

# “Strategic considerations for geospatial collection development from Greek Academic Libraries in an open access era: GIS users point of view”

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## Abstract

Today, that the access in a wide variety of data and services is possible more than ever, GIS patrons need libraries' further engaged with them, meeting their increasingly diverse education/research needs. Patrons are the core element in an organization that provides services and that is why our research approached the Greek GIS users. Excluding some surveys for GIS technology in public sector organizations there have never carried out a survey of this type for geospatial collections and GIS services; therefore, this study provides the basis for future research in academic libraries and information services. The challenge in conducting this research was how to access such a diverse group and how to extract an understanding for their work. To achieve the aforementioned goal we used a three phase based methodology: The first phase aimed to determine the implementation of GIS technology in an academic environment and in informational organizations. We conducted a qualitative study by addressing four experienced GIS scientists (faculty and researchers). For this goal to be accomplished the interview was based on a controlled questionnaire that was used as a research tool. The questionnaire was focused on issues that American Research Libraries (ARL) and National Library of Australia consider as strategic considerations for establishing GIS services. Thus, the questionnaire involved issues concerning policies, staffing, costs, infrastructure, data/metadata, services, users, user education and evaluation. At the second phase a research in the websites of Greek academic libraries was conducted in order to identify whether academic libraries have developed geospatial collections and GIS services fulfilling their users' informational needs.

As from the above two phases, the key findings that emerged were a) the need for geographical/geospatial information and b) the lack of academic libraries to deliver geospatial collections and GIS services to their patrons; the third's phase aim was the “mapping” of GIS user's opinion regarding the current situation in Greek libraries. More particularly, our intention was to capture their beliefs about issues related to the use of libraries, the geospatial collections, GIS services and the open access. While the first two phases of our research will be presented briefly, results of this last research phase will be illustrated in detail in this paper. The electronic questionnaire was chosen as a research tool, which was circulated via e-mail in order to be answered when it's convenient for the respondents. We collected 304 completed questionnaires which represent a wide variety of GIS users (faculty, students, researchers etc). Since this study is the first one that focuses on GIS users and their opinion regarding geospatial collections in

libraries, we consider the number of questionnaires capable of drawing conclusions. Results indicate user's expectations for constant expansion of library's role and provided services in order to use more effectively the spatial data covering their informational needs.

The paper emphasizes in potentially valuable information since it will demonstrate the findings of the above research. Furthermore, issues regarding policies, open access, co operations and strategies will be discussed extensively.

*Keywords: libraries, geospatial collections, user surveys, collection development, open access*

## **1. Introduction**

Geospatial data play an increasingly important role in natural resources management, economy, health, politics, agriculture, conservation, and science-based projects and are generally associated with man's everyday life. Geospatial data are also included in the enormous amount of data produced in different fields or "Big Data" as they are called. Quantitatively, geospatial data are important since they represent almost the 80 percent of public sector information and the economic and political decisions globally involve direct or indirect geographic information. The technological revolution did not leave the geospatial applications unaffected which have matured tremendously nowadays, emerging from specialty tools to become broadly used across numerous disciplines. Libraries which are the main organizations for collecting, processing and distributing the information, have adapted to the current information climate in order to support the educational and informational needs of their users. The upcoming years, two major changes in information environment offer opportunities and challenges for libraries to provide geospatial collections and GIS services: a) the computing landscape and b) the "Big Data era". In many universities in western countries the library has served its community as a central resource allowing students and faculty across academic departments' access to GIS resources.

The paper describes a three phase study regarding geographical information in Greek libraries. We will present the first two parts of the study in summary while focus will be given in the third. Therefore, we will present in detail the research regarding the perceptions of GIS users in Greece about libraries and their services in order to fulfill their educational and research needs.

## **2. Literature review**

ALA's (American Library Association) Guidelines for Information Services §1.7 argues that "*The library should survey and assess the information needs of its community and create local information products to fulfill those needs not met by existing materials*". Several studies have been conducted over the years about user needs identification (Devadason and Lingam 1996; Marchionini et al 2003; Harris 2008).

Academic library staff and managers need to better understand what influences users' judgment of service quality, what is expected from specific services, and what improvements in service design and delivery are effective. They need to understand their users not merely as recipients of services offered, but as partners in the development and implementation of services to make higher

education and research experiences more successful from the customer's perspective (Nitecki 1996, p.188).

After the implementation of ARL GIS Literacy Project, literacy related to GIS in libraries increased. Lots of universities as they recognize the growing user interest in GIS accommodate this demand by providing services and collection development policies (Boston et al 1998; Sweetkind-Singer and Williams 2001; Howser and Callahan 2004 ; Houser 2006). Researchers and professionals in GIS referred not only in the technological infrastructure needed for its use but also in how GIS instructions are being provided to patrons (Kinikin and Hench 2005; Kinikin and Hench 2005a; March 2011). For Abbott and Argentati (1995) the library's decision to provide GIS technology and related services will bring many challenges and learning opportunities but factors that will need evaluation include the diverse needs of the campus or user community. As those professionals indicate "in order to understand the needs of research level GIS users, it is helpful to build relationships and engage in ongoing communication with the users. Florance (2006) in his work points out "*that the selectors should take into consideration the scale most appropriate to the needs of their patrons*" because "*the users of GIS are not necessarily part of the same user community as users of printed geographical information*".

The last two decades Greek libraries made tremendous development in infrastructure and services level. Several studies have been conducted over the years about users needs identification (Papachristopoulos e.a, 2008; Vardakosta and Avramidou 2008; Vardakosta and Tsubrakakou 2008) but none of them referred to the geospatial data and geographic information. This is the gap that our research intends to contribute.

### **3. Motivation for research**

The recent years in Greece an enormous change occurred regarding the availability of geospatial data and an increased number of public sector organizations are becoming familiar with the "open access" culture. While some significant efforts like geodata.gov.gr have been emerged, thus, these advancements have left untouched the Greek academic libraries that seem to have remained in "the paper map era". Today, that the access in a wide variety of data and services is possible, more than ever, GIS patrons need libraries' further engaged with them, meeting their increasingly diverse education/research needs. The recognition and the identification of users needs are necessary conditions for the implementation of any kind of collection in a library. Patrons are the core element in an organization that provides services and that's why our research approached the Greek GIS users. Excluding some surveys for GIS technology in public's sector organizations (Karnavou 2002) there has not been carried out a survey of this type for geospatial collections and GIS services in Greek academic libraries so, this study provides the basis for research development in academic libraries and information services.

This paper is the result of an ongoing research to Greek scientific community dealing with geographic information and its dissemination. Our goal is to use the current research's results in order to formulate those proposals and policies that a library can adopt for developing geographical collections.

## **4. Previous Research**

### **Objectives of the overall research**

As mentioned above the paper aims to present the results of the last phase of an overall research regarding the geographic information in Greek libraries and information organizations, which involves the capturing of GIS users' opinion for the provided services regarding geospatial information by libraries and information centers. The research was conducted by the use of various scientific methods (interview questionnaire in focus group for the first phase, website research and content analysis for the second one and finally a questionnaire for the third phase of our research).

We will briefly analyze the previous researches in order to make the concept of the research fully understood by the reader. We chose to describe in some detail the previous two phases of the research prior to the step by step description of the current study's results.

### **Phase I : What do experts sustain about GIS implementation in Greece**

#### **Objectives**

The overall goal of the study was to determine how institutions/libraries have implemented GIS focusing on the areas of policies, hardware/software, staffing, costs, monetary support, user education and evaluation. We conducted a qualitative study by addressing four experienced GIS scientists (faculty and researchers). For this aim to be accomplished the interview was based on a controlled questionnaire that was used as a research tool.

The questionnaire was carried out, based on surveys that were investigating the implementation of GIS in academic libraries (Kinikin and Hench 2005 ; Kinikin and Hench, 2005a ; Gabaldon and Reppinger 2006), Australia's National Library Position associated with GIS implementation (O'Connor 1996); the strong recommendations of other librarians (French, 2001 ; Sweetkind-Singer and Williams 2001 ; Houser 2006 ; Todd 2008) and finally American Research Library GIS Literacy's Project, guidelines (ARL 1999). Furthermore, we collected information from several papers referring to existing geographical digital collections using GIS just to determine if the requirements of their development were alike (Abbott and Argentati 1995; Pfander and Carlock 2004; Hyland 2006) and we finally added questions mainly regarding the aspects of policies they followed, metadata and evaluation of the project. As it is mentioned above the survey instrument was a questionnaire consisting of 13 conditional sections, 27 questions, grouped by topic and in a way that matches the respondents perceptions of the relationship between the concerned issues: 1) General information : This section contained 6 questions that profiled the respondents (e.g. gender, discipline, education, organization/library, years of working experience and years of working in the specific organization) 2) GIS and library/organization: year that GIS developed and reasons that led to this decision, 3) Policies for collection development through a GIS system, 4) Staff (number, educational background), 5) Costs (number, financial source), 6) Hardware (variety of facilities), 7) Software (name, access), 8) Data (source), 9) Metadata (use and kind), 10) Services

provided, 11) Users, 12) User Education, 13) Evaluation of the project (See Appendix 1).

## **Results**

According to our survey results, researchers and scholars in Greece were familiar with GIS since '90s while in universities this kind of technology appeared in the early 2000. They used an established development *policy* and investigate the format of data they were willing to use. The majority of the participants investigated their *user needs*, the necessary *budget*, limitations in the *use of data* and obtained the *technology* needed while the *staff* that was necessary for the project was partially ensured. Each institute used a different number of *staff* to get involved with the project (1-2, 3-4 and 4-5), while half of them were part time employees and the other half were full time employees. Their knowledge level was very high thanks to their expertise in GIS. Responses about *costs* of the whole project range from 3.000 euros to 1.000.000 euros for all units of the institutions and the funds come mainly from European Union or research programmes. In questions regarding the *hardware* that was used to support GIS services respondents indicated the use of computers, printers, scanners, digitizers, GPS units and Plotters. They all used a proprietary well known *software* (ArcView) operated on Windows platforms while two of the respondents indicated that the *data* required by the system were acquired, either donated by state agencies, or they originated from institutional research while the other two GIS scientists indicated that the data derived only from institutional research.

Three of the respondents use *metadata* while one of them uses CIDOC and the other one FGDC Content Standards for Digital Geospatial Metadata. The provided services differentiated since some institutions offer GIS services accessible through internet for all users while others are offering their services after a user request. The majority claims that the digital collection based upon a GIS system was developed in order to be *used by professionals, scientists and researchers of the organization*. These findings are not surprising since the institutions designed their programs having in mind to cover their users' needs first and the external users' needs secondly. Moreover, in these organizations, as the staff is partially occupied which indicates the limitation of offering services, as it is mentioned above.

It is noteworthy that the necessary assistant in *user education* was given, despite that lack of full employee staff. On the contrary, according to the respondents only one of them attempted to *evaluate* the whole project. This action maybe was the result of a written obligation of the funding commission just to ensure that the whole project finally worth the budget it was given and the goals they set were achieved or it was a decision they took when establishing their collection development policy. Utilizing an assessment survey might assist institutions in shaping GIS service planning efforts.

## **Phase II: Do libraries provide geographical information and GIS services?**

In the second phase a research in the websites of Greek academic libraries was conducted in order to identify whether academic libraries have developed geospatial collections and GIS services fulfilling their users' informational needs. The research in the websites of Greek academic libraries was chosen intentionally

as Hahn and Schmidt (2005) declare “*that library’s website could be a powerful forum for communication with users*”. Thus, a research was conducted in various Greek Higher Education Institutions for departments affiliated with geographic information and the use of GIS; those specific libraries websites were scrutinized for the existence of any geographical collection. The findings indicate that only three academic libraries and one Technological Education Institute Library offer geospatial information to their users although Greek universities sustain an efficient number of departments related to geography, geology, environmental studies etc. (Vardakosta and Kapidakis 2011).

As from the above two phases key findings that emerged were: a) the need for geographical/geospatial information and b) the lack of academic libraries to deliver geospatial collections and GIS services to their patrons; the third’s phase aim was the “mapping” GIS user’s opinion regarding the current situation in Greek libraries. Our intention was particularly to capture their beliefs on issues related to the use of libraries, the geospatial collections and GIS services, and the open access. The results of this last phase research will be presented in this paper.

### **Phase III: What are GIS users’ opinion about libraries’ role in covering their geographical needs?**

#### **Research Question**

The research question formulated for this research was “*Do Greek libraries respond in covering the informational needs of GIS users?*” For answering that, the following sub-questions were formed:

- 1) Is library use a choice for GIS users in their seeking for appropriate information?
- 2) Is the implementation of geospatial collection a necessity for Greek libraries?
- 3) Is open access an opportunity and a perspective for growth for Greek libraries?

#### **Methodology**

The electronic questionnaire was chosen as a research tool which was circulated via e-mail in order to be answered whenever was convenient for the respondents. This process yielded 325 responses which were limited to 304 most completed questionnaires which represent a variety of GIS users (faculty, students, researchers etc). Since this study is the first one that focuses on GIS users and their opinion regarding geospatial collections in libraries, we consider the number of questionnaires capable of drawing conclusions. The questionnaire comprised of 20 questions (3 open questions and 17 closed questions in which 5 of them are in likert scale) (See Appendix 2) which were designed to answer the research questions.

Once the questionnaire was developed, it was sent to three key faculty members in Harokopio University in the Department of Geography and in Department of Home Economics and Ecology for review and to one Doctoral Librarian with expertise in users surveys for review. Based on their comments the instrument was revised.

## Data collection

The questionnaire was anonymous and consists of 4 sections. The first section (questions 1-5) focused on demographic data and included questions about gender, participant's educational background, working environment, discipline, and reasons for using geographical information and GIS, as to enable a deeper analysis. The second section (questions 6-12) explored the participant's use of libraries. The third section (questions 13-17) was designed in a way that permits participants to express their opinion regarding the necessity of the development of geospatial collections. By the fourth section (questions 18-19) the participants were able to answer significant questions regarding open access and libraries. Finally, there was a last (no 20) open ended question asking participants to express their opinion on what should be done for the exploitation of the geospatial data. A cover letter explaining the objectives of the research accompanied the questionnaire. Our intention was to create a sort concise questionnaire in order to increase responsiveness.

The questionnaire was promoted in print format during the 7<sup>th</sup> Panhellenic Conference of HellasGIS (May 2012) posted on the website of HellasGIS, and on the geoportal "Geothea". Due to constraints of the semester expiration and the summer holidays the response rate was low. That's why we decided to disseminate the questionnaire via e-mail to GIS users to academic institutions, research centers, public sector and private sector (companies that are engaged in GIS market) all over Greece. In January 2013 a reminder was sent to all the e-mail accounts that were used. The questionnaire's dissemination lasted till March of 2013. Technical reasons that occurred during the dissemination process (false e-mail, full e-mail account, reject message by the server etc) prevent the fully dissemination of the questionnaire.

## Results

### A. Participants/Demographics

In all, 304 users participated in the study; 57.1% (n=172) of whom were male and 42.9% (129) female. According their answers, 37.2% (n=112) had PhD degrees, 25.2% (n=76) a University grade, 23.9% (n=72) had master degrees, 3.3% (n=31) had a Technical Educational Institution degree and the rest 10.3% (n=31) has a different than above, educational level. 28.1% (n=84) of the participants were faculty in University, 27.42% (n=82) were students in university, 15.71 (n=47) were working in public sector, 15.05 (n=45) were working in private sector, 6.35% (n=19) were researchers in an academic institution, 4.7% (n=14) were researchers in Institution/Organization and finally 2.67% (n=8) has some other working involvement. There was an open ended question in demographic section which referred to the discipline of participant's expertise. Not all of them answered this specific question (90.13%, n=274), and for better analysis the results grouped and a breakdown is shown in Table 1.

The last question of demographic section users were asked to indicate the reason for using geographic information and GIS. As shown in Table 1, the majority of respondents 44.1% (n=131) are using geographic information for research, 38% (n=116) for educational purposes while for 29.7% (n=88) of them,

GIS are part of their everyday work activity. Finally, 2.7% (n=8) indicate that they are using GIS for other purposes (for dissertations, or for several applications).

<b>Table 1:Demographics</b>		
	Frequencies	Percentages
<b><i>Gender</i></b>		
Male	172	56.6
Female	129	42.4
<b><i>Academic qualification</i></b>		
PhD	112	37.2
Postgraduate diploma	86	28.3
Masters diploma	72	23.9
Other	31	10.3
<b><i>Professional Rank</i></b>		
Faculty	84	28.1
Students	82	27.42
Employees in public sector	47	15.71
Employees in private sector	45	15.05
Researchers in Academ.Inst.	19	6.35
Researchers in Res.Inst/Org	14	2.67
Other(unspecified occupation)	8	4.7
<b><i>Discipline</i></b>		
Geography	65	23.72
GIS	50	18.24
Urban Planning	26	9.48
Ecology,Ecosystems	20	7.29
Geology	22	8.02
Agronomy-Topography	18	6.56
Remote Sensing	13	4.74
Seismology	10	3.64
Engineering	11	4.01
Natural Disasters	9	3.28
Transportation	8	2.91
Migration -Demographics	8	2.91
Archaeology	7	2.55
Hydrology	7	2.55
Forestry	6	2.18
Regional Development	4	1.45
Logistics	3	1.09
International Relations	2	0.72
Public administration	2	0.72
Agriculture	1	0.36
Health	2	0.72
Military	1	0.36
History	1	0.36
Taxation	1	0.36

Tourism	1	0.36
Oceanography	1	0.36
German literature	1	0.36
Economics	1	0.36
<b><i>Reasons for using GIS</i></b>		
Research	131	44.1
Education	113	38
Part of everyday work activity	88	29.7
Other	8	2.7

## B. Library Use

The first section of the questionnaire aimed to report the use of libraries by the GIS experts and their opinion for their organizational abilities, the value of their assistance in covering their educational and research needs. Moreover, it aimed to capture their point of view for those issues that can be contribute towards a geospatial collection implementation. In response to the first question the majority of the participants 82.2% (n=244) are using the internet to cover their geospatial information needs, 62.4% (n=181) are using research data for this purpose, 57.3% (n=168) prefer the public sector while 47.3% (n=140) are using educational data and the 28.9% (n=83) of the participants are using the foreign institutions' libraries for covering these needs.

Only half of the participants declare the use of a Greek library (50.2%, n=148), and the majority of them indicate that those libraries they use do not cover their needs.

The participants of the research were asked to evaluate the development of the geospatial collection in Greece using a five-step likert scale ranging from 1 (=very good) to 5 (=insufficient). According to the majority 46.7% (136) of the respondents the geospatial collection development in Greek academic libraries is defined as "insufficient" and only a small percentage of 15.8% (n=46) rates them as "very good".

GIS patrons were asked to indicate possible improvements from a list in the development of geospatial collections. The geospatial collection development policies are indicated for the vast majority of the participants, 63.9% (n=191) as the possible specific area for improvement to the direction of a geospatial collection development, while almost half of them 50.8% (n=152) believe that the organizations' administration must be committed to the development of collections and services. The cooperation with other libraries for joint collection development or purchasing data consists an improvement area for 37.8% (n=113) of the participants, while 36.8% (n=110) mentions as a key factor the enhancing of user interest. Not surprisingly, 33.3% (n=99) do not believe that Greek academic libraries respond to the collection, organization, elaboration and disposal of the geographical information and offer value added services. A great number of respondents 32.3% (n=96) has no clear view while only 16.5% (n=49) believe that Greek libraries respond to that role (Table 2).

**Table 2: Participants' Library Use**

QUESTIONS	RESPONSES	PERCENTAGES
Libraries responsiveness to collect & organize geospatial data	No	33.3% (99)
Medium used for covering geospatial needs	Internet	82.2% (244)
Use of Greek Library	Yes	50.2% (148)
Geospatial needs coverage by Greek Libraries	No	53.8% (77)
Geospatial Collection Development in Greece	insufficient	46.7% (136)
Possible improvements	Policies	63.9% (191)

### C. Collection Necessity

The second section of the questionnaire aimed to gather information regarding participants' perceptions for the necessity of geospatial collection development. In response to the first question of the section, the overwhelming majority of the participants 65.1% (n=194) stated that geospatial collections are essential in all libraries despite their type.

Participants were also asked to indicate their belief whether Greek libraries should collect, organize and communicate the geospatial data that their parent institution/organization creates. The vast majority of 81.9% (n=245) consider the above statement as a necessity in contrast of a small number of participants 12.4% (n=37) that expressed their neutral.

GIS experts were asked to indicate their perceptions from a list of actions that a library can follow towards geospatial collection development. Interestingly, the majority of the respondents 59.9% (n=179) certify the geospatial collection development policies as the main action area that a library should follow to develop a geospatial collection. This answer corresponds directly with the answer in section 2, regarding the areas of improvement towards the geospatial collection development. The 40.5% (n=121) of the participants consider that "cooperation development with other libraries for developing common practices "could contribute to the development of geospatial collections, while "the complete agreement and the support administrations' support" is for the 36.5% (n=109) the main area of contribution.

Additionally in this section participants were asked to testify from a list their perception for the possible reasons that act against to the development of geospatial collections. Not surprisingly, the majority 52.2% (n=156) believes that the main obstacle for this condition is the lack of policies. For the 35.5% (n=106) the main reason preventing libraries from such a collection is the high cost of geospatial data, while for the 24.1% (n=72) is assigned to libraries' administration, and for the 23.7% (n=71) is the lack of qualified staff. The "high cost of infrastructure" remains for the 21.1% (n=63) the main barrier, but for the 10% (n=30) the "lack of users interest" is the main reason that libraries do not develop geospatial collections.

In the final question of the section we asked the participants to testify their beliefs for the kind of the organization that should be responsible for the

collection and dissemination of geospatial data, by rating according to the priority from a list. The “public sector (Libraries, National Documentation Centre, Government Libraries etc)” received the overwhelming majority of 76.8% (n=229) of the answers (Table 3).

**Table.3: Collection Necessity**

QUESTIONS	RESPONSES	PERCENTAGES
Who should gather geospatial information	Public Sector	76.8% (229)
Geospatial Collection is a necessity for all libraries	Yes	65.1% (194)
Libraries should collect geospatial data	Yes	81.9% (245)
What a library should do for developing geospatial collections	Policies	59.9% (179)
Obstacles for geospatial collection development	Lack of policies	52.2% (156)

#### **D. Open Access**

The third section of the questionnaire was designed to collect participant’s perceptions for the open access movement and its use by libraries (Table 4). More particularly, the participants were asked to testify their opinion regarding the library’s choice to use geospatial collections in order to serve their users effectively and the vast majority of 79.8% (n=237) agrees with the statement (Fig.1). The last question of the section asked participants to declare their opinion for the availability of geospatial data only to the members of the organization that produced them and library serves. With the above statement the percentage of disagreement was vast, 64.4% (n=192). With that way, the respondents declared their belief for the free disposal of data.

**Table 4: Open Access**

STATEMENTS	PERCENTAGES
Libraries should use open geospatial data for providing better services	79.8% (237)
Libraries should provide geospatial data of their parent institution	64.4% (192)

#### **What is the next priority for geospatial data?**

We consider that the final open ended question would provide the opportunity to the respondents to share their deep thoughts and suggestions. In that way the questionnaire becomes an important communication channel between researchers and respondents. Thus, in the last open ended question we asked the respondents to express their opinion for the priorities that should be given in the exploitation of geospatial data.

Unfortunately, not all participants answered this open ended question 45.06% (n=137). Table 5 presents respondents' milestones in the utilization and diffusion of geospatial data as ranked after they grouped under 5 subject categories according to their replies: "data", "organizations", "libraries", "infrastructure", "users", "economics".

According to their opinion the "open access to the data and their free availability at no cost" is considered as the first priority for the 20.43% (n=28) of the respondents, the "collection and organization of data" testified by 18.97% (n=26), while "policies development" mentioned by 15.32% (n=21). The "establishment of an aggregator for the management of produced geospatial data" suggested by the 8.75% (n=12), "users information" by the 8.02% (n=11) while the "quality of data" stated by 7.3% (n=10) of the respondents.

**Table 5: Respondents' perceptions for the next priorities to geospatial data**

Rank	Categories	No	Percentages
<b>Data</b>			
1	Open access and disposal at no cost	28	20.43
2	Collection and organization of data	26	18.97
3	Policies development	21	15.32
6	Quality of data	10	7.3
10	Use of standards	6	4.37
11	Implementation of INSPIRE directive Repository for those geospatial data that are produced after public finance	4	2.91
12	Metadata use	3	2.18
13	Determination of disposal conditions	3	2.18
<b>Organizations</b>			
4	Establishment of an aggregator for the management of produced geospatial data	12	8.75
7	Cooperation of public sector units the determination of that entity responsible for quality control	9	6.56
13		3	2.18
<b>Libraries</b>			
8	More data in libraries through the disposal of geospatial data to them Geodatabases development by libraries	8	5.83
11	Cooperation (libraries with each other and with data producers)	5	3.64
12	Libraries' administration interest	4	2.91
12		4	2.91
<b>Infrastructure</b>			
9	Development of infrastructure and use of the new technology (cloud sourcing, location based services etc)	7	5.10
<b>Users</b>			
5	Users information	11	8.02
13	Enhance of interest	3	2.18
13	Staff training	3	2.18
14	Teaching of related courses in school	1	0.72
<b>Economics</b>			

## Discussion

The variety of disciplines that users are involved in, demonstrates GIS technology and data impact in today's information society despite the late involvement of Greek universities in the proliferation of new technologies related to dissemination of geographic information. GIS experts in the first phase of the research indicated the exploration of some key issues (policies, economics, staff, data, hardware, software, metadata, users, and user education) in order to implement GIS services in accordance with other researches (Deckelbaum 1997; Kinikin and Hench 2005; Kinikin and Hench 2005a).

Although GIS patrons in the third phase of our research express a strong recognition for libraries as the main organizations for collecting and disseminating the geospatial information, nevertheless, the absence of geospatial collections leads them to use internet as the primary information source as they indicated. This choice explains the fact that only half of the respondents (50.2%) use a Greek library for covering their informational needs. Their negative answer for geospatial data coverage is indicated by the "*insufficient*" identification of geospatial collection in libraries. Research data, public sector data, educational data, foreign institutions libraries' and private sector follows in users preferences as it was selected. Network-based geographical information services that utilize both wired and wireless internet to access geographical information, spatial analytical tools, and GIS services facilitate the access, processing and dissemination of geographical information and spatial analysis knowledge (Pong and Tsou 2003 p.5). The increasing popularity of the internet, has made it an integral part of our society and has changed how GIS data are accessed, shared, and manipulated.

As research results' reveal GIS patrons specify those actions that will lead libraries to fulfil their mission and expand their roles. A significant action for libraries is the development of policies. Policies indicated from the respondents as the main reason for the geospatial collection's absence. Moreover, as geospatial collections considered as a necessity in libraries despite their type, policies are also illustrated as the challenge needed for their implementation. Policies regarding the development of a digital collection mediate the creation process and maintenance of the collection within the digital library. The current information society along with the procedures of European Union or research programmes requires collection development policies to guarantee suitable resources in information organizations (e.g. RECODE project).

Another issue that the present research reveals and cannot be ignored is the relatively high percentage of participants that propose synergies as the medium that will lead to the collection development. Synergies, as researchers claim, range from commonly agreed metrics, and indicators, to the identification of subtle differences that need to be taken into account, to reform assessment strategies and policies and to facilitate collection analysis and interpretation of data (Lindauer 1998; Tsakonas and Papatheodorou 2009, p.179). The lack of administrations

commitment is considered for many GIS users another important factor that acts against to geospatial collection development.

Comparing the low scores given by participants of financial contribution to the geo-collection development with the high percentage given for open access, leads to the conclusion that is considered as an opportunity to access those data they are interested in for. Special focus should be given to user's opinion about open access. Participants consider open access as an opportunity for growth for Greek libraries since its use will provide better services. Additionally, the free availability of their parent institution geospatial data, will contribute to enhance added value services.

Research's results raise awareness among professionals in libraries and other information agencies motivating them to engage to new initiatives for the exploitation of geospatial data.

## **Conclusions**

Using a variety of methods (focus group, website research, content analysis, questionnaire) we produced a wealth of findings related to the emergent opinion of users for libraries' response in providing geographic information and highlighted the perspectives of GIS experts in Greece for library's role in today's information society.

Although the current situation in Greek academic libraries does not fulfill their information needs regarding geospatial data and GIS services, still, according to our results, the majority of users gave them a vote of confidence since they certified libraries as the main organizations for collecting, organizing and distributing geo-information. GIS patrons' point of view clearly points out the strategic considerations libraries should take into account in order to expand their services and respond to their needs. Thus, the need for library involvement in the development of an integrated environment for access to geospatial information is clearly highlighted. The past two decades have clearly shown that libraries have the power to alter the information environment and to provide added value services to their patrons.

The above results indicate user's expectations for constant expansion of library's role and provided services in order to use effectively the spatial data covering their informational needs.

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**APPENDIX 1**  
**QUESTIONNAIRE FOR GIS IMPLEMENTATION IN**  
**LIBRARIES/ORGANIZATIONS**

**1. Demographics**

1. Gender:
- Female
  - Male
2. What is the organization you are working at?
3. What is your position in the organization?
4. Education level:
5. Total years of working experience:
6. Years of working experience in the same organization:

**2. GIS and Organization**

7. Year that GIS implemented in your organization:
8. Report the GIS implementation purposes (e.g. geospatial information needs of the organizations' researchers) 1. 2. 3. 4. Other:

**3. GIS Services Development Policies**

9. Did library/Organization develop a policy for the provided collection in order to emerge GIS services?
- Yes
  - No
  - I'm not sure
10. In order Library/Organization to provide GIS services:

	Yes	No	Partially
1. Investigated and identified users needs			
2. It took into account organizations budget			
3. Investigated use restrictions of various types of data			
4. Investigated resources availability			
5. Investigated data's format			
6. Obtained the necessary staff			
7. Developed a policy for the data used in a GIS			
8. Ensured the necessary technological infrastructure			

**4. Staff**

11. How many people are involved in the organization in GIS services?
- 1-2
  - 3-4
  - 4-5
  - 6-
  - Other ...
12. The personnel involved in the organization of GIS service is:
- Full Time employee/s in GIS (*Please specify which expertise*)
  - Part Time employee/s in GIS (*Please specify which expertise*)
  - Other
13. The personnel involved in GIS service's organization:
- Is/Are GIS specialist/s
  - Have been trained on GIS
  - Not specialized but interested in GIS

**5. Economics**

14. Please determine the amount of the annual available budget for Library/organization of the annual available budget for your Library /Organization:
15. Please determine the amount of money that has been spent for the development of GIS in your Organization:

16. The amount of money spent for the implementation of the system that is derived from:
- The annual budget
  - Research programme
  - European programme
  - Other (*please specify*)

#### **6. Hardware**

17. What kind of equipment do you provide to support GIS services? (*you may choose more than one answer*)

- PC's
  - Printers
  - Scanners
  - Digitizers
  - GPS units
  - Plotters
  - Other (*please specify*)
18. The operating system that GIS is installed on is:
- Windows
  - Macintosh
  - UNIX
  - Other (*please specify*)

#### **7. Software**

19. The software you use for data processing is:

- Developed by us
  - ArcView
  - ArcGIS
  - Arc Info
  - MapInfo
  - Other (*please specify*)
20. This software is:
- Accessible only from single workstations
  - Installed on library's/Organizations' server
  - Other (*please specify*)

#### **8. Data**

21. Data entered in GIS derived from (*Please check all that applies*):

- Purchase
- Donations
- Internet Resources
- Public Sector's Organizations
- Organizations' research production
- Other (*please specify*)

#### **9. Metadata**

22. Do you use metadata standards?

- Yes
- No
- Where appropriate

23. If yes, what schema? (*please specify*)

#### **10. Level of provided service**

24. Services provided by Library/Organization related to GIS include:

- Installed base system in the Library/Organization from which users can have access
- Remote access to the system for all users
- Remote access to the system to authorized users
- Customized services (if requested by users)

#### **11. Users**

25. You developed this system to be used by: (please specify scientific or other disciplines in order of priority filling in as needed e.g. geographers, archaeologists): 1...2...3...4...

#### **12. User Education**

26. The education provided for the use of GIS:

- Provided by Library/Organization through organized seminars
- Provided by Library/Organization through electronic help
- Provided by skilled persons not belonging to the Library/Organization
- Education or help is not provided

### 13. GIS Evaluation

27. Have you carry out an evaluation study of the GIS that have been applied?
- Yes
  - No
  - I'm not sure

## APPENDIX 2

### QUESTIONNAIRE FOR GEOSPATIAL COLLECTIONS AND OPEN ACCESS IN GREEK LIBRARIES

#### A. Demographics

1. Sex:

- Female
- Male

2. You have:

- Technological Educational Institute Grade
- University Grade
- Post Graduate Grade
- PhD
- Other (*please define*):

3. You are employed in:

- Public Sector
- Private Sector
- University (as Faculty)
- University (as researcher)
- University (as student)
- Technological Institute (as Faculty)
- Technological Institute (as researcher)
- Technological Institute (as student)
- Research Institution/Organization
- Other (*Please define*)

4. Which is the field of your scientific specialization? Please give a brief reference:

5. For what reasons do you use GIS and data:

- Educational reasons
- Scientific reasons
- Are part of my every-day work activity
- Other (*please specify*)

#### B. Library Use

6. How do you cover your informational needs regarding geospatial data? (*Please prioritize*):

- Internet
- Research Data
- Educational Data
- Libraries of foreign Institutions
- Public Sector
- Private companies
- Other (*please define*)

7. Do you use any Greek library in order to cover your educational/research needs?

8. If yes, please identify the library/libraries:

9. If yes, do you believe that the library/ies you mentioned above cover your informational needs considering the digital geospatial information and the GIS services?

- Yes
- No

10. How would you evaluate the development of geospatial collection in Greece (with 1 evaluate as “very good” and 5 as “insufficient”).

11. In your opinion which areas should be improved in order geospatial collections to be developed?

- The planning of geospatial collection development policies
- Administration's commitment in developing collections and services
- Library's staff training
- Enhancing user's interest
- The development of synergies with the members of the parent organization
- The development of synergies with other libraries for common collections development practices or data acquisition
- Other (*please define*)

12. Do you believe that the Greek libraries respond well in collecting, organizing elaborating and spreading the geospatial information, so that they can offer services of additional value to their users?

- Yes
- No
- Maybe
- Don't know/Don't answer

### **C. Collection Necessity**

13. Please evaluate the necessity of geospatial collections and GIS services in libraries. Identify the proposal you agree to:

- It is necessary only to libraries serving similar departments (university) or needs (institutions)
- It is necessary for all libraries regardless their kind
- It is not necessary for libraries

14. Do you believe that libraries should collect, organize and diffuse the geospatial data produced by their parent institution?

- Yes
- No
- Maybe
- Don't know/Don't answer

15. How, in your opinion, could a library contribute to the development of a geospatial collection?

- By planning geospatial collections development policies
- With the agreement and support of the administration
- By further training of the library's staff
- By strengthening patron's interest
- By developing synergies with members of the parent organization
- By developing synergies with other libraries for common collections development practices or data acquisition
- Other (*please define*)

16. In your opinion what are the reasons that inhibit the development of geospatial collections and GIS services in Greek academic libraries?

- Lack of geospatial collection development policies
- The high cost of geospatial data acquisition
- The high cost of infrastructure
- Lack of interest by libraries' administration
- Staff's lack of knowledge
- Users' lack of interest
- Other (*please define*)

17. Who in your opinion, should have the responsibility to collect geospatial data from producers and spread them with a uniform way? (*Please, prioritize*)

- Nobody, can be found sparsely on the web
- In private agencies
- Research Institutions /Organizations
- Academic Institutions
- Public Sector (National Documentation Centre, National Library, Ministries etc.)
- Other (*please define*)

#### **D. Open Access**

18. Do you believe that libraries should turn to geospatial data to better serve their users;

- Yes
- No
- Maybe
- Don't know/Don't answer

19. Do you believe that libraries should provide data only to members of their organization, even if they are not subject to legal restrictions (copyright issues)

- Yes
- No
- Maybe
- Don't know/Don't answer

20. In your opinion which is the next priority for utilization/spread of geospatial data?