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**“Geoskills amongst academic librarians in
Greece, Cyprus and Spain”**

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Geoskills amongst academic librarians in Greece, Cyprus and Spain

Abstract

Existing literature on Geographic Information (GI) and libraries points out that American and Canadian librarians have long been aware of the intimate relationship between geospatial data and libraries. In Europe, though, there is almost no literature to this regard, and academic libraries that offer GI services are the exception. Despite the fact that European and National institutions are putting lots of efforts forward for making open data freely available to society, and for supporting full programmes to generate business out of it, this paper examines why libraries and librarians are not perceived as key players in the (geo) data-driven economy. Starting with a survey addressed to academic librarians (in three European countries: Greece, Cyprus and Spain) about their GI knowledge and skills, the paper attempts to shed some light on the librarians' perception about their role in GI management, and to identify to what extent they are ready for providing GI services to their communities. The ultimate goal of this paper is to serve as a triggering factor to wake up European academic libraries, Librarianship programmers and librarians themselves, to encourage them to look for opportunities in geospatial data management.

Keywords

Geographic Information, academic libraries, Mediterranean region, geodata management skills, GIS Librarian

1. Introduction

Data is increasingly turning into a valuable asset across economic sectors, widely recognised by international organizations like the European Commission (EC) that recently outlined a strategy to accelerate the transition towards a data-driven economy

in Europe (COM 2014 442 final). Opening up public data is central to such strategy. In the 2014 “Guidelines on recommended standard licenses, datasets and charging for the reuse of documents” (OJEU C/240-1) reported, the EC prioritized datasets from the public sector information (PSI) (Directive 2003/98/EC) that must be openly available to support a data-driven economy. Geospatial data was the top category because of its special relevance in the context of economic growth (COM (2011) 882 final), (COM 2014 442 final) and transparency initiatives. Despite being left out of the “geospatial data” category, the next listed categories -earth observation and environment, and transport-, cannot be fully understood without a spatial dimension.

What the above guidelines report and EC communications suggest is that geospatial data undoubtedly play an important role in economy and public sector. To put it simply, everything that happens somewhere has a footprint and a location. Geospatial data is so pervasive because of a conglomeration of factors:

- the easiness of generation of geospatial data with the help of ubiquitous technology (smartphones, sensors, etc.) provokes
- an increase in the number of individuals (government, education, private sector, and society at large), out of the strict researchers community and experts, dealing with and benefiting from data (Sui, 2014); which in turn leads to
- a full range of uses across many disciplines, from Sciences to Humanities (Blaschke & Merschdorf, 2014).

As Clemons (2015) argues “the management of geospatial data sets is increasing in importance because of the proliferation of available data”. This fact should make us reflect on the importance of geospatial data by itself, as a critical category of data

within open data. When it comes to public-funded research data, not only journal articles and papers - as direct output generated by research processes – should be managed and uploaded into open access repositories, but other outputs being generated during the course of research projects such as informal documentation and data sets, among other resources, need proper preservation and curation (Ride the wave, 2010). This is also prioritized by the strategic policy for the European Research Area (ERA) (COM 2012 392 Final) highlighting on the one hand, more effective national research systems, and on the other hand, the need for optimal circulation, access and transfer of scientific knowledge. Better management of geospatial data from academic institutions could directly contribute to the ERA priorities and consequently impact the improvement of research infrastructures and the re-use of information (Steinhart, 2006).

In this context, universities and academic institutions are beginning to look at Research Data Management (RDM) as a key factor for developing an open access strategy that catalyzes Science and Innovation. However, geospatial data –as part of the open data movement and research data – has not yet been considered individually. There is an urgent need to specifically treat geospatial data as a specific category of datasets by its own, given:

- its paramount importance as an economic booster (Carpenter & Snell, 2013),
- its social importance and wide diffusion (Craglia & Shanley, 2015),
- its particular role in being a common substrate in research data coming from many diverse scientific disciplines (Schade et al., 2015, p. 271-293), and
- its particular characteristics (Lemmens et al., 2006).

Despite the aforementioned efforts and initiatives being made towards an economic model based on the access, exploitation and reuse of (geospatial) open data, there are still critical barriers that deserve a further look. Through the exploration of the librarian community in three Mediterranean countries (Cyprus, Greece and Spain), this paper aims to reveal to what extent academic librarians support geospatial data management activities and whether they are ready to offer geographical information services to patrons.

2. The role of libraries in geographical data management

A common claim is that “somebody else” has to provide the ground level support and to “engage and thrive in the messy and ambiguous” (Jaguszewski, 2013, p. 14) panorama of data management. This situation is getting worse in the European context where geospatial data management lacks a clear professional profile to take care of the entire life-cycle of geospatial data. However, in order to play a role on the geo-driven data economy, research institutions have to define who is going to take the responsibility for all this data, as well as sustain it for later discovery and use. As suggested in the guidelines mentioned above, it is strongly recommended to “ensure[ing] their availability, quality, usability and interoperability [of open data]”, as well as its preservation, and these are exactly the tasks addressed by library professionals when dealing with information and data in general. Despite the fact that libraries have always been in charge of managing information - which is in its minimal unit data - they are not perceived as centers for taking care of the whole data life cycle (Clemons, 2015). Cataloguing, documenting, curating, metadating and preserving large amounts of research data (and other kinds of information) to ensure

long term access for future investigations have been traditionally part of the know-how acquired by librarians over years. Libraries can be effective in handling massive and heterogeneous geospatial datasets, thereby contributing actively to the development of geospatial (cyber)-infrastructures (Yang et al., 2010; Wright & Wang, 2011), as they possess expertise in areas like collection development, archival practices, cataloguing and indexing, development of platforms for discovery and distribution, education and user support (Steinhart, 2006). Given the increased pressure in the researcher's community to make research (spatial) data available (Little, 2012), librarians and libraries as key stakeholders involved in boosting the access to scientific information, could substantially contribute to the process of opening geospatial data for making research data accessible and increase the rate of reuse of previous research results.

As opposed to what happens in USA, where university and public libraries have been involved in managing and disseminating geospatial data across disciplines since the 90s, universities and academic or research libraries in Europe have not paid enough attention to geospatial datasets which, to some extent, contradicts EC guidelines. This paper argues that while RDM initiatives and specific educational programmes for librarians have been already started (Pinfield et al., 2014), little room has been left to geospatial data as a particular case. A new profile called "geolibrarian" or "geographic information librarian" should emerge in Europe, as it happened in other countries (ALA, 2008), to fill the gap amongst communities involved in data management, and to leverage the potential capabilities of librarians regarding geospatial data management.

3. Literature Review

One of the initial requirements for a successful implementation of GI services in libraries is having a well trained staff (Longstreth, 1995; Abbott & Argentati, 1995; Florance, 2006). Cline and Adler (1995) stated that GIS support and implementation in a library environment requires not only the typical skills that librarians should have but also an understanding of computing and the ability to work with visual representation of data, while Adler and Larsgaard (2002, p.904) also claim that “*the significant learning curve associated with GIS has placed new demands on library staff*”. Similarly, Abbott and Argentati (1995) revealed that the librarian’s role is more complex than assisting users to use GIS as a high-tech map-drawing tool, since they should assist users to be able to search, select and integrating data from various databases for producing the desired result. On the other hand, Longstreth (1995) identified institutions with strong GIS programs already associated with the library and argued that these librarians may have little experience to draw upon in developing GI services. Gabbaldon and Replinger (2006), in their survey about libraries offering GI services in two consortia, concluded that one of the barriers for implementing GI services is having trained and experienced library staff. Shawa (1998) indicated the lack of staff preparation and specific training as the main reasons for GI services to fail. For Boston et al. (1998) the integration of geospatial resources and services in their university library was accompanied by a training project for librarians aiming to improve their knowledge and skills, as well as developing an understanding of the geospatial data sets.

ARL GIS Literacy Project was chronologically the first initiative in developing GIS collections (Vardakosta & Kapidakis, 2011; Vardakosta & Kapidakis, 2012) in which librarian's training was foreseen (ARL, 1999; French 2000). The term "*Geographic Information Librarianship*" and "*GIS Librarian*" as "*the profession of providing geographic information resources and services in a library setting*" (Weimer & Reehling, 2006) was formally defined thereafter. Shawa (2012) stated that a geolibrarian "*[has] knowledge of GIS data models, concepts, techniques, technologies, and information and library science, and of who can apply this knowledge in collecting, organizing, disseminating, and preserving geographically referenced data, providing general help in GIS reference and in displaying geospatial data*".

MAGIRT¹ and WAML² in USA, ACMLA³ in Canada, ANZMapS⁴ in Australia and New Zealand, are some of the map and library organizations which provide fora for people involved in map librarianship around the world. MAGIC⁵ (Map and Geoinformation Curators Group former LIBER Groupe des Cartothécaires) associated with the ICA Commission on Digital Technologies in Cartographic Heritage, and Map Curators Group of British Cartographic Society⁶ in UK are well-known at the European level. Most of them - besides being a medium of communication for those professionals interested in maps - aim to "*improve the skills and status of persons working with map collections*"⁷.

Johnson (2012) provided insight into the involvement of information professionals across academic, corporate, and government sectors in the management of all forms

¹ <http://www.ala.org/magirt/front>

² <http://www.waml.org>

³ <http://www.acmla-acacc.ca>

⁴ <http://www.anzmaps.org>

⁵ <http://cartography.web.auth.gr/ICA-Heritage/MAGIC>

⁶ <http://www.cartography.org.uk/default.asp?contentID=702>

⁷ <http://www.anzmaps.org/documents-policies>

of geoscience data. Bishop et al., (2013) compared the contents of MAGIRT competencies (MAGERT, 2008) and Geographic Information Science and Technology Body of Knowledge (GI S&T BoK) (DiBiase 2006) - as reference documents for curriculum development - with the skills and knowledge useful for map and GIS librarians, finding that suitable abilities were missing. This previous research mainly differs from the present survey in the sample population studied. Whereas the present survey was addressed to academic librarians in general, Johnson (2012) investigated an expert sample of information professionals in 30 work units, and Bishop et al., (2013) analyzed exclusively map and GIS librarians.

There are not many studies regarding geospatial data managed by libraries or academic libraries offering GI services in Europe. The survey conducted by Moore (2005) highlighted the role of the map libraries and the absence of well trained academic librarians to promote Digimap⁸ efficiently in UK. Moore is not the only European scholar that points out the need for a change in the management of geographic materials since the digital era demands more skilled librarians (Korsgaard, 2008; Granell & Aguilar, 2013). Millea (2005b) discussed the results of a survey by the LIBER Groupe des Cartothecaires Working Group for Education conducted in 2003, and emphasized the fact that *“the map users tend to be in need of greater assistance than the conventional library user such is the specialist nature of the cartographic materials with which they deal”*. Unfortunately, Mediterranean countries were not included in Millea’s study.

⁸ Digimap is a service offering free access to maps and geospatial data from a number of national data providers to UK universities and colleges <http://digimap.edina.ac.uk/>

Although previous surveys in Greece (Vardakosta & Kapidakis, 2011; Vardakosta & Kapidakis, 2014a; Vardakosta & Kapidakis, 2014b; Liarou, 2015) and Spain (Granell & Aguilar, 2013; Aguilar & Granell, 2015a) have been conducted for the investigation of GIS penetration and implementation in academic libraries, these studies have a reduced geographical coverage, and they do not delve into the understanding of the level of the librarians' awareness of geospatial data. In Spain, Aguilar and Granell (2015a), surveying libraries' directors, pointed out the lack of involvement of academic libraries when managing geospatial data, but not considering academic librarians themselves, neither academic libraries' policies. In Greece, the survey that Vardakosta and Kapidakis (2012) conducted was focused on librarian's role in the use of geographical collections and GIS services.

Therefore, there hasn't been any previous research in Europe examining the academic librarians' perception of their role in geospatial data management. This is precisely what our research intends to cover. In particular, the paper concentrates on the existing relation between academic librarians - in Cyprus, Greece and Spain - with geographic information in their daily activities, as well as aims to gather their opinion on the skills a librarian should fulfill in order to provide geospatial data management tasks and services.

4. Research in Greece, Cyprus and Spain

4.1. Problem statement and research questions

This research is based on the assumption that libraries should provide geographical information and GI services to cover their patrons' specific information needs, since there is a role for them in the data-driven economy. Therefore, librarians should be equipped with particular skills that would provide them with an effective way of action as information professionals. This research examines to what extent academic librarians from three Mediterranean countries, Cyprus, Greece and Spain are prepared to offer GI services.

For investigating the above, the following research questions were formulated:

RQ1: Are academic librarians familiar with geospatial information?

RQ2: Are academic librarians used to work with geographical data as part of their daily library routines?

RQ3: What are librarians' perceptions of their own ability to deal with geospatial data?

RQ4: Are academic libraries taking geographic data as a valuable resource to form part of their collections and services offered?

4.2. Methodology

The research methodology followed is summarized in Figure 1. After reviewing existing literature, a questionnaire was designed to “map” academic librarians’ knowledge and perceptions regardless their current job obligations. It comprised 19 questions grouped into four categories linked to research questions. Because of its free access and usability, a Google form⁹ was set up for publishing the questionnaire and gathering participants’ responses.

The questionnaire was initially specified in English (Appendix 1), validated through a pilot distribution, and then translated into local languages (Greek and Spanish)., In Cyprus, it was distributed to 80 mail accounts as they were listed in Cyprus academic libraries’ websites. It was also published in the “Cyprus Association of Librarians-Information Scientists (CALIS)” and in its Facebook page.

In Greece, the questionnaire was sent to 600 personal e-mail accounts as they were listed in academic libraries’ websites. It was also circulated to the main librarianship mailing list for academic libraries “acadelib”. Social networks Facebook and Twitter were used as well.

In Spain, the questionnaire was circulated to the main Librarianship Spanish discussion list, IWETEL, disseminated through social media (Twitter and LinkedIn), and sent by direct mailing to REBIUN members (Spanish university libraries network).

The questionnaire was opened on June 5th 2015 and available until the end of June. The results gathered were extracted from both questionnaires, translated into English,

⁹ Short link to the questionnaire in Spanish <http://goo.gl/forms/mxOI5IE35F> and in Greek <https://goo.gl/FyNq5x>

merged and coded in one file. Microsoft Excel and SPSS Statistics (V 22.0) were utilized as tools for results analysis which took place in July 2015.

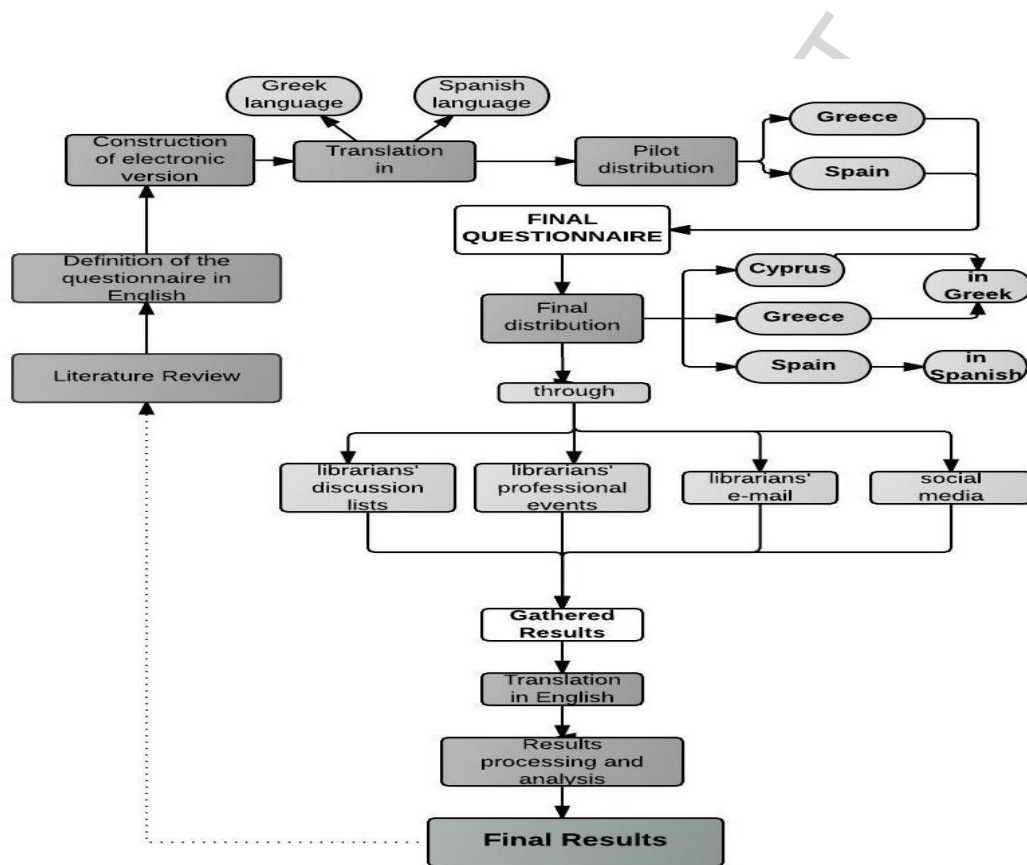


Fig.1: Methodology of the research

5. Results and discussion

5.1. Research sample

The questionnaire was answered by 249 academic librarians from Greece, Cyprus and Spain. 70% of the answers were provided by Greek librarians, followed by 19% Spanish librarians and 11% of Cypriot librarians. Given the fact the Greek results could bias our study, the subsequent analysis differentiates the results between

countries when discrepancies are significant. Otherwise, the analysis will treat the three countries' results as a whole.

Most respondents were between 31 and 50 years old, and 78.7 percent were females. More than 93 percent of respondents declared having Librarianship as their main background, and a degree or a Msc in 91 percent of the cases. More than 17 years of experience as a librarian was declared by the 48.6 percent of the participants as can be seen in Table 1.

In relation to the research sample, it is important to note one subtle aspect that distinguishes job offers between Unites States and Europe. Unlike United States and Canada, librarians' job offers in Europe do not ask for a specific role as cataloguer, metadata librarian, legal librarian, or GIS librarian. Therefore, job announcements in the three European countries analyzed most often indicate a required degree the applicant should possess rather than a specific professional profile. That is why the survey was addressed to all kind of librarians working in an academic context.

Table 1: Respondents' demography

DEMOGRAPHICS	RESPONSES	PERCENTAGES
Age	31-50	83.5%
Gender	Females	79.4%
Country	Greece	70%
	Cyprus	11%
	Spain	19%
Educational Background	Librarianship	93.6%
Educational Level	Degree or Msc	91%
Working experience	>17 years	48.6%

5.2. Familiarity with geospatial information

Our first research question intends to realize whether librarians were familiar with geospatial data. 80.3 percent of participants concede not to have any additional knowledge in GIS or a related discipline. Those librarians with some GIS knowledge admit that it was acquired through self-learning (11.4 %).

When presenting GIS concepts like “Geodata”, “GIS”, “Geo-Library” and “GIS-Librarian”, the majority noted that they were “not at all familiar” with them, and the results showed 43.4 percent, 31.3 percent, 54.2 percent and 56.3 percent, respectively (Figure 2).

Librarians are aware of their lack of knowledge and recognize the necessity of obtaining additional knowledge related to “Geography” (65 percent) as well as the necessity of developing related “Computer skills” (63 percent), followed by “Technical skills” (48.2 percent) as main knowledge for a librarian working in a geolibrary. This result is in agreement with Hallmark’s (1998) specific competencies of ideal skills for professionals engaged in geoscience while “Technical skills” is highlighted in Johnson’s (2012) research as “other general skills”.

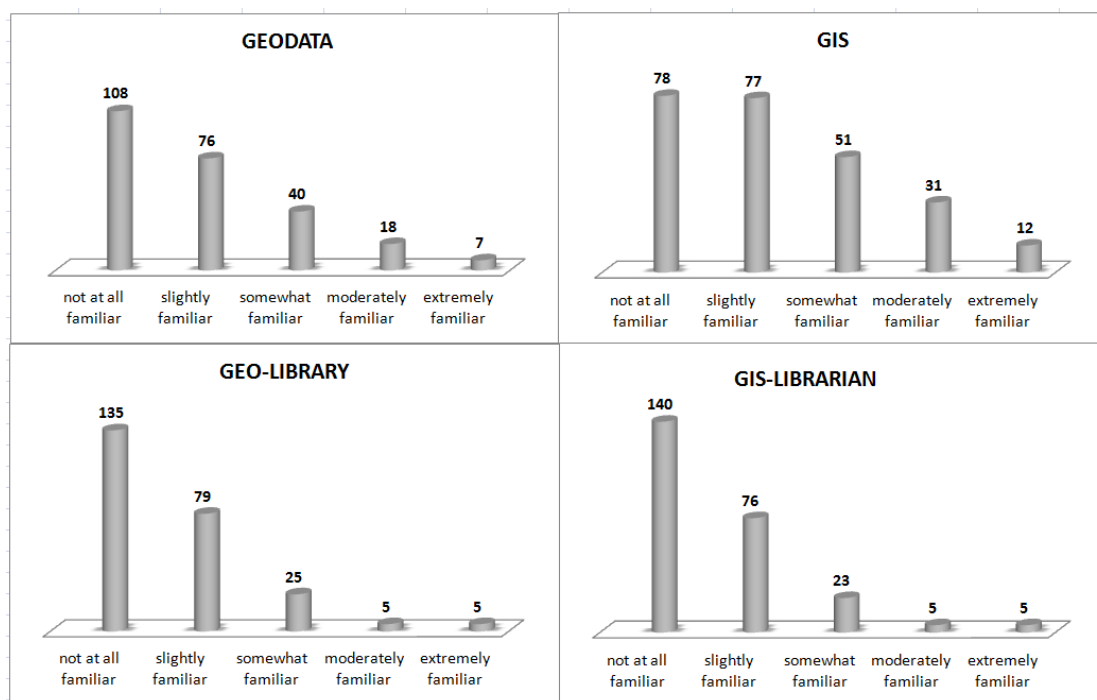


Figure 2: Familiarity per Geo-concept

5.3. Geographical data as part of librarians' duties performed in their libraries

For Greek and Cypriot librarians the most commonly used response was “I never get in touch with maps” (73 percent and 80 percent respectively), which reinforces the lack of familiarity of librarians with geo-data. Nevertheless, the case of Spain was slightly different, because answers were more centered in “once a year” (40 percent) or “once a month” (25 percent), which forces Spanish librarians, despite of their lack of geo-knowledge, to deal occasionally with this kind of data.

In any case, previous research that focused on GIS users revealed that for covering their geoinformational needs, the majority of patrons use other sources but academic

libraries, (internet, research data, etc.) given the fact that “[libraries] do not cover their needs”(Vardakosta & Kapidakis, 2014). Overall, the lack of geographical collections and GIS services might be caused by a combination of factors, which creates a vicious circle. On the one hand, librarians do not encourage users to use geo collections and specialized geoservices because they do not feel skilled enough to deal with this kind of data. On the other hand even if patrons would perceive libraries as the right place to find geographical services, they would neither find the proper sources for covering their needs, nor would have the proper guidance from a skilled librarian.

5.4: Librarians’ perception of their own ability when dealing with geospatial data

Taking into account the results of a previous work from Aguilar and Granell (2015b) which analyzed American geolibrarian’s job offers, we asked respondents about their level of confidence in developing the 5 most and the 5 less demanded competencies¹⁰ or tasks. In overall, neither “most demanded” competencies, nor “less demanded”

¹⁰ **Most** demanded competencies (descendent order) were: 1) Serve as a liaison and advisory needs of geographical materials between different faculties, coordinating needs and priorities; 2) Provide reference service in geographic materials, 3) Being responsible for the maintenance of the collection, distribution and preservation, 4) Discover sources of information of geographic data, and 5) Develop GIS work strategy in the short, medium and long term. **Less** demanded competencies were (descendent order): 1) Identify potential needs of GIS in the whole university and its staff (students, staff and researchers), 2) Provide alert service on developments in cartography, digital materials, advances in software, etc.3) Data visualization, 4) Collect and create galleries of GIS projects generated inside the university; and 5) Addressing the budget for geographic materials.

obtained a positive answer, which possibly means that actual related-geo skills did not give librarians enough confidence to perform any of the possible tasks presented.

If we analyze the results in more detail (Figures 3-5), whereas Cyprus and Greece follow a similar pattern in which there is a predominance of lack of confidence, it seems that Spanish respondents feel relatively more confident with their skills.

For Greek and Cypriot librarians (Figures 3 and 4), both showed strong disagreement (red line) when asking them if they were able to perform certain tasks, to forming small inner rings when answers move towards “strongly agree” (greenish lines). It is particularly interesting to note that respondents showed “strong disagreement” with those skills less demanded (left part of figures).

In contrast to Greek and Cypriot librarians, Spaniard’s answers seem to be more scattered, tending towards a more “neutral” response, which does not mean that they are confident in engaging in such skills and competences but only that they seem to be less insecure (Figures 5). In this vein, Spanish librarians showed favorable predisposition for incorporating new GIS skills, given the fact that green lines (strong agreement and agreement) outnumbered reddish lines in some competences.

All countries’ results revealed “Develop GIS strategy in the short, medium and long term” as a peak, indicating that librarians, regardless of their country, considered this competence out of their reach.

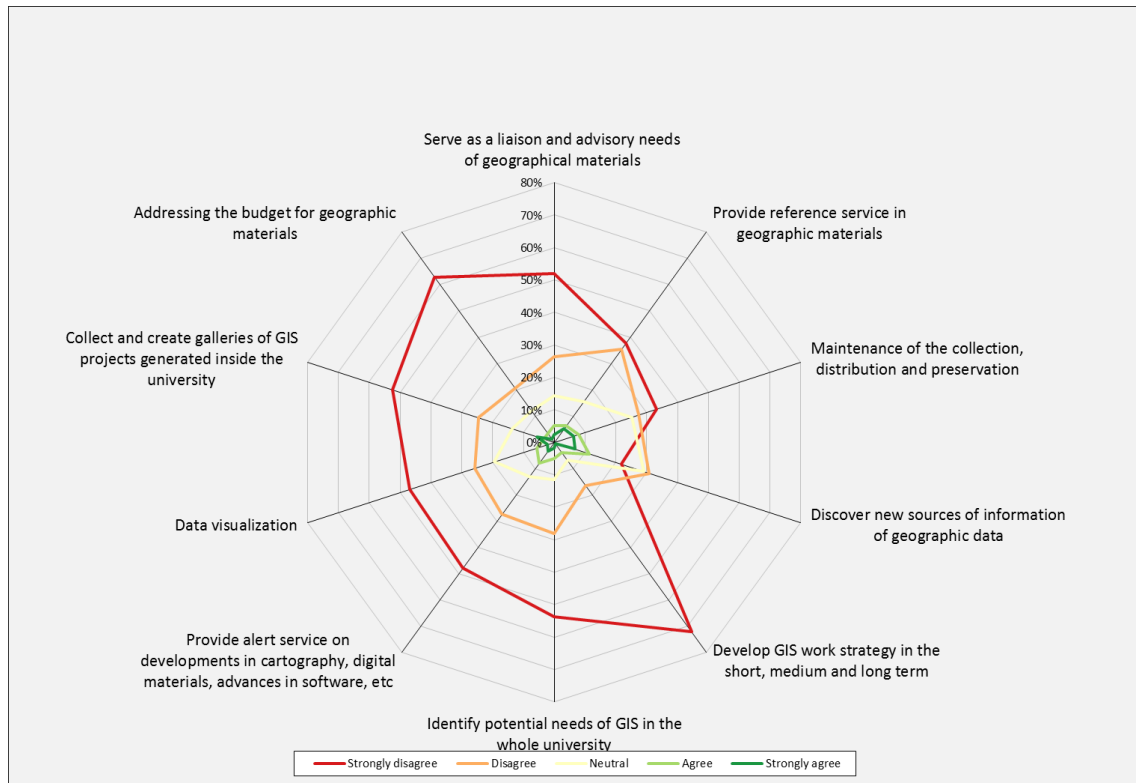


Fig.3: Greek results in percentage (N=175) for question “Taking into account your actual skills, how comfortable do you feel with these affirmations? I am able to...” Results follow clockwise in descending order from most demanded competencies “Serve as liaison and advisory needs of geographical materials” to the less demanded “Addressing the budget for geographic materials”

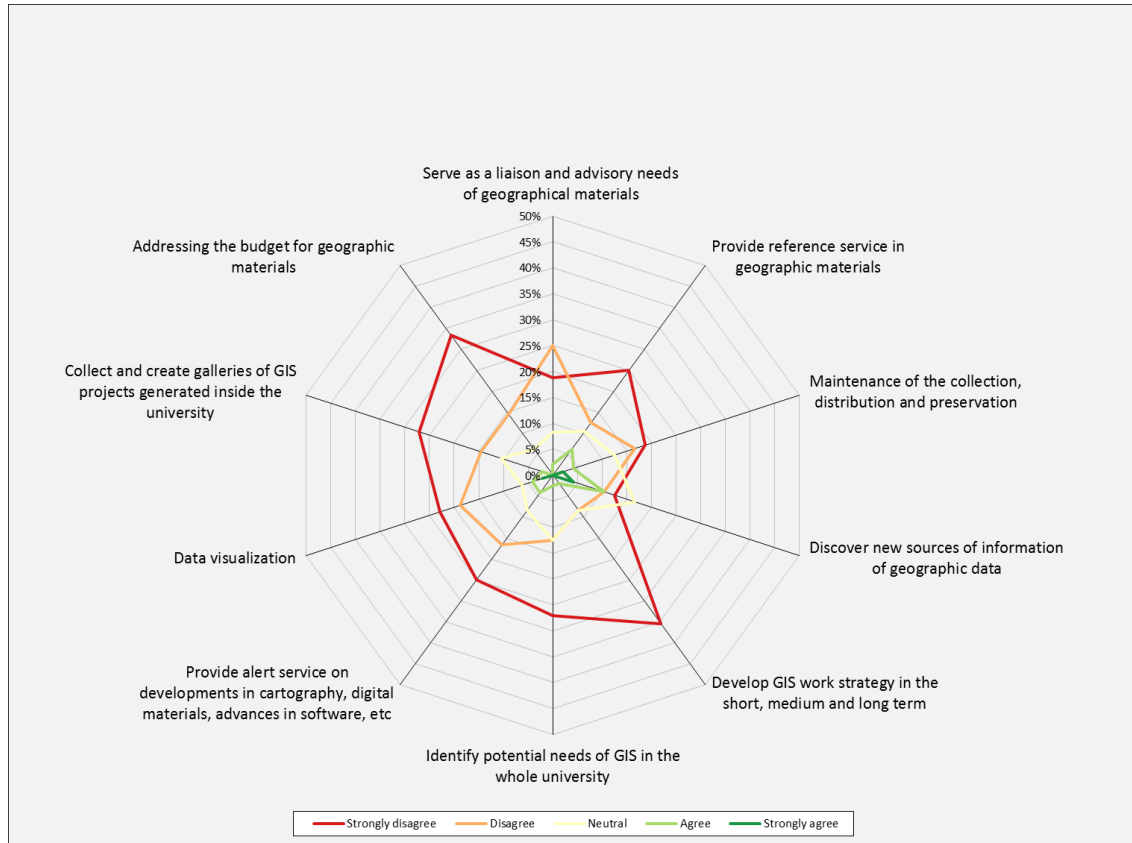


Fig 4. Cypriot results in percentage (N=26) for question “Taking into account your actual skills, how comfortable do you feel with these affirmations? I am able to...”. Results follow clockwise in descending order from most demanded competencies “Serve as liaison and advisory needs of geographical materials” to the less demanded “Addressing the budget for geographic materials”

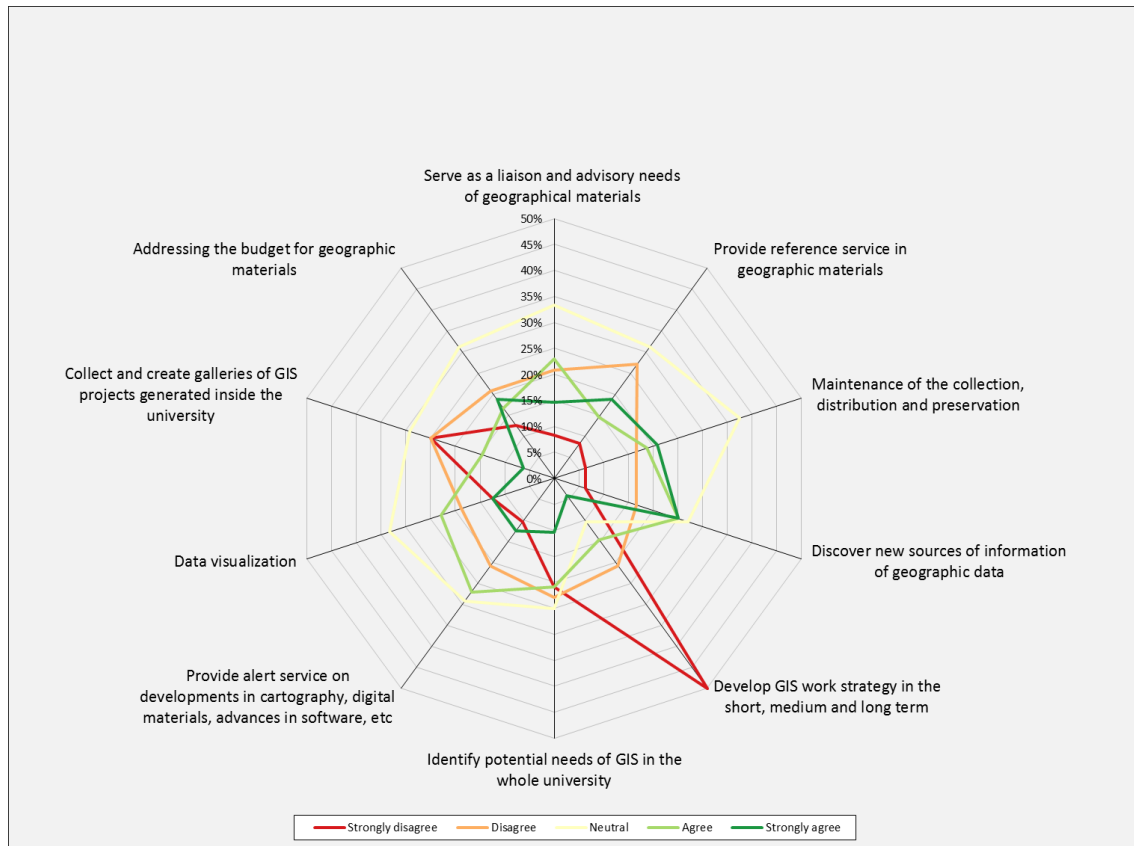


Fig. 5 Spanish results in percentage (N=48) for question “Taking into account your actual skills, how comfortable do you feel with these affirmations? I am able to...”. Results follow clockwise in descending order from most demanded competencies “Serve as liaison and advisory needs of geographical materials” to the less demanded “Addressing the budget for geographic materials”

Having answers scattered all over the possible options could indicate that librarians do not know how to feel about their actual knowledge and their feelings about their responsibility of dealing with this type of data, because – as we have seen in section 5.3 they rarely get in touch with geospatial data.

Nevertheless, they recognize that librarians working with geodata should have extra skills since the vast majority of 79.1 percent noted that a librarian working in a geolibrary should have such specific skills.

Despite that Greek and Cypriots librarians indicate that they do not have additional knowledge related to GI and also that they are not familiar with geo-terms and specific geo-tasks, they seem to be satisfied with the “current” geographical skills they have for performing their daily activities in the library. This may happen because they didn’t have to deal with complex geoinformational needs of their users at all, since geographic information and GIS are used only in a few academic libraries related to departments where geographic information is essential for their educational needs (Vardakosta & Kapidakis, 2012).

5.5. Geographic data as a valuable resource for Mediterranean academic libraries

The majority of respondents (44.2 percent) “did not know” if their academic community produces or uses geographic data. The same answer was given by 41.4 percent of librarians when asked if their institutional repository sustained a collection of research data (including geographic data) produced by its researchers. At the libraries’ management level, in Spain Aguilar and Granell (2015b p.6) came to the same result; 40 percent of respondents were unaware of having departments or services inside their universities dealing or generating geospatial data.

Greek and Cypriot librarians declare to maintain a geographical collection by 61 percent, whereas 70 percent of the Spanish libraries did. These results show similar results as those produced by previous research addressed in Greek academic libraries which demonstrated that only a small number of academic libraries developed geospatial collections and services (Vardakosta & Kapidakis, 2011), although GIS users emphasized that “*Libraries should collect geospatial data*” (81.9 percent)

(Vardakosta & Kapidakis, 2014). The mean of the answers related with the existence of geographical collections was 1.530.

For those librarians that do not sustain a geographical collection the triggering factors were (in order of importance): “*not being a priority for the library*” (mean 0.538), “*lack of patron’s interest*” (mean 0.409) “*there is no need, because other departments are working on that*” (mean 0.364), followed by “*personnel issues*” (mean 0.205) and final “*budget issues*” (mean 0.167). It was also sustained by previous work that showed there were no need or it was not a priority to sustain a geographical collection for Spanish academic libraries (Aguilar & Granell, 2015a).

In the case of libraries sustaining a geographical collection, there is no significant difference amongst countries, and librarians are “*slightly or moderately satisfied*” (41.1 percent) with the information services offered. Nevertheless, in previous research addressed to GIS users, the majority, 46.7% of the respondents, rated geospatial collection development in Greek academic libraries as “*very poor*” (Vardakosta & Kapidakis, 2014).

The most common answer provided by academic librarians from all studied countries was the recognition “*to educate its staff*” (mean 0.815) as the best action a library could take in order to develop a geographical collection. However, the other options proposed were ranked differently by studied countries. For Greece “*staff education*” was followed by “*policies development*”, “*libraries cooperation*”, and “*cooperation among departments/services*”. For Cyprus it seems that “*staff education*” is as important as “*policies development*”, followed by “*libraries cooperation*” and “*cooperation among departments/services*”. In Spain, however, “*cooperation among*

departments/services” was recognized as the second most important action to take, after “*staff education*”, followed by “*cooperation with other libraries*” and “*policies*”.

All countries consider “*to have administrator’s commitment*” (mean 0.438) as the least significant action to be taken.

Table 2: Geographic data as a valuable resource for Mediterranean academic libraries

QUESTIONS	RESPONSES	PERCENTAGES
Production of geo-data from university patrons	“I don’t know”	44.2%
Collection in university’s repository of the geo-research data that faculty/researchers produce	“I don’t know”	41.4%
Geographical collection in the library*	Greece : Yes	38.3%
	Cyprus: Yes	61.5%
	Spain : Yes	70.8%
Satisfaction of the geographical information services offered to the academic community	“moderately satisfied”	41.1%
Triggering factors for not sustaining a geo-collection**	“not a priority for the library”	105
Actions for developing a geographical collection and GIS services**	“staff education”	203

*the percentage is related to each country

**number of answers (rank question)

6. Conclusions and further research

The most relevant conclusion arising from this study is that Mediterranean libraries (based on the countries surveyed) and their staff are not yet prepared to provide GI services with the actual skills and knowledge their staff have. The lack of “Data confidence” (Lewis, 2010, p. 145-68) a librarian should develop in order to deal with

research data, such as acquiring new skills or combining them, and perform new roles, was hereby confirmed with regard to the manipulation of geospatial data.

The results obtained bring up issues related to the lack of awareness about the momentum geography and geospatial technologies have lately acquired, as was suggested in the introduction.

Academic Librarians in Cyprus, Greece and Spain seem to be unprepared to get involved with geospatial data that the European Community, through established mechanisms (e.g. HORIZON 2020), intends to diffuse through open access initiatives to all citizens.

In overall, the survey results suggest that librarians present high levels of unawareness of concepts and terms presented, and also reflect the absence of interaction with geoinformation in general. Nevertheless, as they are information professionals, librarians are aware of their lack of geographic skills and recognize the necessity of obtaining such abilities regardless of the environment they are dealing with (academic library or geolibrary in particular).

As Vardakosta and Kapidakis (2015) suggested in their model for developing a geospatial collection in Greek academic libraries, whether librarians want to acquire geographical skills and knowledge necessary for providing efficiency guidance and support in their communities, a variety of actions could be taken organized into three axes:

1. Library's/Librarians own activities. Examples of such activities are: encouragement of collaboration between the Library and departments/institutes that use geoinformation and/or GI services to support

and guide interested academic personnel and students; specific training in GIS to library personnel; and participation of library personnel in workshops, events, and seminars concerning geographical science and its technologies.

2. Librarianship curriculum development. For example, the addition of GIS courses in the professional curriculum; the realisation of regular seminars and workshops by guest librarians who are experts in the field of GIS Librarian; and the pursuit of collaborations and agreements with public bodies that produce geographic information.
3. Association of Librarians and Information Scientists. Next steps that this sort of associations might undertake are for example the participation in national educational programs for its members, the organisation of scientific meetings and educational seminars for Librarians, and the stating of active collaborations with sister associations like the Archivists' Society to conduct joint events for the presentation, edition and dissemination of geoinformation that is derived from historical maps.

The aforementioned initiatives if taken by the stakeholders to improve librarians' geo-related skills and their upcoming services could lead to the utilization of a wide range of information useful for human's everyday life.

Thus, important efforts have to be made if universities and academic institutions want to meet the European Commission's requirements for managing geospatial data and fostering its use. Libraries, as "effective institutions to serve as distributors of geospatial data within larger spatial data infrastructures (SDIs)" (Steinhart, 2006) could definitely contribute to universities' success in proper use and reuse of geographic information generated inside the university's walls.

In the throes of building up a robust geospatial data e-infrastructure, academic and research librarians' contribution – together with other European efforts like the INSPIRE Directive¹¹ (see Chias & Abad (2015) as example) - could be an enabler for a better European geospatial data management (Lewis, 2010). It will also encourage synergies between European academic libraries and the geospatial community, in order to use academic and research libraries as focal points to spread GIS throughout all levels of society through scholarly institutions.

Moreover, for confirming our assumption about the lack of librarians spatially skilled in European academic libraries, it would be particularly interesting to address the same survey to other European countries not included in this study.

In order to make libraries progress, as well as for taking the maximum advantage of geospatial data generated by academic institutions, putting geospatial data life-cycle in librarians hands could preserve the profession as well as the data.

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8. References

Abbott, L.T. & Argentati, C.D. (1995). GIS: a new component of public services. *The Journal of Academic Librarianship*, 21, 251–56.

¹¹ <http://inspire.ec.europa.eu/>

Adler, P.S. and Larsgaard, M.L. (2002). Applying GIS in libraries. In P. Longley, ed. *Geographic Information Systems*. Chichester, New York: Wiley.

Aguilar-Moreno, E. and Granell Canut, C. (2015a). Geobibliotecario: competencias necesarias para satisfacer la demanda de datos geográficos. Paper presented at 14as Jornadas Españolas de Documentación FESABID, May 28-30, in Gijón, Spain. pp. 226-244. [in Spanish]

Aguilar-Moreno, E. and C. Granell-Canut. (2015b). Geographic data management in Spanish university libraries: state of the art. *Revista Española de Documentación Científica*, 38, 2. <http://redc.revistas.csic.es/index.php/redc/article/view/888/1232> [in Spanish]

American Library Association. (2008). *MAGERT: Map, SIG and cataloguing/metadata librarian core competencies*.

http://www.ala.org/magirt/sites/ala.org.magirt/files/content/publicationsab/MAGERTCoreComp2008_rev2012.pdf (accessed, October 10, 2015)

Association of Research Libraries. (1999). *The ARL Geographic Information Systems Literacy Project*. Spec Kit 238. Washington DC: Association of Research Libraries.

Blaschke, T. and Merschdorf, H. (2014). Geographic information science as a multidisciplinary and multiparadigmatic field. *Cartography and Geographic Information Science*, 41, 196-213.

Boston, J., Dean, C. W., Phillips, H. & Pope, N. (1998). The Public Electronic Library: integrating GIS Resources and Tools. *Library Hi Tech*, 16, 100–6.

Bishop, B.W., Grubesticand, T. H. & Prasertong, S. (2013). Digital Curation and the GeoWeb: An Emerging Role for Geographic Information Librarians. *Journal of Map and Geography Libraries*, 9, 296-312.

Carpenter, J. & Snell, J. (2013). *Future Trends in Geospatial Information Management: The Five to Ten Year Vision*. United Nations Initiative on Global Geospatial Information Management. <http://ggim.un.org/docs/Future-trends.pdf> (accessed, November 2, 2015)

Chias, P & Abad, T. (2015). Spatial Data Infrastructures and Spanish Cultural Heritage: The INSPIRE Framework Applied to the Monastery of El Escorial. *Journal of map and geography libraries*, 11, 245-65.

Clemons, J. (2015). Identifying local hidden data sets: the first step to begin a geospatial data collection. *Journal of map and geography libraries*, 11, 5-17.

Cline N. M. & Adler, P. (1995). GIS and research libraries: one perspective. *Information Technology and Libraries*, 14, 111-115.

COM (2011) 882 final. *Communication from the Commission to the European parliament, the Council, the European Economic and social committee and the Committee of the regions: Open data: an engine for innovation, growth and transparent governance*. Brussels: European Commission.

<http://eur->

lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0882:FIN:EN:PDF

(accessed, October 10, 2015)

COM (2012) 392 Final. *Communication from the Commission to the European Parliament, the Council, the European economic and social committee and the Committee of the regions: Reinforced European Research Area Partnership for Excellence and Growth*. Brussels: European Commission.
http://ec.europa.eu/euraxess/pdf/research_policies/era-communication_en.pdf
(accessed, October 10, 2015)

COM (2014). 442 final. *Communication from the Commission to the European parliament, the Council, the European Economic and social committee and the Committee of the regions: Towards a thriving data-driven economy*. Brussels: European Commission.
http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=6210
(accessed, October 10, 2015)

Craglia, M. & Shanley, L. (2015). Data Democracy – increased supply of geospatial information and expanded participatory processes in the production of data. *International Journal of Digital Earth*, 8, 679-93.

DiBiase, D., DeMers, M., Johnson, A. Kemp, K. , Luck, A.T. , Plewe, B. & Wentz, E. (2006). *Geographic Information Science and Technology Body of Knowledge*. Washington DC: Association of American Geographers and University Consortium for Geographic Information Science.

Directive 2003/98/EC of the European parliament and of the council of 17 November 2003 on the re-use of public sector information. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:345:0090:0096:EN:PDF>
[Last accessed: 07.09.2014] and Directive 2013/37/EC of the European parliament and of the council of 26 June 2013 amending Directive 2003/98/EC on the re-use of

public

sector

information.<http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:175:001:0008:EN:PDF> (accessed, October 10, 2015)

European Union. (2010). *Riding the wave: how Europe can gain from the rising tide of scientific data*. <http://cordis.europa.eu/fp7/ict/e-infrastructure/docs/hlg-sdi-report.pdf> (accessed October 10, 2015)

Florance, P. (2006). GIS collection development within an academic library. *Library Trends*, 5, 222–35.

French, M. (2000). The ARL GIS Literacy Project: Support for Government Data Services in the Digital Library. *IASSIST Quarterly*, Spring, 19-23. <http://www.iassistdata.org/sites/default/files/iq/iqvol241french.pdf> (accessed October 5, 2015)

Granell-Canut, C. & Aguilar-Moreno, E. (2013). Geolibrarian wanted: geographic data come to the library. *El profesional de la información*, 22, 569-75. [In Spanish]

Jaguszewski, J.M. & Williams, K. (2013). *New roles for new times: transforming liason roles in research libraries*. Washington: ARL. <http://www.arl.org/storage/documents/publications/NRNT-Liaison-Roles-final.pdf>

(accessed October 5, 2015)

Johnson, V. E. (2012). The Role of Information Professionals in Geoscience Data Management: A Western Australian Perspective. *LIBRES*, 22, 1-23.

Hallmark, J. (1998). Education for the successful geoscience information specialist. *Science and Technology Libraries*, 17, 81-91.

Korsgaard, P. (2008). From Map Curator to Information Manager or The Last of the Dinosaurs. *LIBER Quarterly*, 18, 292-8.

Lemmens, R., Wytzisk, A., de By, R. Granell, C., Gould, M., & P. van Oosterom. (2006). Integrating Semantic and Syntactic Descriptions to Chain Geographic Services. *IEEE Internet Computing*, 10, 42-52.

Lewis, M. J. (2010). Libraries and the Management of Research Data. In *Envisioning Future Academic Library Services*. London: Facet Publishing.

Liarou, M. (2015). *Adoption of GIS services in academic libraries*. Master Thesis. Universtiy of Macedonia. <https://dspace.lib.uom.gr/handle/2159/17046> (accessed October 15, 2015) [In Greek]

Little, G. (2012). Managing the Data Deluge. *The Journal of Academic Librarianship*, 38, 263-64.

Longstreth, K. (1995). GIS collection development, staffing and training. *The Journal of Academic Librarianship*, 21, 267-74.

MAGERT Education Committee and subcommittees on GIS Librarian Core Competencies. (2008). *Map Librarian Core Competencies, Cataloging and Metadata Core Competencies*.

<http://www.ala.org/magirt/files/publicationsab/MAGERTCoreComp2008.pdf>

(accessed October 22, 2015)

Millea, N. (2005). Map Library Usage in Europe: A Vision for the Future? An Assessment of a Questionnaire Conducted During the Summer of 2003. *Journal of Map and Geography Libraries*, 1, 51–83.

Moore, J. (2005). Digital Map Soup: what's Cooking in British Academic Libraries and are we helping our Users? *LIBER Quarterly* 15
<http://liber.library.uu.nl/index.php/lq/article/view/7800> (accessed October 23, 2015)

OJEU C/240-1, 24/07/2014 COMMISSION NOTICE: Guidelines on recommended standard licences, datasets and charging for the reuse of documents.
[http://eurlex.europa.eu/legalcontent/EN/TXT/HTML/?uri=CELEX:52014XC0724\(01\)&from=EN](http://eurlex.europa.eu/legalcontent/EN/TXT/HTML/?uri=CELEX:52014XC0724(01)&from=EN) (accessed October 10, 2015)

Pinfield, S., Cox, A.M. & Smith, J. (2014). Research data management and libraries: relationships, activities, drivers and influences. *PLoS ONE*, 9, e114734.

Schade, S., Granell, C., & Perego, A. (2015). Coupling Public Sector Information and Public-Funded Research Data: A Vision of an Open Data Ecosystem. In: C.G. Reddick, L. Anthopoulos (Eds). *Information and Communication Technologies in Public Administration: Innovations from Developed Countries*. Boca Raton: CRC Press.

Shawa, T.W. (1998). A critical study of GIS services in research libraries: A case study of SUNY Albany and New York State libraries.
<http://www.princeton.edu/~shawatw/gis.html> (accessed October 25, 2015)

Shawa, T.W. (2002). What Should a GIS Librarian Do? Paper presented at American Library Association Map and Geography Round Table, June 17, in Atlanta, United states

<http://www.ala.org/magirt/sites/ala.org.magirt/files/content/Archives/whatgis.pdf>

(accessed October 11, 2015)

Steinhart, G. (2006). Libraries as Distributors of Geospatial Data : Data Management Policies as Tools for Managing Partnerships. *Library Trends*, 55, 264–84.

Sui, D. (2014). Opportunities and impediments for Open GIS. *Transactions in GIS*, 18, 1–24.

Vardakosta, I. & Kapidakis, S. (2011a). Geographic collections development policies and GIS services: a research in US academic libraries' websites. Paper presented at First Workshop on Digital Information Management, March 30-31, in Corfu, Greece <http://eprints.rclis.org/15851/> (accessed September 5, 2015).

Vardakosta, I. & Kapidakis, S. (2011b). Geographical collections in Greek academic libraries: Current situation and perspectives. Paper presented at International Conference on Integrated Information, September 29-October 3, in Kos, Greece <http://eprints.rclis.org/16169/> (accessed September 5, 2015).

Vardakosta, I. & Kapidakis, S. (2012a). Policies for Geospatial Collections: a Research in US and Canadian Academic Libraries. Paper presented at 2nd Workshop on Digital Information Management, April 25-26, in Corfu, Greece <http://eprints.rclis.org/17449/> (accessed September 5, 2015)

Vardakosta, I. & Kapidakis, S. (2012b). GIS Librarian: a necessity or an exaggeration? Paper presented at 21st Panhellenic Conference of Academic Libraries, October 18-19, in Peiraeus, Greece, <http://eprints.rclis.org/18120/> (accessed September 2, 2015) [In Greek]

Vardakosta, I. & Kapidakis, S. (2014a). Users perspectives for geospatial collections development in an open access era: The case of Greek libraries. Paper presented at British Cartographic Society-Map Curators Group Workshop, September 9-10, in Birmingham, United Kingdom <http://eprints.rclis.org/23779/> (accessed October 30, 2015)

Vardakosta, I. & Kapidakis, S. (2014b). Strategic considerations for geospatial collection development from Greek Academic Libraries in an open access era: GIS users point of view. Paper presented at 10th International Congress of the Hellenic Geographical Society, October 22-24, in Thessaloniki, Greece <http://eprints.rclis.org/25077/> (accessed October 12, 2015)

Vardakosta, I. & Kapidakis, S. (2015). Suggestions for developing geospatial collections in Greek academic libraries. Paper presented at 10th International Cartographic Association Conference: *Digital Approaches to Cartographic Heritage*. May 27-29, in Corfu, Greece.

https://www.academia.edu/12692248/Suggestions_for_developing_geospatial_collections_in_Greek_academic_libraries

Weimer, K. H. and Reehling, P. (2006). A New Model of Geographic Information Librarianship: Description, Curriculum and Program Proposal. *Journal of Education for Library and Information Science*, 47, 291-302.

Wright, D.J. & Wang, S. (2011). The emergence of spatial cyberinfrastructure. *PNAS*, 108, 5488-91.

Yang C., Raskin, R., Goodchild, M. & Gahegan, M. (2010). Geospatial cyberinfrastructure: Past, present and future. *Computers, Environment and Urban Systems*, 34, 264–77.

ACCEPTED MANUSCRIPT

Appendix 1 : The Questionnaire in English

QUESTIONNAIRE

A. Demographics & working experience

1. Gender

- Female - Male

2. Age

- < 30 - 31-40 - 41-50 - 51-60 - > 60

3. Choose the country where you work

- Cyprus - Greece - Spain

4. Choose the university you are working for

(a list with Cypriot/Greek/Spanish Universities)

5. What do you consider as your main educational background?

- Librarianship / Information Science
- Geography/Geodesy / Cartography/ Geomatics / Topography / Cartography or Geographic Information Systems related studies
- Other (please specify)

6. Educational level

- Degree - Master - PhD - Other (please specify)

7. If you have any additional knowledge related to Geographic Information, Geographic Information System (GIS), Geospatial technologies, etc. indicate the mean/s you used to achieve it.

- Formal and regular education
- Informal education: MOOC, self-paced courses, workshops
- Self learning: Technical literature, conferences, professional bulletins...
- Other (please specify)
- I do not have any additional knowledge regarding these topics

8. How many years have you been working in an academic library?

- < 5 6-11 12-16 >17

B. Librarians duties regarding geographical data & technologies**9. How well do you know the following terms?**

	1 not at all familiar	2 slightly familiar	3 somewhat familiar	4 moderately familiar	5 extremely familiar
9a."Geospatial data"					
9b."Geographic Information Systems (GIS)"					
9c."Geolibrary"					
9d."GIS Librarian or Geolibrarian"					

10. When performing your duties, do you get in touch with maps, geographical datasets and so on?

Never	Once a year	Once a month	Once a week	Daily basis
1	2	3	4	5

11. How comfortable you feel with this affirmation? "I am satisfied with the geographic skills I have for performing my daily activities in the library"

1 strongly disagree ○ ○ ○ ○ ○ 5 Strongly disagree

12. In your opinion should a librarian working in a geolibrary have extra skills?

- Yes (go to 13)
- No (go to 14)
- I do not know/I can't answer (go to 14)

13. What should be the main knowledge a librarian working in a geolibrary should have? (check as many as appropriate)

- Geographical knowledge
- Computer skills
- Technical knowledge
- Other (please specify)

14. Here we present you a list of the possible tasks to be performed by a geolibrarian. Taking into account your actual skills, how conformable do you feel with these affirmations? I am able to...

	1 Stronly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree
14a. "Develop GIS work strategy in the short, medium and long term"					
14b. "Addressing the budget for geographic materials".					
14c. "Provide reference service in geographic materials".					
14d. "Collect and create galleries of GIS projects generated inside the university".					
14e. "Discover sources of information of geographic data".					
14f. "Being responsible of the maintenance of the collection, distribution and preservation"					
14g. "Provide alert service on developments in cartography, digital materials, advances in software, etc."					
14h. "Data Visualization"					
14i. "Identify potential needs of GIS in the whole university and its staff (students, staff and researchers)"					
14j. "Serve as a liaison and advisory needs of geographical materials between different faculties, coordinating needs and priorities"					

C. Geographic information services offered

15. Do you know if your university patrons (faculty, students, researchers, etc.) are producing or using geographic data?

Yes No I do not know/I can't answer

16. Does your library sustain a geographical collection? (i.e.maps, aerial photos, geospatial data, etc)

- Yes (go to 16a) - No (go to 16b)

16a. Given the fact your library sustains a geographical collection, grade the geographical information services offered to the academic community:

1 Not at all satisfied ○ ○ ○ ○ ○ 5 Extremely satisfied

16b. Given the fact your library does not sustain a geographical collection, which could be the triggering factors from your point of view?

- Lack of human resources
- Lack of money
- Lack of patrons' interest
- There is no need, other departments are on working on that issue
- It is not a priority for the library
- Other (please specify):

17. Does your institutional repository sustain a collection of the geo-research data that faculty/researchers produce?

- Yes - No - Planning to sustain - I do not know /I can't answer

18. From your perspective, which are the actions a library should take in order to develop a geographical collection and GIS services?

- To develop policies
- To educate its staff
- To cooperate with University departments/services
- To cooperate with other libraries
- To have administrators' commitment (Rectors)
- Other (please specify)

19. Thanks for your participation! We would appreciate any additional comment you would like to express