use, while users were most likely to be faculty from the geography and geology disciplines. Four libraries actively promoted library GIS services through workshops or seminars, with some success, while five libraries engaged in collaborative efforts with university departments (Kinikin & Hench, 2005b). The mixed experiences of the libraries surveyed demonstrate both the challenges GIS services face in smaller American libraries as well as the successes.

A similar study of United States academic libraries carried out by Gabaldon and Replinger (2006) with data gathered just over three years after Kinikin and Hench, showed an increasing trend in the implementation of GIS services. This study of 103 varied institutions in two consortia also found that better-funded libraries were more likely to implement GIS services, although it is likely that libraries in consortia have higher purchasing power than those that are not part of consortia (Gabaldon & Replinger, 2006).

2.5 Studies of GIS services outside of North America

A content analysis survey of web-sites undertaken by Kelly (2013) offers a rare comparison of GIS services in academic libraries from different regions. Kelly aimed to compare cartographic and GIS services offered at a selection of South African and leading international academic libraries, with a focus on technology, services, standards and policy. The methodology used for the analysis and research design has limitations as it consisted of a content analysis of websites, which may not include all GIS services offered, and the survey

did not include important aspects such as GIS staffing, expertise and reference services. The study highlights the service gaps that exist between highly ranked North American and lower ranked non-American libraries.

Five leading universities around the world and three in South Africa were identified using the Academic Ranking of World Universities. The websites of these institutions were then informally analysed (in 2010) to discover what GIS services were currently offered, both in the library and outside the library. The study found that the highly-ranked European and American university libraries selected for the study offered significantly greater GIS and related map services than those in South Africa, particularly software and access to maps and geospatial datasets. However, South African universities often did provide some of these services outside the library, while the majority of the non-South African universities offered these services both inside and outside of the library (Kelly, 2013). This study highlights the contrasting levels of GIS services offered by highly ranked American and non-American academic libraries.

Vardakosta and Kapidakis (2011) carried out a study with the primary aim of analysing world-wide academic library geospatial collection development policies. This content analysis of 160 university academic library websites outside of the United States also gathered data regarding what kind of GIS services libraries offer and whether they use open-source or commercial GIS software. Of the 160 libraries identified, six were located in New Zealand and thirty-eight in Australia.

The authors found that 102 (64%) of surveyed libraries did not provide a GIS service. 48 (30%) of libraries did provide a geospatial data collection. Seven Australian libraries offered GIS services, and one from New Zealand. Of the 48 non-American libraries that offered GIS services, 35% were found to offer user education programmes, 21% offered remote access to data and 33% provided information regarding GIS hardware and software provided by the library (Vardakosta & Kapidakis, 2011). According to Vardakosta and Kapidakis' (2011) data, seven of the thirty-eight (18%) Australian and one of the six (17%) New Zealand libraries surveyed provided GIS services. They also found that the New Zealand library offered a geospatial collection development policy, GIS user education, GIS infrastructure in the library

and access to proprietary GIS software. From the seven Australian libraries providing GIS services, one provided a geospatial collection development policy, one provided propriety software and two open-source software.

Vardakosta and Kapidakis' survey indicates that some GIS services are being offered in the New Zealand/Australia region, however the fact that it was limited to university libraries and used the methodology of website content analysis, indicates a need for a more in-depth survey of the landscape of GIS services in this region.

2.6 Relevant concepts

Concepts relevant to the study that have been identified from the literature review are:

- The increasing importance of GIS, geodata and mapping technologies as a communication tool due to new technologies.
- GIS and geodata services as an example of libraries staying relevant by adapting to meet a new or increasing need of academic communities.
- The existence of barriers to the implementation of GIS and geodata services, such as lack of demand, expertise and funding.
- The established models of GIS library services, namely: Houser's (2006) models of providing GIS services and Kowal's (2002) three levels of GIS services related to Web-based mapping.

3 Study objectives

The overall objective of the project was to gain an understanding of the GIS and geospatial data services offered by university, polytechnic, institutes of technology and TAFE academic libraries in New Zealand and Australia. The project aimed to do this by determining what factors influence decisions to implement, or not implement GIS services, the GIS service models used and the level of service and types of GIS tools used by libraries. The project also aimed to discover whether libraries have any future plans to implement GIS services and librarians' perception of what elements may need to be in place before these services can be implemented.

4 Research questions

The main research question is:

To what extent, and in what ways, do academic libraries in New Zealand and Australia provide support for Geographic Information Systems and geospatial data activities?

Sub-Questions:

- What GIS and geodata *resources, services and training* do libraries provide?
- What GIS and geodata *activities or projects* do libraries participate in?
- Which *service models* do libraries use to provide GIS services?
- What *factors drive the implementation* of GIS and geodata services?
- Do libraries identify demand for, and needs of a library GIS service? If so, how is this done?
- What *factors inhibit the implementation* of GIS and geodata services? Why do libraries not provide GIS services?

5 Research design

5.1 Methodology and methods

To sufficiently investigate the extent of support for GIS and geodata services offered by academic libraries in the region, a quantitative research methodology was used. The project consists of a quantitative survey of a sample of academic libraries (or library networks) in New Zealand and Australia. The technique of descriptive survey research was identified as the most effective method to gather data pertaining to many variables from a dispersed group of libraries, through specific questions and analysis of the gathered data. Vardakosta and Kapidakis (2011) have completed a GIS related content analysis project that included libraries in New Zealand and Australia, however no survey by questionnaire has previously been undertaken. The data gathered via questionnaire allows for a useful analysis of GIS services for the participating libraries from the perspective of those who make decisions about library GIS services, enabling the research questions can be effectively answered (Leedy and Ormrod, 2014).

5.2 Population and sample

The study is limited to New Zealand and Australia as very little research has been published regarding library GIS services in this region. The sampling frame consists of universities, polytechnics, institutes of technology and TAFE's located in New Zealand or Australia listed on the International Association of Universities' World Higher Education Database at <http://www.whed.net/home.php>. Tertiary academic libraries (including polytechnics in New Zealand and TAFEs in Australia and universities in both countries) were selected since subjects that use geodata and GIS technologies are frequently taught at these institutions, and are potentially useful for their academic communities.

In order to attempt to seek an accurate picture of how GIS services are supported, all libraries in the sampling frame that fit the definition for the study were invited to participate. The number of institutions in the sampling frame was 78. 20 libraries (28%) agreed to participate in the survey, with 17 of these (22% of the sampling frame) successfully completing the survey.

5.3 Ethical considerations

The project was given ethical approval from the School of Information Management Human Ethics Committee. Participants were provided with an explanation of the research project (see Appendix A) and a consent form (see Appendix B). Participants were given an opportunity to ask questions and to withdraw from the project. It was decided to conduct the research project confidentially since respondents could potentially be identified if institutions were named in the final research report due to the small number of respondents. Potentially sensitive institutional data was included in the survey, therefore all questions were optional. Questions regarding potentially sensitive budget data were kept general (i.e. no amounts were gathered). In the interests of transparency, respondents were given the opportunity to receive a summary of the research findings directly from the researcher. Eleven respondents exercised this opportunity.

5.4 Data collection

Data relating to multiple variables of library GIS and geodata services was gathered from the survey participants for quantitative analysis via an online questionnaire. Qualtrics survey software was used to create, distribute and manage the questionnaire. Qualtrics was chosen because it provides sophisticated functionality for survey building, data gathering and reporting. The risks of using the method of a questionnaire for data collection included a low return rate and inaccurate data due to poor questionnaire design (Leedy and Ormrod, 2014).

Potential participants were initially contacted by email with a request to take part in the research. As only one response per library was sought, it was important that the questionnaire was completed by the person with the best understanding of GIS services at each institution. In most cases library executive managers, who are likely to have a thorough overview of the organisation were contacted to answer the questionnaire, with a request to delegate to another person with greater knowledge if necessary. However, in some cases, a library staff member whose job title specifically included GIS or geodata was identified and the request sent directly to them.

Invitees that had agreed to participate were sent an email providing an explanation of the research project and a link to the survey (see Appendix A). Branching was built in to the survey flow to allow respondents to see only questions that were relevant to them, based on previous answers. This made the survey clearer and faster for respondents, as they were not faced with redundant questions or complex instructions. For example, respondents were only asked what GIS software they provided if they had previously answered that their library provides GIS software.

A 'carry forward' survey function was used to ensure only un-selected responses from question 7: "Which of the following GIS related services does your library currently provide?" were displayed for question 8: "Does your library plan to implement any of the following services in the future?" (see appendix B).

Open comment boxes were used at times to allow participants to provide greater detail, specific data or comments for particular questions.

5.5 Data analysis

Statistical analysis of the response data was undertaken to provide insight relevant to the project's research questions. Percentages are used to communicate variables and present a quantitative profile of GIS library services which are displayed using multiple graphs along with discussion of the findings. This method allows for clear analysis and communication of the gathered data. Qualtrics software was also used to complete the data analysis. As the sample size of 17 is small, percentages are primarily used to convey results. Percentages may not always add up to 100%, due to rounding. Data was gathered between 17th December 2015 and 18th January 2016.

5.6 Assumptions and limitations

It is assumed that the survey answers were completed in good faith and consist of accurate data, and that those answering the survey have either detailed knowledge of the GIS and geodata services offered in their library network, or knowledge regarding the reasons these

services are not offered, or may be offered in future. Steps taken to encourage accurate survey completion include targeting a senior library manager or library GIS library specialist and designing the questionnaire to be as clear and brief as practicable.

The small sample size could limit the usefulness of the data. There was a need for a sample that includes both libraries that provide, and do not provide GIS services to answer the research questions effectively. The lack of responses from institute of technology, polytechnic and TAFE libraries (only five responses were received for these types of institution) means the research offers more valuable insight into the circumstances of university libraries (twelve university libraries responded). The sample was not a representative sample as it did not reflect the population accurately.

Libraries that do not offer GIS or geodata services may have been reluctant to participate since they may not see the value of contributing to the research project. This could result in data that is biased toward the experience and perceptions of libraries that do provide GIS services.

Detailed data relating to library GIS users and GIS activities may not be retained or known by survey respondents which could lead to gaps in the data relating to GIS activities.

Delimitation

The requirements of GIS users for access to training and resources were out of scope for this project. Librarians' perceptions regarding these issues were gathered, however data was not be gathered directly from GIS users.

6 Survey results and analysis

6.1 Profile questions

Of the seventeen survey responses, ten were received from New Zealand libraries (59%) and seven from Australian libraries (41%) (Fig. 1).

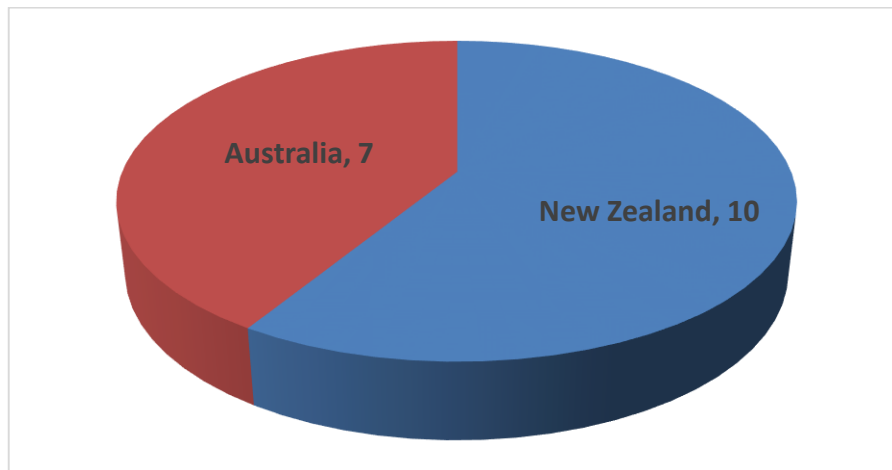


Figure 1: What country is your library based in?

Twelve responses came from university libraries (71%), three from polytechnics (18%), one from a TAFE (6%) and one from an institute of technology (6%) (Fig 2).

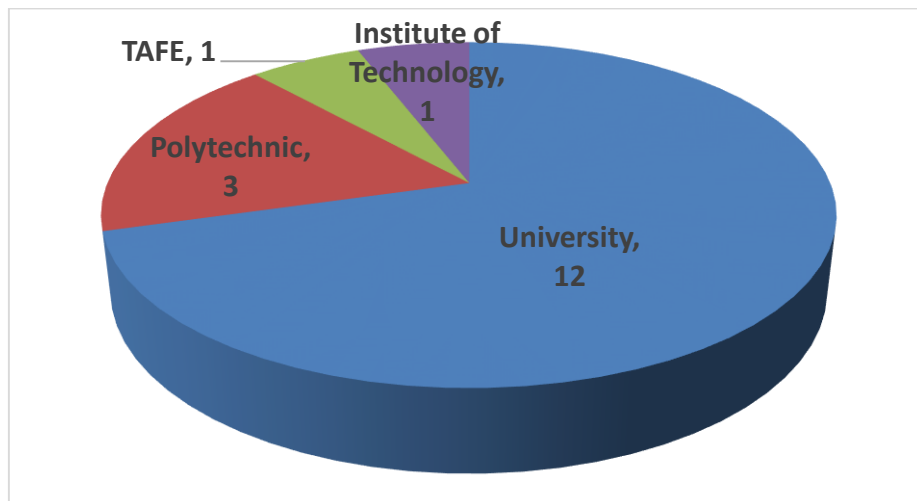


Figure 2: What type of institution does your library belong to?

Of New Zealand's eight universities, six responded to the survey (75%) and of Australia's 32 universities, six responded (19%).

Libraries from institutions of various sizes responded (see Fig. 3.). Six (35%) have under 15,000 EFTS/EFTSU (two universities, three polytechnics and one institute of technology). Four respondents (24%) have between 15,000 and 29,999 EFTS/EFTSU (three universities and one TAFE). The seven respondents (41%) who have over 30,000 EFTS/EFTSU are all university libraries.

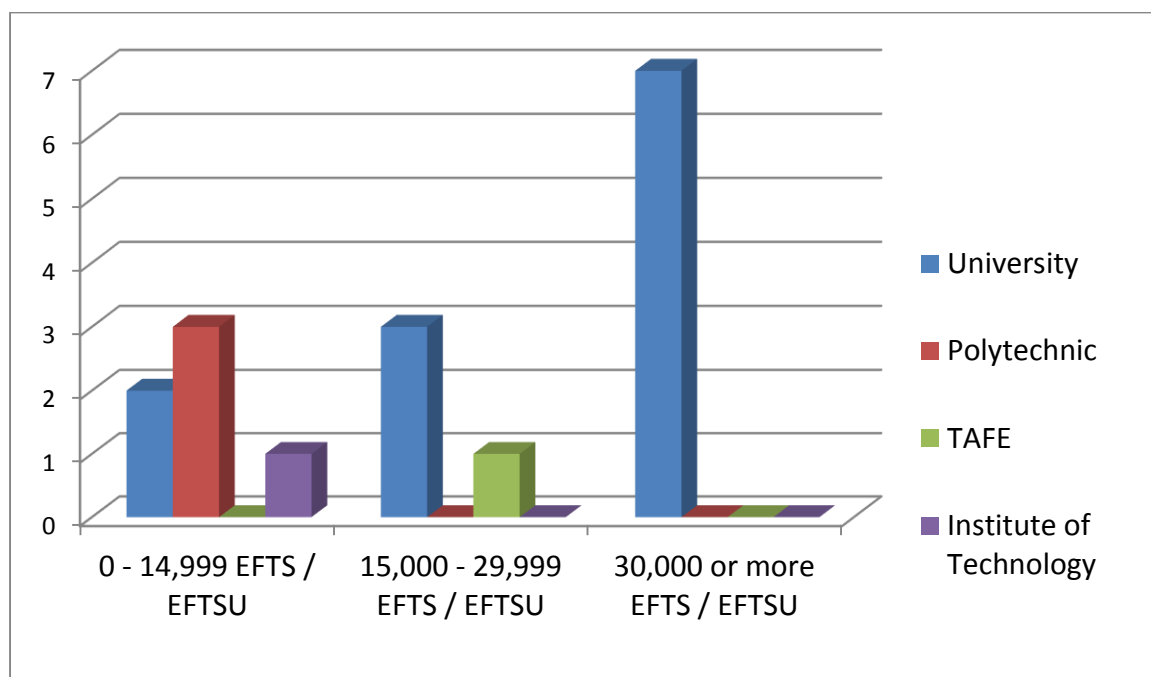


Figure 3: What is the student population of your institution?

6.2 GIS and geodata resources, services and training

Which of the following GIS related services does your library currently provide?

Libraries were asked to indicate which of nine aspects of a library GIS service they offer. Ten (59%) offered at least one of the services, while seven (41%) did not offer any of the GIS services. A total of 23 different services were offered, giving an overall average of 1.4 services for the whole sample.

Of the ten libraries who responded positively to this question, eight were university libraries (six Australian and two from New Zealand), one was a Polytechnic (New Zealand) library and

one a TAFE (Australian) library. These ten libraries offer an average of 2.3 GIS services per library.

Seven of the ten libraries offering GIS services were in the 30,000+ EFTS/EFTSU range, two were in the 15,000-29,999 range, and one was in the 0-14,999 range, indicating GIS services tend to be offered by larger university libraries.

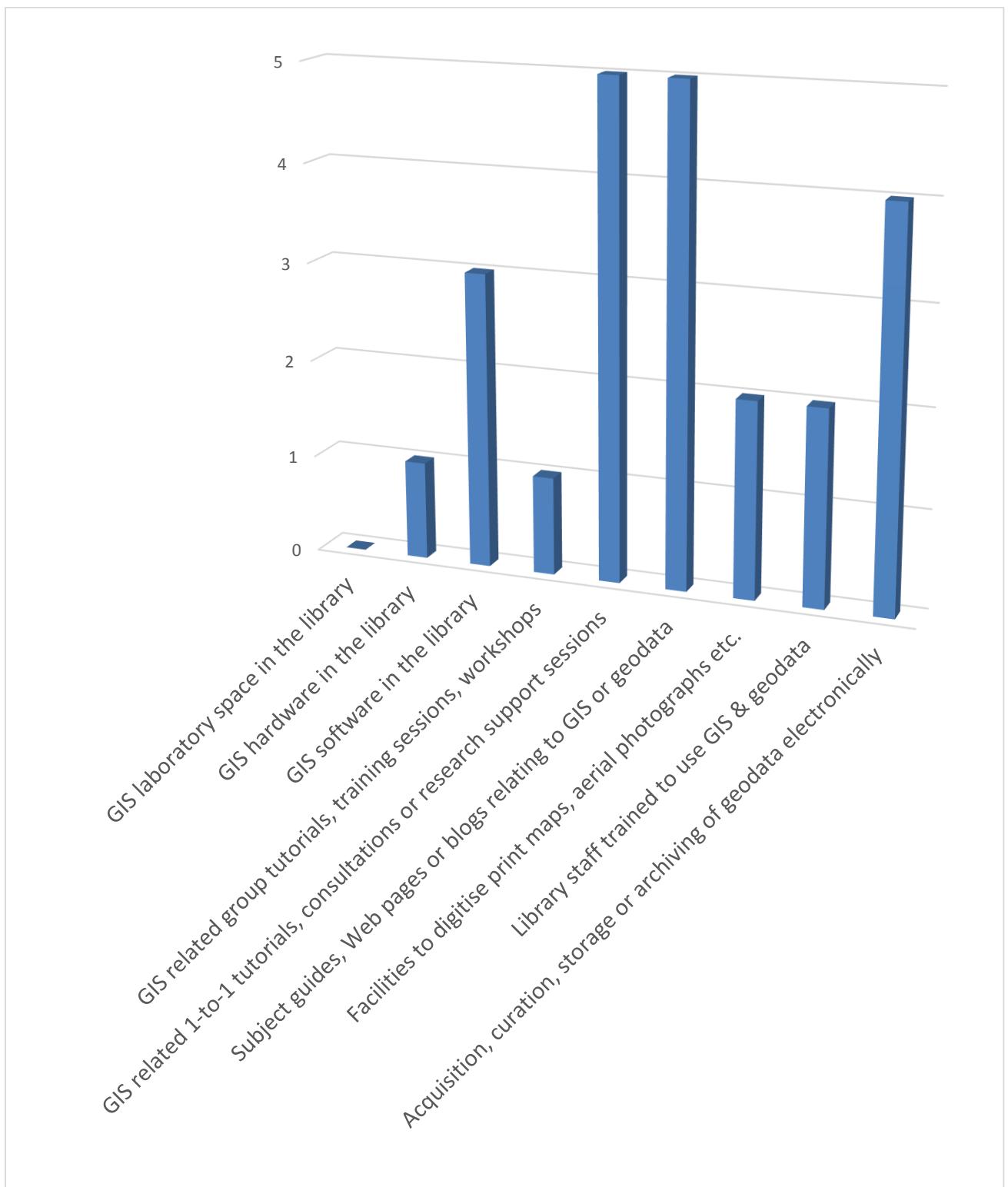


Figure 4: Which of the following GIS related services does your library currently provide?

As Figure 4 shows, the most common GIS services offered are “...GIS related one-to-one tutorials, consultations or research support sessions” and “...subject guides, web pages or

blogs relating to GIS or geospatial data”, with five libraries (29%) offering each of these services. Four libraries (24%) provide “acquisition, curation, storage or archiving of geospatial data electronically”. Three libraries (18%) provide GIS software in the library. Two libraries (12%) offer digitisation facilities.

Two libraries (12%) also provide library staff trained to use GIS and geospatial data. One library (6%) provides GIS hardware in the library, while one provides GIS related group tutorials, training sessions or workshops. No libraries indicated they provide “...dedicated GIS laboratory space in the library”.

Two libraries (12%) offer four or more unique GIS services. One library (6%) offers seven of the nine possibilities, indicating an advanced GIS service, with only laboratory space and group training sessions not offered by this library. The second library offers four services: one-to-one training, subject guides, Web pages or blogs, GIS trained library staff and geospatial data management. Both of these libraries are at universities with over 30,000 EFTS/EFTSU.

Overall, expertise relating to GIS and geodata services are provided more than GIS software, tools and hardware. The positive responses to this question were explored in more detail with follow up questions.

How many GIS workstations does your library provide? What other GIS hardware does your library provide?

Only one library (6%) provides GIS workstations or hardware. This library provides between one and two workstations (Fig.5), as well as a large scale scanner and large scale printer (Fig. 6).

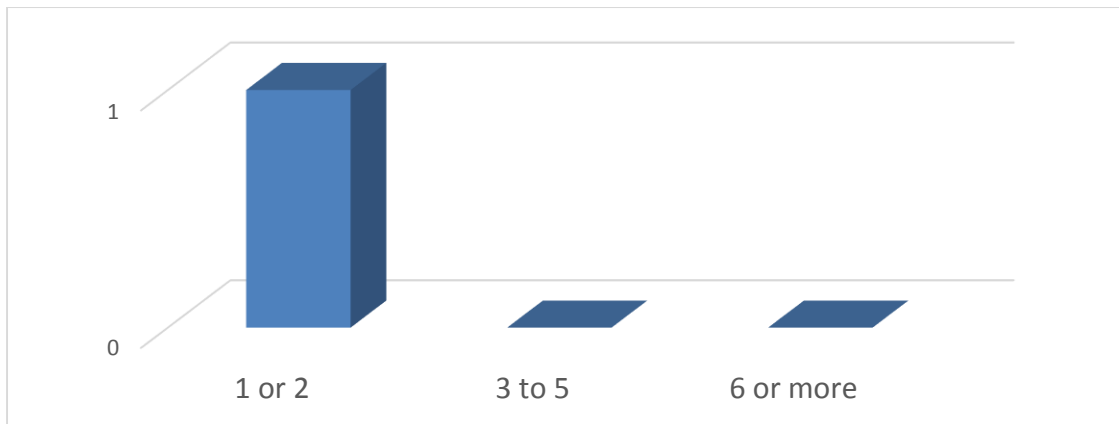


Figure 5: How many GIS workstations does your library provide?

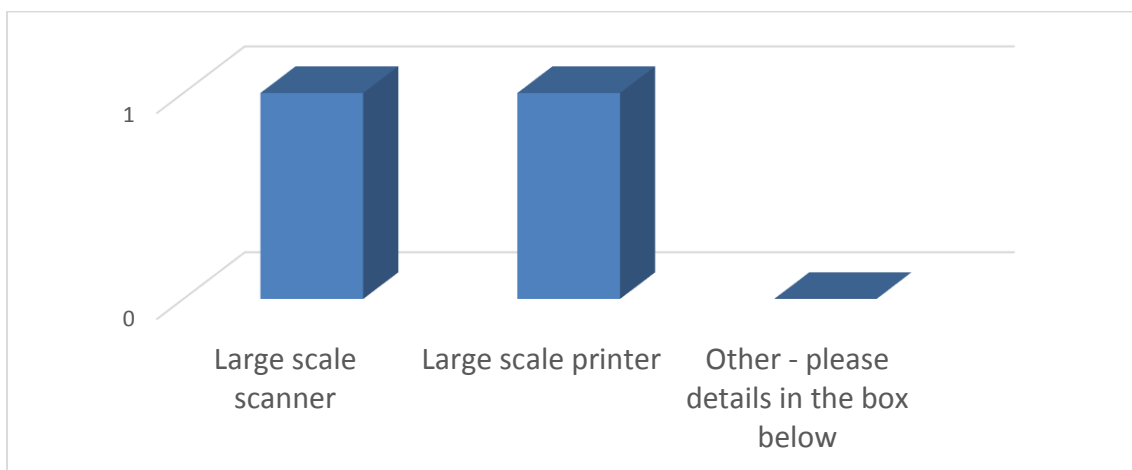


Figure 6: What other GIS hardware does your library provide?

What GIS software does your library provide?

Four libraries (24%) indicated they provide GIS software. Two offer the industry leading ArcGIS software and one offers ENVI 5.0, (“software for processing and analysing geospatial imagery”). One indicated they provide Google Earth, which is a useful programme for beginners and GIS users from disciplines without a strong GIS focus (Scaramozzino et al., 2014).

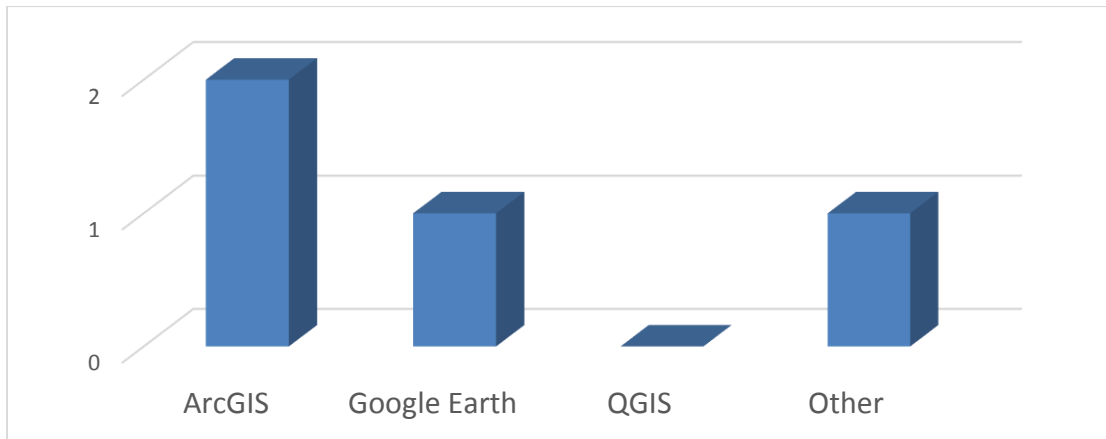


Figure 7: What GIS software does your library provide?

One of these respondents indicated in a later free text question (question 19) that the GIS software is available as part of a suite to all students over the internet, eliminating the need for dedicated GIS workstations: “The GIS software is a standard application available within a suite of applications for all students to access over the internet via a client instance of the 'lab' on their computer or device”.

Through provision of this software, these four libraries could be considered to offer high level Web-mapping services, as defined by Kowal (2002).

How many library staff members are trained to use GIS and geospatial data?

Of the two libraries (12%) to provide GIS trained staff, one library (6%) indicated they have one staff member trained to use GIS and geospatial data, while one other library (6%) indicated they have two staff members with these skills. These libraries offer the two strongest GIS services of the responding libraries.

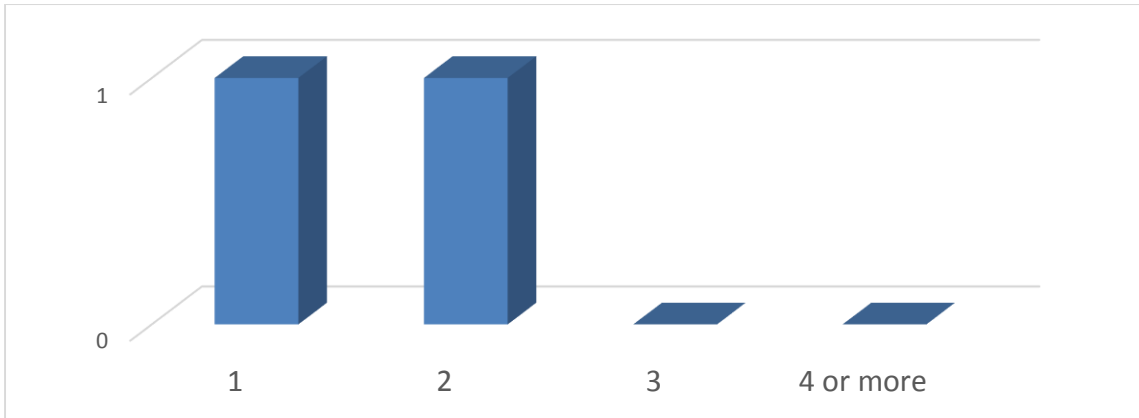


Figure 8: How many library staff members are trained to use GIS and geospatial data?

How many GIS related group tutorials, training sessions or workshops did your library provide from January 2015 to July 2015?

One library (6%) offered between 1-4 GIS related group tutorials in the first half of 2015. It is worth noting that “related” could be interpreted as tangentially related. These group sessions may not be GIS specific or particularly in-depth as this library indicated they do not have GIS trained staff. This library also indicated they provide one-to-one GIS related tutorials.

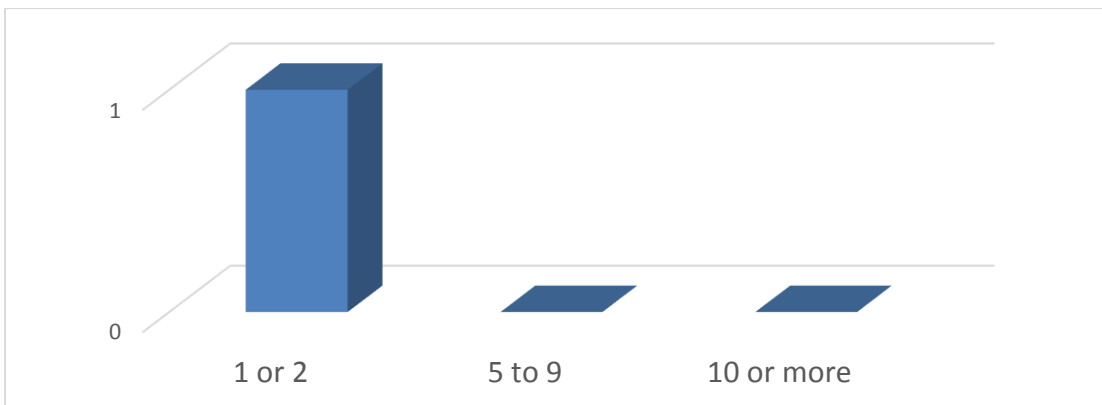


Figure 9: How many GIS related group tutorials, training sessions, or workshops did your library provide from January 2015 to July 2015?

How many GIS related one-to-one tutorials, consultations or research support sessions did your library offer from January 2015 to July 2015?

One-to-one GIS sessions were offered more frequently than group GIS sessions. As Figure 10 shows, three libraries (18%) indicated they offered one-to-one GIS related tutorials, consultations or research support sessions between January and July 2015.

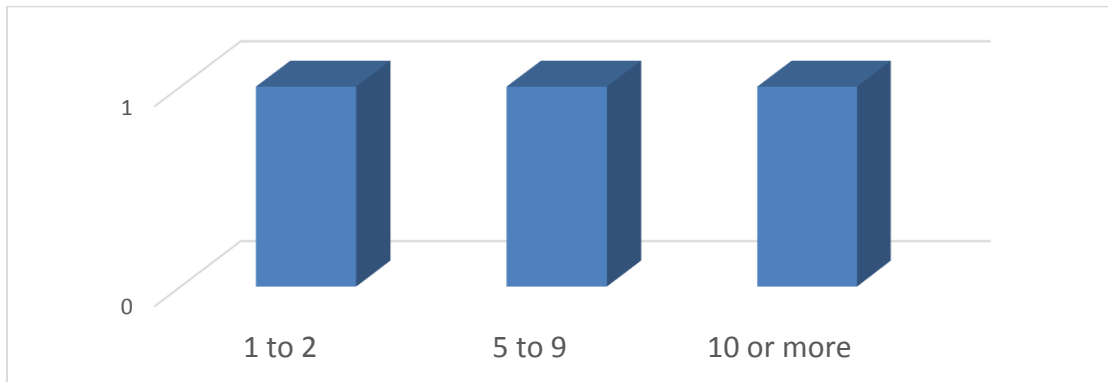


Figure 10: How many GIS related one-to-one tutorials, training sessions, or workshops did your library provide from January 2015 to July 2015?

One library (6%) offered 1-4 sessions, one (6%) offered 5-9 sessions, and one (6%) offered 10 or more sessions. These three respondents were university libraries with student populations of at least 15,000 EFTS. Two of these libraries indicated they have staff trained to use GIS.

How does your library manage electronic spatial data?

Seven libraries (41%) indicated they are involved with managing electronic geospatial data (see Fig. 11).

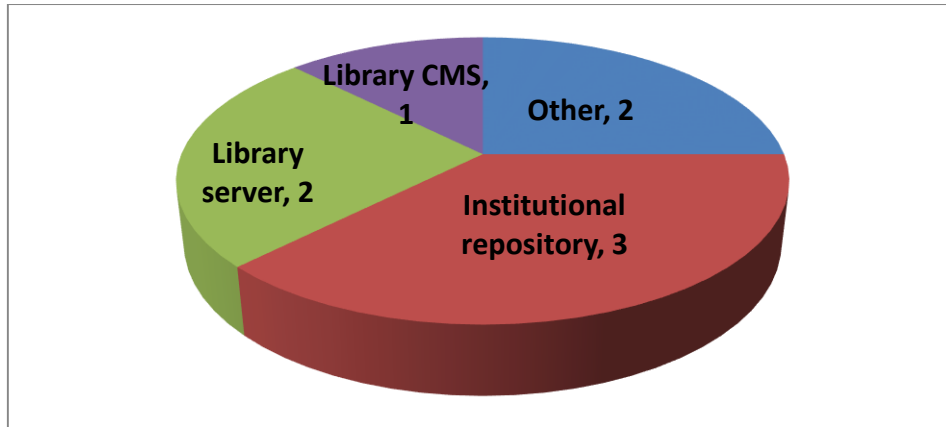


Figure 11: How does your library manage electronic geospatial data?

Three libraries (18%) indicate they use an institutional repository, two (12%) use a library server and one (6%) uses a library content management system (CMS). One library noted they store datasets on USB storage devices. A further response noted “We don’t [sic] manage geospatial data. We subscribe to some online geospatial resources”.

As many open access geodata sets and services exist in the region, (for example LINZ, geodata.govt.nz, and local government websites) there is potentially less need for library geodata management than in other nations.

6.3 GIS and geodata activities and projects

Apart from the specific GIS services offered by libraries outlined above (see Fig. 5), the survey aimed to gather information on GIS related collaborative activities or projects libraries were involved in since these can play important role in establishing or developing GIS capabilities in academic libraries (Houser, 2006; Scaramozzino et al, 2014).

Has your library collaborated on a GIS related project, or a project with a GIS element, in the last 5 years?

Fourteen responses were received, with four libraries (29%) answering positively (see Fig. 12) and providing details in a free text box. Three answers were significant.

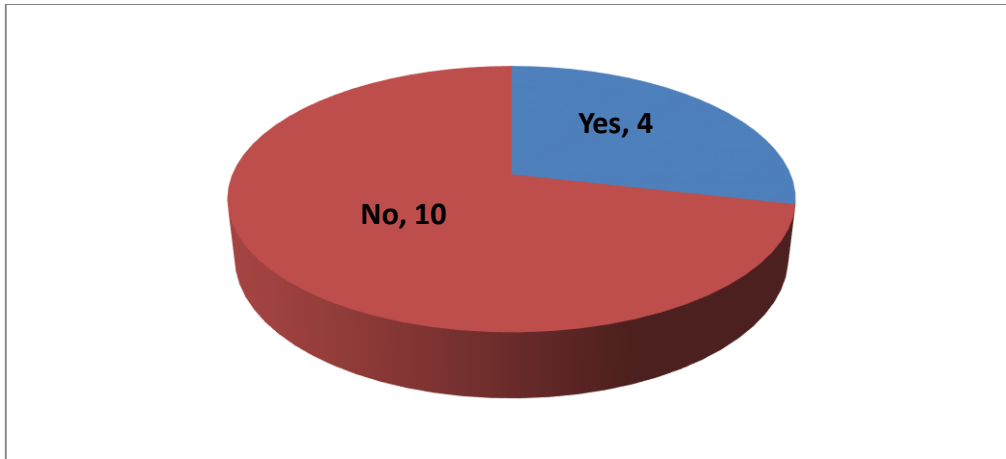


Figure 12: Has your library collaborated on a GIS related project, or a project with a GIS element, in the last 5 years?

1. *“Provision of the University Campus Map”*
2. *“In 2011 a couple of library staff created a geocaching treasure hunt for an item to be found within the library.”*
3. [Library collaboration on]... *“The Digital Mineral Library...”*.
4. *“Hosting Kiwi Image database on the Libray Website. Providing access to databses underpinned by GIS technology such as Maptoaster and Archsitey [sic: Archsite]”*.

The information provided shows three varied GIS projects contributed to by libraries. Response #4 could be considered an activity more than a collaborative project since it relates to provision of access to databases. Response #1 would likely require significant amount of library staff GIS skills, knowledge and resources. Response #3 indicates library involvement in creating a collaborative database with a GIS element.

6.4 GIS service models

Which service model most closely describes how your library provides GIS and geospatial data services?

Figure 13 shows the distributed model is the most common method of providing library GIS services. Of nine responses, three libraries (33%) offered GIS services via a hybrid model, where some aspects of the GIS service are managed by the library. However, in an earlier question (see Fig. 11) eight respondents indicated they manage geospatial data, which is

considered an aspect of the hybrid model, so the true number of hybrid models is potentially higher, and distributed models less.

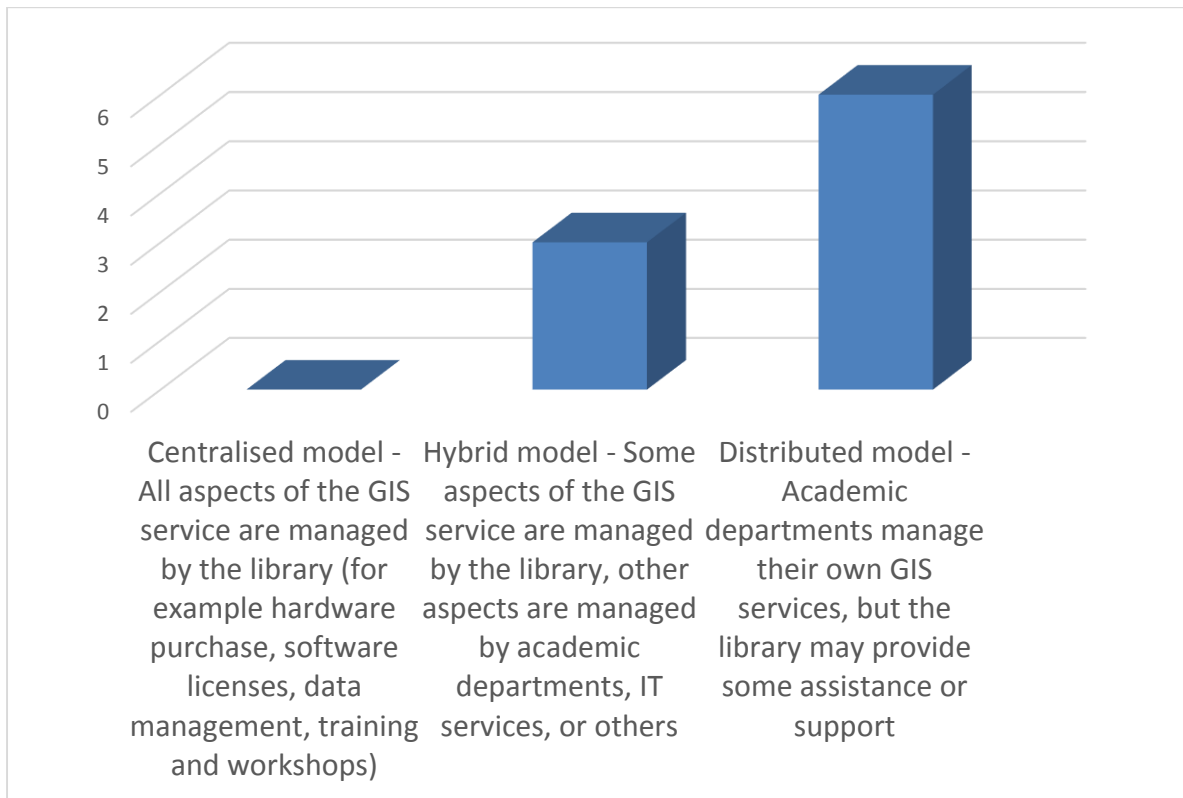


Figure 13: Which service model most closely describes how your library provides GIS and geospatial data services?

One library that indicated they use the hybrid model offers an extensive range of GIS services at a large university. Another is a university library which offers only geodata management, while the third is a polytechnic library that offers only GIS software.

Six libraries (67%) indicated they use a distributed model, providing assistance to departmental GIS services. No libraries have a resource heavy centralised model, where all aspects of the service are offered by the library.

Do any academic departments in your institution maintain their own GIS and/or geospatial data services?

This question was asked of all seventeen respondents. Twelve responses were received for this question. Ten respondents (83%), all university libraries, indicated that academic

departments maintain their own GIS and geospatial data services, while two (17%) indicated academic departments do not maintain these services at their institutions (see Fig. 14).

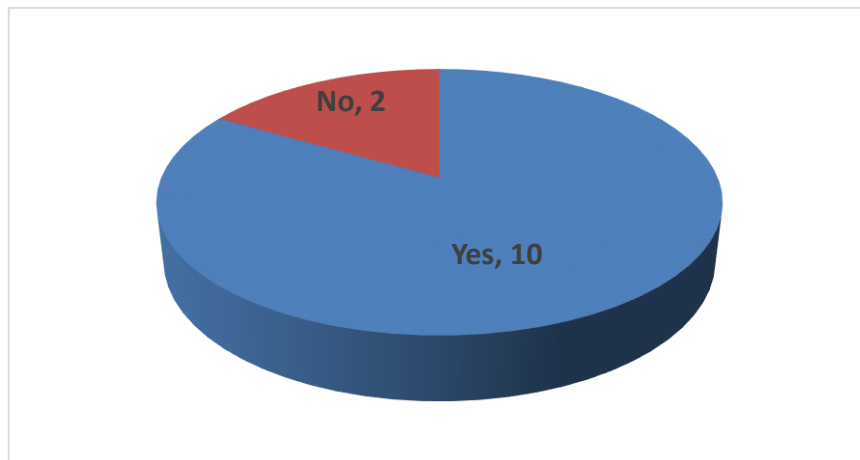


Figure 14: Do any academic departments in your institution maintain their own GIS and/or geospatial data services?

The responses indicate GIS and geospatial data services are frequently provided by academic departments. Of the ten respondents with academic departments providing GIS services, seven (70%) also offer library GIS services, indicating the presence of departmental GIS is a strong influence on the provision of library GIS services. The two negative responses were from polytechnic and TAFE institutions, where it is possible departments with a significant need for GIS services are not present in the institution.

6.5 Factors that drive the implementation of GIS and geodata services.

All respondents were asked to indicate the GIS services they plan to implement in the future. The options displayed to each respondent reflected services they indicated they did not provide in Question 7 (See Figure 4 and Appendix B).

Does your library plan to implement any of the following services in the future?

Three libraries indicated they have plans to implement new GIS services (see Fig. 15). These three are all university libraries.

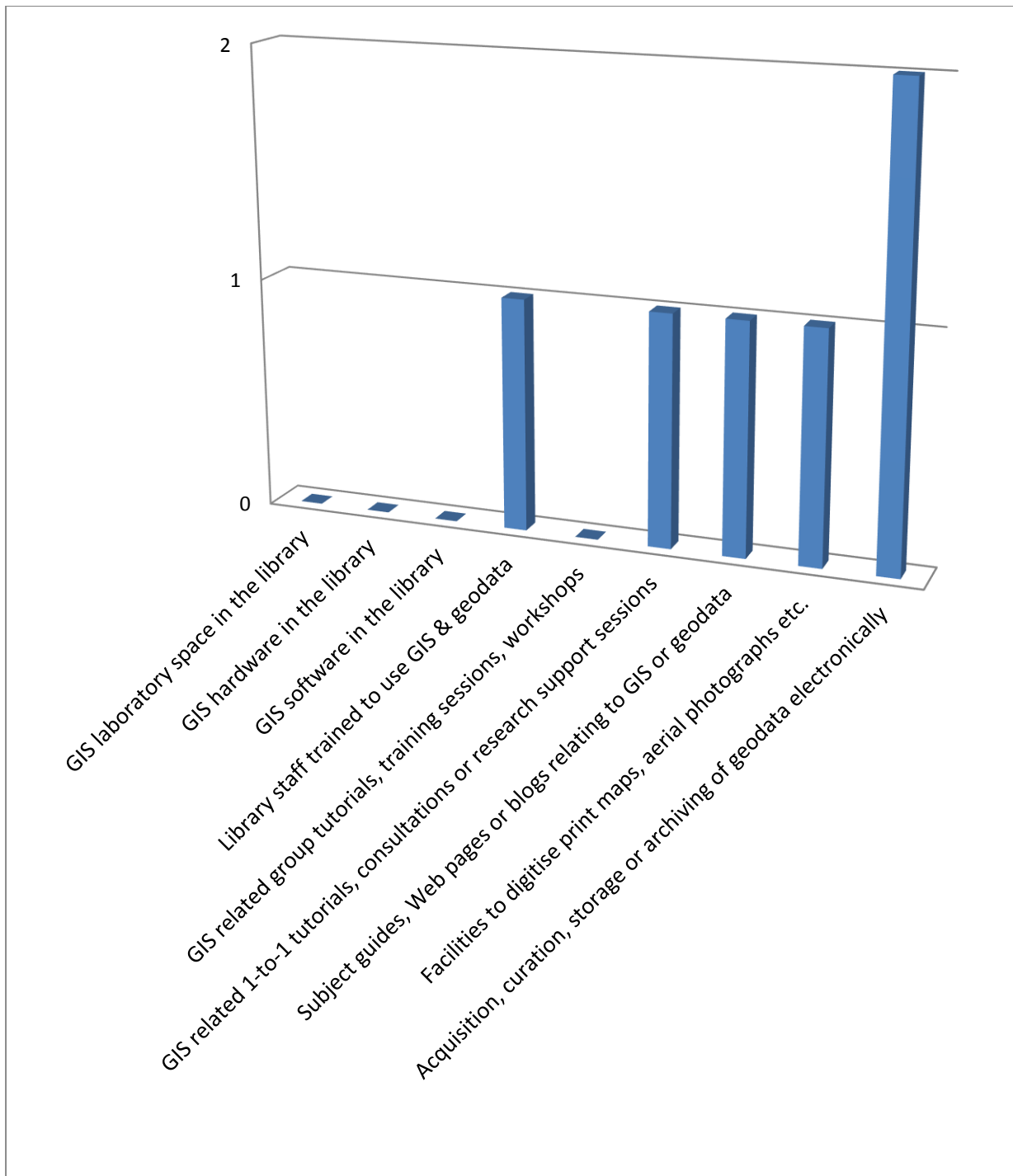


Figure 15: Does your library plan to implement any of the following services in the future?

One library plans to implement the following three services: GIS related one-to-one tutorials, consultations or research support sessions; subject guides, Web pages or blogs relating to GIS or geospatial data; acquisition, curation, storage or archiving of geospatial data electronically. Another library plans to offer two services: library staff trained to use GIS and geospatial data and acquisition, curation, storage or archiving of geospatial data

electronically. The third library plans to implement facilities to digitise print maps, aerial photographs, etc.

Two of these libraries currently offer no GIS services, while one offers only the management of electronic geospatial data. Interestingly, one indicated there is no department on campus using GIS technology, yet they plan to implement GIS services.

In your perception, for what reasons did your library implement the GIS related services you offer?

Between six and eight responses were received for each statement. The perception was that the strongest reason for implementing library GIS services was having academic departments on campus using GIS technology, with all eight responses to this statement (100%) either strongly agreeing or agreeing (see Fig. 16).

Demand for GIS services from library stakeholders was also perceived to be an important factor. All seven responses (100%) agreed or strongly agreed that faculty demand was a reason for implementing GIS services, and five out of six responses (83%) agreed or strongly agreed that student demand for GIS services was a reason for implementation.

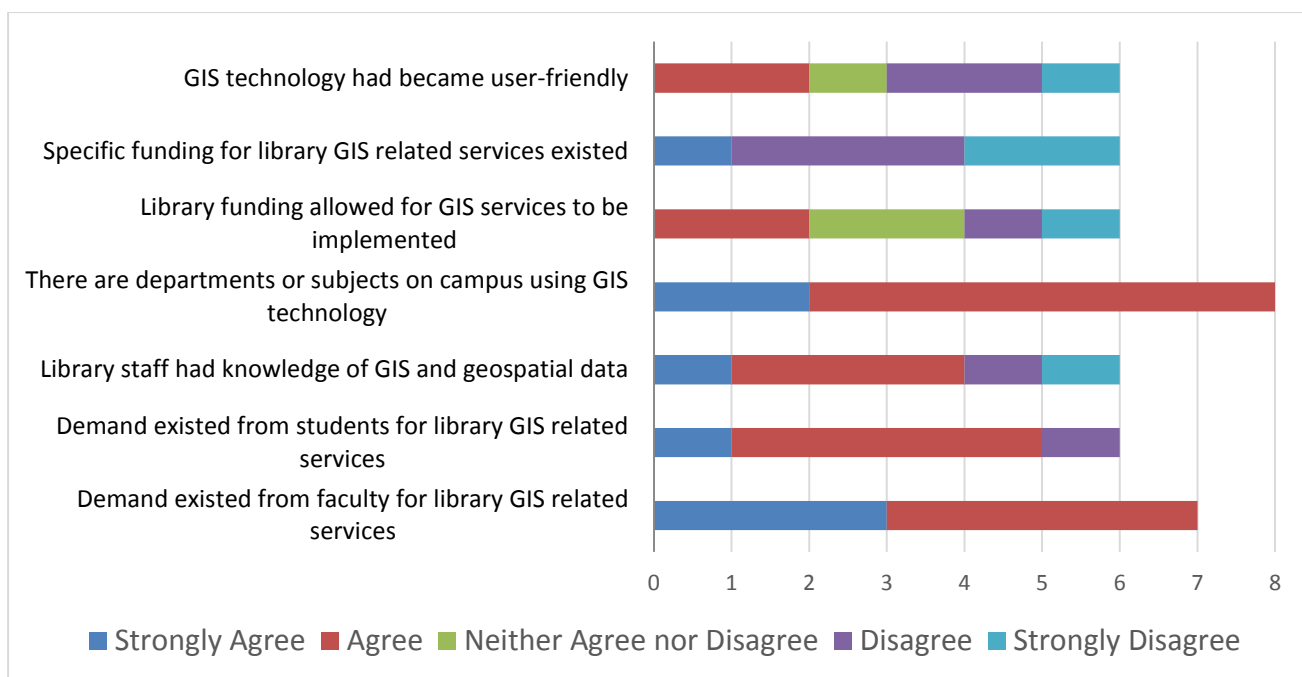


Figure 16: In your perception, for what reasons did your library implement the GIS related services you offer?

Two responses out of six (33%) agreed that library funding allowed for GIS services to be implemented, while one out of six (17%) strongly agreed that specific funding for a library GIS services existed. The general perception was that specific GIS related funding was not an important factor in implementing GIS services, as five of six (83%) respondents either disagreed or strongly disagreed with this statement. The response regarding non-GIS specific library funding was mixed. From the six responses, there were two (33%) neutral responses, two (33%) negative responses, as well as two (33%) positive responses.

Please briefly describe any other reasons your library has implemented GIS and/or geospatial data services.

Two relevant responses were received for this free text question. One response reflects faculty demand for library GIS services: “Request for specific subscriptions by [...] researchers”.

Another response implies a library role as a place for providing centralised campus-wide GIS resources: “Consolidation of institutional geospatial resources”.

In your perception, what would need to occur for increased GIS related services to be offered in your library?

This question was asked of the ten libraries that indicated they currently offer GIS services. The perception is strongest that demand from faculty and students for GIS services would need to occur for increased services to be offered, with all ten respondents (100%) either agreeing or strongly agreeing. Respondents also indicated that library staff knowledge of GIS and geodata would be an important factor regarding introducing these services, with 80% of respondents either agreeing or strongly agreeing this would need to occur (see Fig. 17).

Funding is perceived as an important aspect to increasing GIS services, with seven of nine responses (78%) perceiving GIS specific funding as necessary, and six responses of ten (60%) indicating a general increase in library funding would be needed to increase current services.

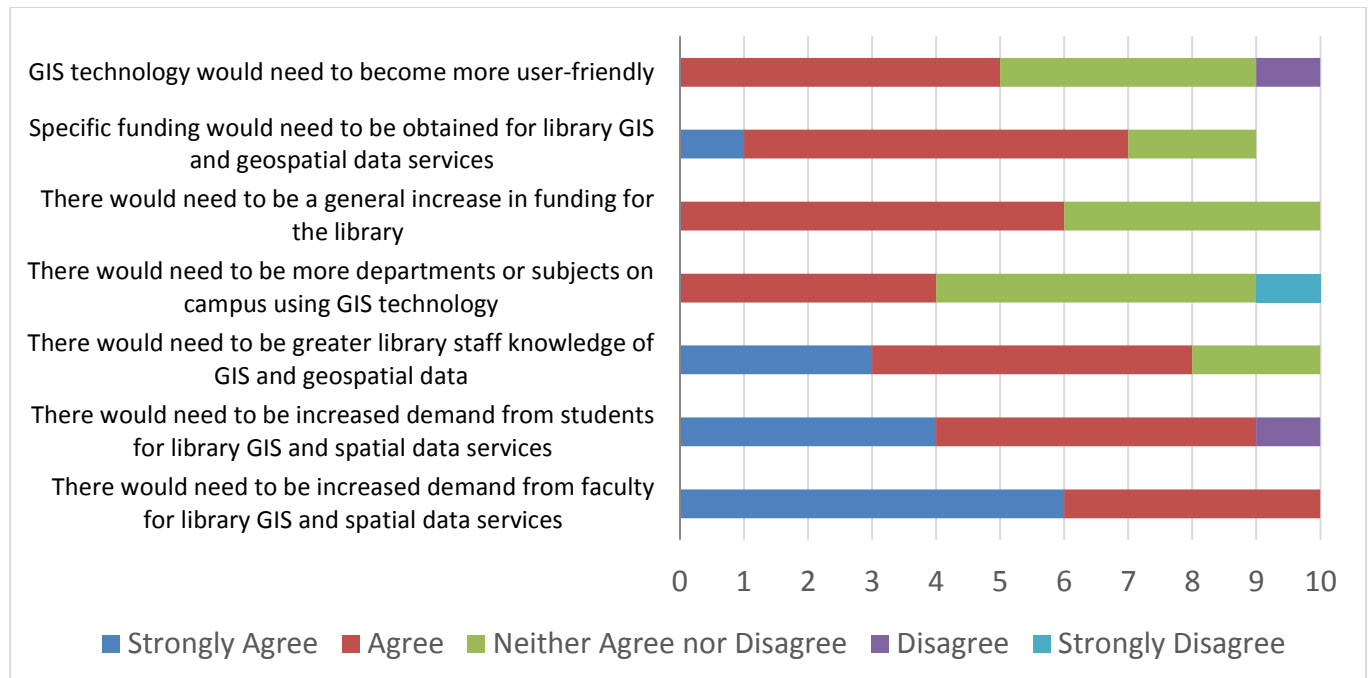


Figure 17: In your perception, what would need to occur for increased GIS related services to be offered in your library?

As the libraries that currently offer GIS generally offer lower cost services (tutorials and data management), to implement more specialized GIS services would likely be dependent on spending or investing more funds for software, hardware, staff with GIS knowledge and space for GIS laboratories.

Briefly describe any other factors that would influence an increase in GIS and/or geospatial data services in your library.

Four free text responses were received for this question. Three responses (#2, #3 and #4) describe demand for GIS services and two responses mention marketing (#1 and #2). One also mentioned hardware (#1).

1. "Better outreach and perhaps the provision of more dedicated computers"
2. "Getting the Faculty input about the library support required. Providing more visibility to the library support through a subject guide, workshops and training sessions. Proactively offering one to one consultation subject librarian services to newly enrolled students."
3. "We would need to perceive GIS services to be something that a library should provide."
4. "There is well-developed expertise within our faculties for GIS so we do not see any reason for providing specialised services. There has been no expressed demand from our faculties for us to provide services. There would have to be very strong demand for us to consider this."

6.6 Identification of demand for, and needs of a library GIS service

Has your library attempted to identify the demand for library GIS services, or the needs of a library GIS services?

Libraries were asked if they have tried to identify demand for, or needs of a library GIS service. Three libraries (18%) answered yes, eleven (65%) answered no, and three (18%) did not know.

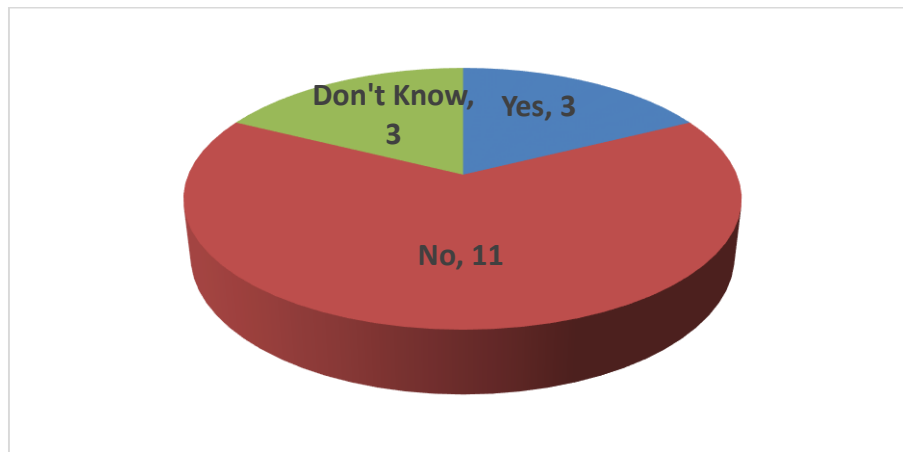


Figure 18: Has your library attempted to identify the demand for library GIS services, or the needs of a library GIS services?

Please briefly describe how your library identified the demand for library GIS services, or the needs of a library GIS service.

This question allowed libraries to elaborate on the answers given to the previous question. Three responses were received. Response #1 cites user-driven demand. Response #2 describes an annual content review which could detect demand for services. Response #3 seems to indicate access to tools was provided, and this access was met with demand from library users.

1. "On the basis of queries from staff and students for access to datasets and other GIS services."
2. "Each Year we conduct a content review, requesting expressions of interest in new resources, and for possible cancellations".

3. “Provision of access to geospatial resources to aid GIScience teaching and research
Provision of basic information on GIS and associated tools”.

6.7 Factors inhibiting implementation of GIS and geodata services

In your perception, why does your library not provide GIS related services?

The seven respondents that indicated their library does not offer any GIS services were asked for their perception of why these services were not provided. Not all respondents gave an answer for each statement. Figure 19 shows the strongest perceived factor is having a lack of library staff knowledge of GIS, with six out of seven respondents (85%) strongly agreeing or agreeing, while the next most significant factors were lack of funding with five of six respondents (83%) either strongly agreeing or agreeing, and lack of stakeholder demand, with five of the seven respondents (71%) agreeing that both lack of demand from faculty and students is a factor for not providing GIS services.

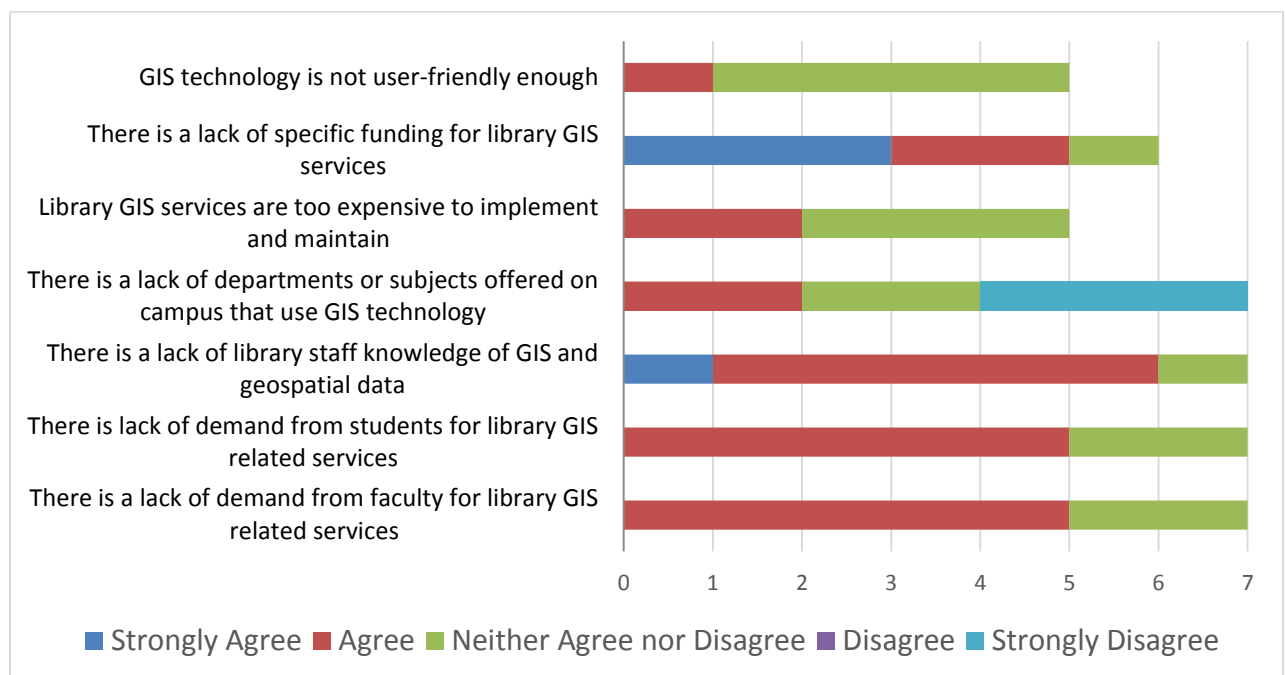


Figure 19: In your perception, why does your library not provide GIS related services?

Most did not consider the user-friendliness of GIS technology to be an issue, with four of the five respondents (80%) giving a neutral response, while one agreed lack of user-friendliness is a reason their library does not offer GIS services (20%). Respondents were divided on the

presence of departments using GIS as a factor influencing library implementation. From seven responses to this statement, two agreed (29%), two were neutral (29%), and three strongly disagreed (43%) that this is a reason their library does not offer GIS services.

7 Discussion

59% of the surveyed academic libraries in New Zealand and Australia offer at least one GIS support service. Most of these libraries offer only one or two aspects of a GIS service and these tend to be the services that most closely fit within traditional library activities. Only two of the sampled libraries offer four or more GIS services, with one of these libraries offering advanced support by offering seven different services. Factors that most influence the implementation of university library GIS services are institution size, stakeholder demand, the presence of GIS in academic departments and library staff knowledge of GIS.

The types of services most commonly offered reflect the key role of libraries regarding GIS services as discussed by Dodsworth (2012, p.98), namely introduction to GIS services and helping beginner users. The libraries that offer more advanced GIS services generally have staff trained to use GIS.

Few GIS services are offered by polytechnic, TAFE, and institute of technology libraries. This may reflect the limited use of GIS technology in these institutions, or that academic departments are self-sufficient in their use of GIS. In similar findings to Kinikin and Hench (2005a), library funding limitations and lack of staff knowledge of GIS also appear to be reasons for the limited services offered, although conclusions must be drawn cautiously from such a small sample.

The most significant factors driving implementation of existing GIS services are having a campus where GIS is widely used and stakeholder demand. Gabaldon and Repplinger (2006) found that institutions with better purchasing power tend to offer more GIS services, and the findings of this study support this as libraries from larger institutions were found to offer more GIS services. There is some evidence of growth of GIS support services, with several libraries planning to implement new services. Similarly, the most important barriers to implementation of library GIS services are perceived as lack of library staff knowledge, lack of stakeholder demand and funding issues.

Regarding funding issues for GIS services, 83% of libraries with established GIS services did not consider the presence of specific GIS funding an important factor regarding the implementation of their current services. However, of these same libraries 78% believe specific GIS funding would be necessary for implementation of new services. This may be due to the expense of implementing more advanced GIS services (such as software), while established services are primarily lower cost services that operate alongside regular activities such as data management and information literacy programmes. 83% of libraries without GIS services considered a lack of specific GIS funding a reason for services having not been implemented.

Libraries in New Zealand and Australia tend to use distributed and hybrid service models for their GIS activities, focussing on using library expertise to support departmental GIS services. The necessary demand, expertise and resources are rarely strong enough for a centralised library GIS service models to be used, although one library indicated they are working towards this model (see section 6.5, p.34).

8 Conclusion

8.1 Conclusion

This study has found that many academic libraries in New Zealand and Australia libraries offer some support for GIS services. The GIS services offered are primarily related to user education and data management. Few libraries offer advanced GIS services requiring a higher level of GIS knowledge, such as hardware and software provision. The libraries that offer advanced services have GIS trained staff. GIS support services are more likely to be offered by larger academic libraries, and particularly by university libraries in the region. The GIS and geodata services that exist complement the strengths of library information and data services.

Few libraries have engaged in collaborative projects relating to GIS services. Two libraries have provided expertise for valuable GIS related projects.

Libraries in the region use hybrid or distributed GIS service models to deliver their GIS support services as these most suit the needs of GIS users on campus and the resources available to libraries.

Existing library GIS services were perceived as being implemented primarily due to stakeholder demand, the presence of subjects on campus using GIS technology and library staff knowledge of GIS. The existence of funding and ease of use of GIS were not perceived to be important factors.

Respondents perceive that any future implementation of GIS services is dependent on user demand, library staff knowledge and availability of funding. This is the perception for both libraries that currently offer GIS services and those that do not, indicating that these factors are the greatest barriers to implementation.

Libraries in the region do little to specifically identify stakeholder demand for GIS and geodata services.

8.2 Implications of Findings

There may be a perception among libraries that do not offer GIS services that they are unnecessary, however GIS data management and GIS information literacy are two specific areas where many New Zealand and Australian academic libraries offer useful services. As GIS technology becomes more widely known and used in academia, demand for library GIS services is likely to grow and will drive the need for library guidance and introductory instruction (Kowal, 2002; Scaramozzino, et al., 2014; Weimar & Reehling, 2006). This is relevant both to increasing existing library GIS services and implementing new services.

Libraries need to make greater efforts to become aware of any growing demand for GIS services and prepare to respond to it (Aufmuth, 2006; Vardakosta & Kapidakis, 2011).

Libraries should make an increased effort identify stakeholder GIS needs as they arise or change. As March (2011, p.9) has found, many researchers may want to use GIS, but they lack skills and knowledge to do so. Providing introductory information and training for these users is a key aspect of library GIS services.

If GIS services are implemented, they can be implemented gradually allowing for library staff skills and knowledge grow, to fit in with budget constraints and to ensure the service reflects the needs of GIS users. For example, libraries could first incorporate GIS resources and tools into subject guides or web pages, and curate geodata. This could lead to offering GIS related tutorials and research support, and then to providing digitisation services and perhaps access to GIS software, depending on the specific requirements of GIS users.

Gradual, demand driven implementation of library GIS services will protect against underutilisation of services and allow library staff time to establish the necessary GIS skills and knowledge. When implementing new services, libraries need to beware of duplicating GIS services offered elsewhere on campus (Kinikin & Hench, 2005b). Libraries should also seek opportunities to participate in collaborative GIS related projects in order to build library GIS competencies and relationships with stakeholders involved in GIS activities.

The prevalent use of distributed and hybrid library GIS service models is likely to continue as demand increases, with libraries in the region unlikely to experience enough demand to justify the expense of a centralised library GIS service.

8.3 Future research opportunities

It would be useful to investigate how academic departments work with GIS to discover their specific GIS and geodata needs, particularly among non-traditional GIS areas that may have the occasional interest or need for GIS. This group is unlikely to have the support of, or access to departmental GIS expertise and services, so it would be valuable to know what libraries could do to help to meet these needs.

Another area worthy of investigation is to explore whether it would more cost effective, or a better use of resources, to have certain aspects of GIS services across campus centralised and managed by the library. For example, regarding geodata management, libraries could provide a neutral campus-wide service building on their considerable data management expertise.

A research project using a qualitative approach focussing on a library with an advanced GIS service in New Zealand and Australia could be useful to better understand why and how particular libraries meet the needs of existing GIS users.

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10 Appendices

10.1 Appendix A: participant invitation

Dear [participant],

My name is Mike Smith and I am a Masters student in the School of Information Management at Victoria University of Wellington. I am conducting research as part fulfilment toward a Master of Information Studies. Your library has previously indicated interest in participating in this study.

The research project I am undertaking aims to gain an understanding of the geographic information system (GIS) and geospatial data services offered by academic libraries in New Zealand and Australia.

The project aims to determine what factors influence decisions to implement, or not implement GIS services, the service models used, the level of service and types of GIS tools used. The project also aims to discover whether there are future plans to implement GIS services and the perception of what elements may need to be in place before implementation.

If you agree to take part you may access the online questionnaire via the link below. The questionnaire will ask you about GIS related services in your institution. The questionnaire will take twenty to thirty minutes to complete. The survey software will record the responses. You can choose not to answer any question. You can stop the questionnaire at any time, without giving a reason. Completion of the online questionnaire implies informed consent.

This research is confidential. I will not name you in any reports, and I will not include any information that would identify you. Because of the likely small sample, it has been deemed best NOT to name the institutions that participate to protect confidentiality. Only my supervisor Dr. Chern Li Liew and myself will be able to see the questionnaire responses. The responses will be kept secure and destroyed 2 year after the research ends.

The information from my research will be used in my Master of Information Studies research project. The final report will be submitted to the School of Information Management for marking and subsequently deposited in Victoria University of Wellington's institutional repository. I may also use the results of my research for conference presentations or publishing in academic journals. I will take care not to identify you in any presentation or article. You will have an opportunity to request a summary of the research findings.

If you have any questions, either now or in the future, please feel free to contact me at smithmich12@myvuw.ac.nz or you may contact my supervisor, Dr. Chern Li Liew, Information Studies Programme Director, School of Information Management at chernli.liew@vuw.ac.nz or telephone +64 4 463 5781.

This research has been approved by the Victoria University of Wellington Human Ethics Committee, reference 0000022456.

If you have any concerns about the ethical conduct of the research you may contact the SIM HEC Convener: Dr David Johnstone. Email david.johnstone@vuw.ac.nz.

Please click here to begin the questionnaire: [survey link omitted]

Kind regards,

Mike Smith

Master of Information Studies (MIS) Candidate
Victoria University of Wellington School of Information Management
P O Box 600, Wellington 6140,
New Zealand

10.2 Appendix B: consent form and questionnaire

Q1 Research Project Title: An Analysis of Support for Geographic Information Systems and Geospatial Data in New Zealand and Australian Libraries.

Researcher: Mike Smith, School of Information Management, Victoria University of Wellington

I have been given and have understood an explanation of this research project. I have had an opportunity to ask questions and have them answered to my satisfaction.

I understand that I may withdraw myself (or any information I have provided) from this project, without having to give reasons, by e-mailing smithmich12@myvuw.ac.nz by 15 January, 2016.

I understand that any information I provide will be kept confidential to the researcher and their supervisor, the published results will not use my name, or name my organisation, and that no opinions will be attributed to me in any way that will identify me.

I understand that the data I provide will not be used for any other purpose or released to others.

I understand that the survey data will be destroyed within 2 years after the conclusion of the project. Furthermore, I will have an opportunity to receive a copy of my completed questionnaire.

By selecting 'I agree to participate' below, you will be giving consent to participate in the research project.

- I agree to participate
- I do not agree to participate. (By selecting this option you will exit the survey)

Q2 What country is your library based in?

- New Zealand
- Australia

Q3 What type of institution does your library belong to?

- University
- Polytechnic
- TAFE
- Institute of Technology

Q4 What is the student population of your institution? Please provide the latest data you have available.

- 0 - 14,999 EFTS / EFTSU
- 15,000 - 29,999 EFTS / EFTSU
- 30,000 or more EFTS / EFTSU
- Don't know

Q5 Has your library attempted to identify the demand for library GIS services, or the needs of a library GIS services?

- Yes
- No
- Don't know

Q6 Please briefly describe how your library identified the demand for library GIS services, or the needs of a library GIS service.

Q7 Which of the following GIS related services does your library **currently provide**?

- Provision of dedicated GIS laboratory space in the library
- Provision of GIS hardware in the library
- Provision of GIS software in the library
- Provision of library staff trained to use GIS and geospatial data
- Provision of GIS related group tutorials, training sessions, or workshops
- Provision of GIS related one-to-one tutorials, consultations or research support sessions
- Provision of subject guides, Web pages or blogs relating to GIS or geospatial data
- Provision of facilities to digitise print maps, aerial photographs etc.
- Acquisition, curation, storage or archiving of geospatial data electronically

Q8 Does your library **plan to implement** any of the following services in the future? [*only unselected answers from Q7 displayed*]

- Provision of dedicated GIS laboratory space in the library
- Provision of GIS hardware in the library
- Provision of GIS software in the library
- Provision of library staff trained to use GIS and geospatial data
- Provision of GIS related group tutorials, training sessions, or workshops
- Provision of GIS related one-to-one tutorials, consultations or research support sessions
- Provision of subject guides, Web pages or blogs relating to GIS or geospatial data
- Provision of facilities to digitise print maps, aerial photographs etc.
- Acquisition, curation, storage or archiving of geospatial data electronically

Q9 How many GIS workstations does your library provide?

- 1 - 2
- 3 - 5
- 6 or more

Q10 What other GIS hardware does your library provide?

- Large scale scanner
- Large scale printer
- Other - please details in the box below _____

Q11 What GIS software does your library provide?

- ArcGIS
- Google Earth
- QGIS
- Other - please enter details in the box below _____

Q12 How many library staff members are trained to use GIS and geospatial data?

- 1
- 2
- 3
- 4 or more

Q13 How many GIS related **group** tutorials, training sessions, or workshops did your library provide from January 2015 to July 2015?

- 1-4
- 5-9
- 10 or more
- Don't know

Q14 How many GIS related **one-to-one** tutorials, consultations or research support sessions did your library offer from January 2015 to July 2015?

- 1-4
- 5-9
- 10 or more
- Don't know

Q15 How does your library manage electronic geospatial data?

- Institutional repository
- Library server
- Library content management system (CMS)
- Other - please enter details in the box below _____
- Don't know

Q16 In your perception, why does your library **not provide** GIS related services?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Don't Know
There is a lack of demand from faculty for library GIS related services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is lack of demand from students for library GIS related services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is a lack of library staff knowledge of GIS and geospatial data	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is a lack of departments or subjects offered on campus that use GIS technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Library GIS services are too expensive to implement and maintain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is a lack of specific funding for library GIS services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GIS technology is not user-friendly enough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q17 Please briefly describe any other reasons your library does not provide GIS related services.

Q18 In your perception, for what reasons did your library **implement** the GIS related services you offer?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Don't Know
Demand existed from faculty for library GIS related services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Demand existed from students for library GIS related services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Library staff had knowledge of GIS and geospatial data	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are departments or subjects on campus using GIS technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Library funding allowed for GIS services to be implemented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Specific funding for library GIS related services existed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GIS technology had become user-friendly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q19 Please briefly describe any other reasons your library has implemented GIS and/or geospatial data services.

Q20 In your perception, what would need to occur for **increased** GIS related services to be offered in your library?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
There would need to be increased demand from faculty for library GIS and spatial data services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There would need to be increased demand from students for library GIS and spatial data services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There would need to be greater library staff knowledge of GIS and geospatial data	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There would need to be more departments or subjects on campus using GIS technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There would need to be a general increase in funding for the library	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Specific funding would need to be obtained for library GIS and geospatial data services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GIS technology would need to become more user-friendly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q21 Briefly describe any other factors that would influence an increase in GIS and/or geospatial data services in your library.

Q22 Do any academic departments in your institution maintain their own GIS and/or geospatial data services?

- Yes
- No
- Don't know

Q23 Which service model most closely describes how your library provides GIS and geospatial data services?

- Centralised model - All aspects of the GIS service are managed by the library (for example hardware purchase, software licenses, data management, training and workshops)
- Hybrid model - Some aspects of the GIS service are managed by the library, other aspects are managed by academic departments, IT services, or others
- Distributed model - Academic departments manage their own GIS services, but the library may provide some assistance or support
- Don't know

Q24 Has your library collaborated on a GIS related project, or a project with a GIS element, in the last 5 years?

- Yes - please briefly describe the project(s) below. _____
- No
- Don't know

Q25 Please enter any other comments you wish to share regarding to your library's GIS and/or geospatial data services, or these services in general, here.

Q26 Would you like to receive a summary of the final research findings?

- Yes - please enter your email address below _____
- No