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The change of paradigms in digital map libraries

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Summary

Recent developments in information and communication technologies, especially the internet and web, have brought significant changes in the ways we generate, distribute, access and use information. This new era, the digital era, is changing the paradigms of librarianship. The changing paradigms have different impact on academic and national map libraries. GIS applications are usually not included in the national map libraries web pages. This paper discusses a pilot web-based application, which explores the possibilities of GIS by creating virtual collection of diverse geocoded library holdings (historical maps, postcards, portraits, panoramic views, audio clips). The described project tried to modify the role of national map library from geospatial access data point to active 'creator of map-based' access model portal, enabling users to access materials relative to spatial locations.

Introduction

In the third millennium BC the Sumerians were using soft clay and a wedge-shaped stylus or pointed stick to record information and maps. The heavy clay tablets favored the collection of permanent records, and the Sumerians established libraries. The essence of library has not changed over the centuries. It is still a collection of textual and graphic materials arranged for easy use, cared for an individual or individuals familiar with the arrangement, and accessible to at least limited number of persons (Tedd, Large 2005).

Recent developments in information and communication technologies, especially the internet and web, have brought significant changes in the ways we generate, distribute, access and use information. This new era, the digital era, is changing the paradigms of librarianship. One of the most important contributions of web technology has been the creation of digital libraries, which allow users to access digital information resources from virtually anywhere in the world. But, digital libraries should not be regarded only as a point of access to digital information. The changes are deeper and they go through numerous librarian structures. Maps, charts and atlases were part of the library collections since they were established. Nowadays, due to the establishment of digital cartography, geospatial databases and multimedia, the role and activities of map libraries have been changed.

Academic vs. national map libraries in the geospatial age

The changing paradigms have different impact on academic and national map libraries. Academic map libraries are increasingly collaborating with the experts in geosciences, GIS and digital cartography, which introduced their policies and activities within the tra-

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ditional frames of librarians. By supporting students, scholars and researchers academic map libraries have to recognize the changing nature of librarian field as well as information formats that they support (Goodchild 2000). In addition to scanned maps, which are a part of their collections (so called digital map libraries), they also provide different ways of GIS and geolocation facilities.

The usage of GIS in map libraries began in 1992 with the American Research Libraries (ARL) GIS Literacy Project. The Project sought to provide a forum for libraries to experiment and engage in GIS activities by introducing, educating, and equipping librarians with the skills needed to provide access to digital spatial data (French 1999). The goals of the Project were designed to provide the tools and expertise necessary to ensure that digital government information can be used effectively and remain in the public domain. The Project increased knowledge of GIS among librarian and in the 1999 survey among 121 Project participants, 89% were already offering GIS services (French 1999).

Since the beginning of incorporation of GIS services in academic map libraries in the nineties, changes and improvements have been achieved. Opinions on novel technology and services have been presented in several articles (Ferguson 2002, Kowal 2002, Martindale 2004, Jablonski 2004, Dixon 2006). They accentuate technology and user access to GIS data and GIS resources. These articles point out to the needs of academic users, and strive to meet those needs in a service sense. It became an academic map library policy to collect, manage and disseminate geospatial data.

In contrast to academic map libraries, the national library map collections are different. They collect, preserve and archive national cartographic heritage. They are highly involved in legal deposit problems, its changing forms (printed maps to digital), archiving (digital cartography), copyright law, etc. They also recognize changing nature of librarianship (Bäärnhielm 1998, Campbell 2000, Dupont 1998¸ Fleet 2000, 2004, Häkli 2002, Kildushevskaya and Kotelnikova 2000, 2002), but due to their history and rigid hierarchical structure, they are not so rapid in implementing the needed changes.

Their essential interest lies in presentation and easy access to cultural heritage. This is the reason why scanned historical maps are the main contents of national library map collections web pages. In general, they provide users with the ability to easily manipulate the maps, magnify and zoom in on specific sections. High number of hits for the National Library of Scotland and Library of Congress, as mentioned above, demonstrates a high interest of the users for the historical maps and cartographic heritage. While offering GIS support and services as a part of the national map libraries are not part of the standard practice nowadays, especially in the smaller libraries, things are starting to change (Kotelnikova and Kildushevskaya 2004). These changes are mostly dependent on the structure of the users. In addition, GIS applications are usually not included in the national map libraries web pages with the exception of the projects that are part of the National Library of Scotland (Fleet 2004) and British Library.

The geolibrary paradigm in the National Library of Slovenia

In the National Library of Slovenia, maps and other cartographic material are part of the collection that encompasses postcards, drawings, portrait images, posters, and panoramic views. The majority of the pictorial items incorporate spatial locations or geographic

footprints, which are hidden and unexploited in a traditional, non-digital library. New technologies such as GIS enable its usage.

Spatial access to diverse library holdings has not been investigated and applied in national libraries portals. The reasons can be found in GIS characteristic, spatial illiterateness and/or collections policies and tradition. Fortunately, GIS is slowly being converted from its highly exclusive professional usage (in geography and geodesy) towards general public use. At the moment, there are no defined GIS standards for the public domain. On one hand, there are specialized GIS applications, and on the other, there are functionally impoverished browsers for cartographic (not GIS) contents. In addition, GIS is not user friendly for those who are not familiar with geosciences and for all who do not "think graphical" (Fleet 2006).

Since 2004, the Map Collection of Slovenian National Library in cooperation with Geodetic Institute of Slovenia has tried to explore and use advantages of GIS in a way which has not been used in the national digital library presentations. We have tried to modify our role from geospatial access data point to active 'creator of map-based' access model portal, enabling users to access materials relative to spatial locations. The origin of this idea was put forward by M. Goodchild (1998, 2004), who was one of the initiators of the Alexandria Digital Library project. M. Goodchild suggested that geolibraries should become a 'spatially-oriented' type of digital libraries filled with georeferenced information, with locations acting as the primary basis for representation and retrieval of the information.

For that reason GIS prototype has been developed in two parts, in 2004 and 2007, both on the following objectives (Šolar and Radovan 2005):

- To integrate and analyze historical maps with modern geographical data in digital form in terms of accuracy, cartographic projection, cartographic presentation techniques, development of settlements and changes of toponymy.
- To explore the possibilities of GIS as a tool for creating a virtual collection compounded of diverse materials on a map-based access model, enabling users to access materials relative to spatial locations.
- To provide users with an interactive, dynamic environment for exploring, manipulating and transforming a collection holding which was not possible with traditional print media.
- To bring together the conservation and promotion of selected materials for education and research purposes by internet users.

Part I – GIS prototype completed in 2004

Diverse materials from the Collection holdings, such as maps, portraits, views, audio clips and manuscripts were selected from the same historical period for the GIS prototype completed in 2004. The prototype web-site contains: a) a part of the map covering the central region of Slovenian territory from the mid 19th century, the *"Special – Karte des Herzogthums Krain"* b) city maps of Ljubljana entitled *"Croquis zur…"* c) panoramic views of the city of Ljubljana dated from the same period, d) portrait images of the famous Slovenian poet France Prešeren and e) the national anthem "Zdravljica" written by him. Contemporary items such as a section of modern digital topographic map of Slove-

nia at 1:100.000 and a digital city map of Ljubljana at 1:20.000 were also included to allow comparison with 19th century items.

To non spatial items i.e. panoramic views and portraits, spatial components (coordinates) were added manually to bibliographic metadata regarding to the contents. They were marked as hot spots on interactive maps.

Additional hypertext describing the view, the portrait and the author were added to picture images with informative and educational meaning.

The historical map "*Special – Karte des Herzogthums Krain*« as well as two city plans titled »*Croquis zur…* » from the mid-19th century were integrated into the GIS and overlaid with contemporary digital maps.

Coordinate system conversion was required to begin with, since the original map coordinate system and the Slovenian national coordinate system differ, eg. the Austro-Hungarian cartographic tradition was to use "Ferro" (Ferro Island, Canary Islands) as the prime meridian and conversion to "Greenwich" was necessary. Ten ground control points were defined for the "*Special – Karte des Herzogthums Krain*". The resulting geo-rectified map was compatible with the current longitude/latitude representations. The ArcMap Geo- referencing tool was used to perform an affine approximate transformation from the (x,y) local grid coordinates of the map image to the (x,y) coordinates of the UTM projection system (Universal Transverse Mercator) of the contemporary digital Military map (1:100.000) for the same ten ground control points. The resulting image has been geo-rectified, enabling overlay operations. Geo-referencing of the two city maps of Ljubljana from the mid -19th century was done by the same procedure.

In 1846, a brochure of German – Slovenian toponymy, the »Gazetteer Alphabetisches Verzeichnitz aller Ortschafts und Schlösser Namen des Herzogthums Krain in deutch und krainischer Sprache" was published as a supplement to "Special – Karte des Herzogthums Krain". The gazetteer contains a very detailed and extensive list of historic Slovenian and German place names and incorporates also some important information on tax county and church hierarchy. It is a valuable source for historic Slovenian and German toponymy, and was used as a prototype gazetteer. This prototype gazetteer for ten selected point places (settlements) enabled users to query current and historic Slovenian and German names from the "*Special – Karte des Herzogthums Krain*" referenced to the same geographic location, linking the name of the place to the map image.

Part II – updated GIS prototype within TEL portal

The successfully completed project entitled the European Library (TEL), which was initiated with European funding, is the online service that went live in March of 2005. This website allows search through the resources of 47 national libraries in 20 languages. New initiatives are currently supported with European co-funding, and they continue to build upon TEL. One of those was the European Digital Library (EDL) initiative (2006-2008). Its main aim was to expand network and contents of TEL. Improvement of the usability of the portal by integrating new services, TEL is seeking ways to make its contents more usable, to enhance search results and to explore novel ways of presenting them; mainly to make the user experience more engaging and interesting.

Tested feasibility of integrating GIS in the portal of TEL became a part of the EDL. The Map Collection in cooperation with the Geodetic Institute of Slovenia was appointed to develop a GIS prototype as an external service to which the European Library linked (Angelaki et al. 2007). The application provided by the Slovenian team was based on experiences from 2004.

The 2004 prototype content was expanded to another three georeferenced historical town plans of Ljubljana and the collection of 15 postcards. The postcard collection on the TEL portal was a search start point for the user (Figure 1). Coordinates were also in this test case added to bibliographic metadata manually.
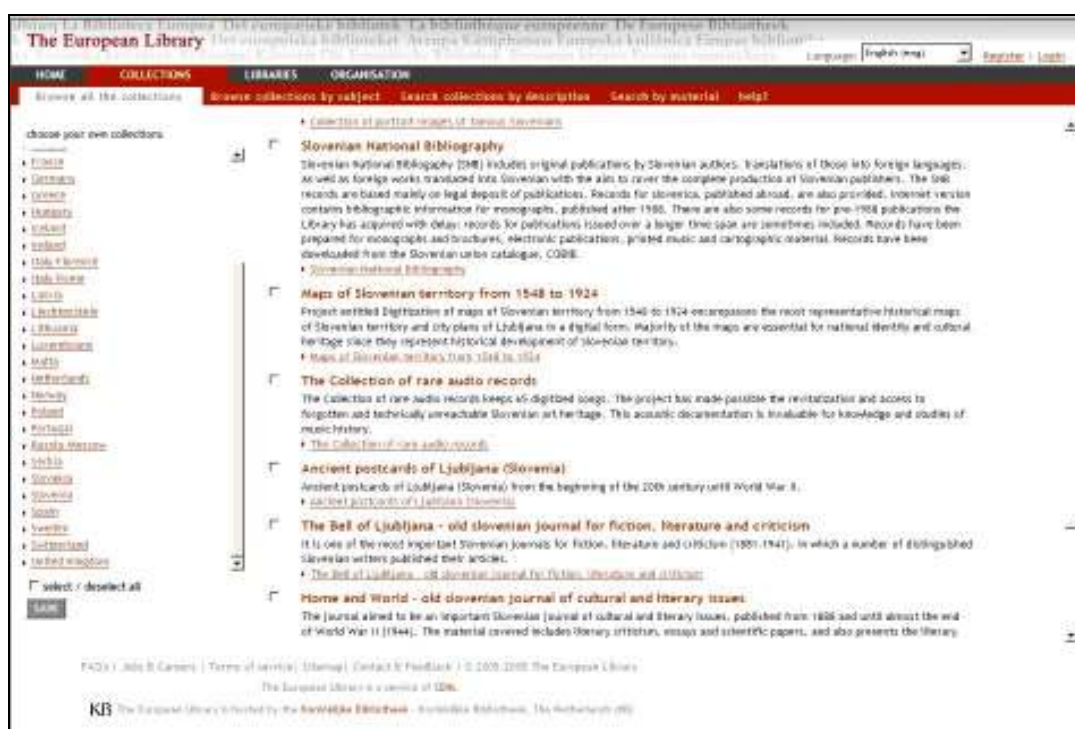

Figure 1: The postcard collection on the TEL portal

By clicking on the collection icon, the user enters the GIS application. He/she is then invited to interact with the other elements of the GIS application thereby exploring Slovenian history (Figure 2).

The user can explore the map by directly clicking on the map signs or he/she can use the interface.

By clicking on the map sign user can get information about depicted view, postcard, portrait or place name (Figure 3).

Thus, the user interface allows search based on various criteria; spatial coverage, title, author, date and publisher. Search results (pictorial items) are displayed in a separate window simultaneously with their specific locations on the map (Figure 4). Metadata and locations are used for this purpose.
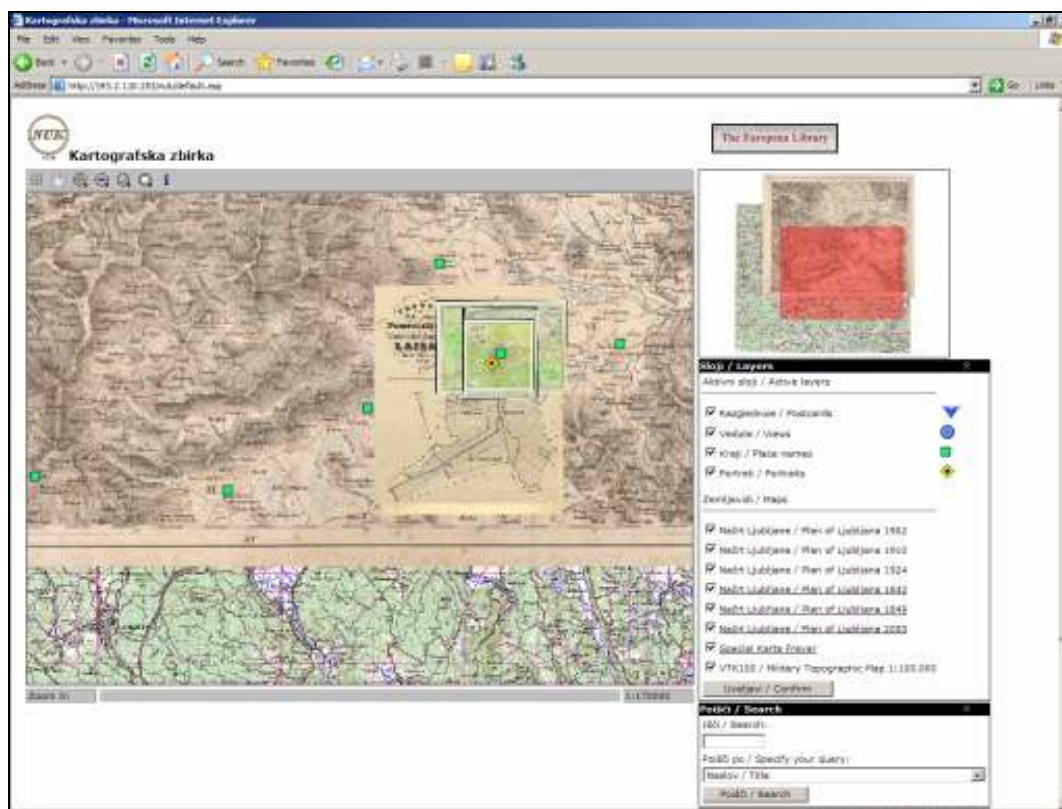
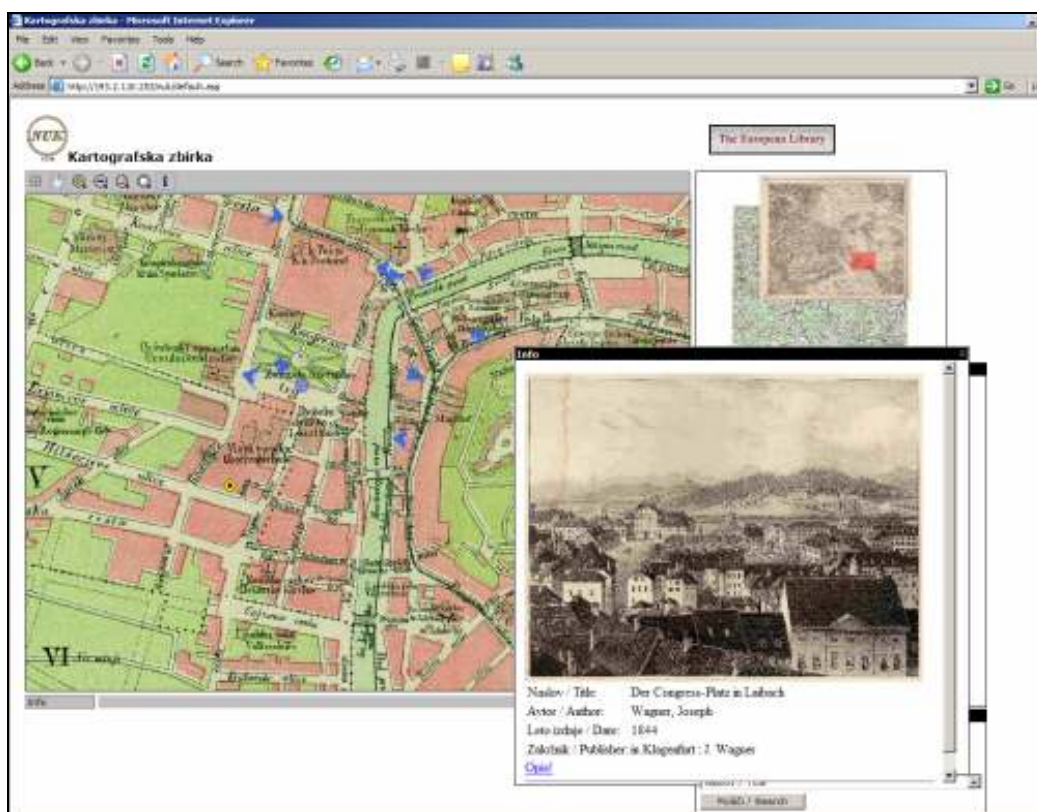Figure 2: Entrance to GIS application showing preview of old and new maps

Figure 3: Information about the depicted panoramic view, marked on the appropriate old plan of Ljubljana.
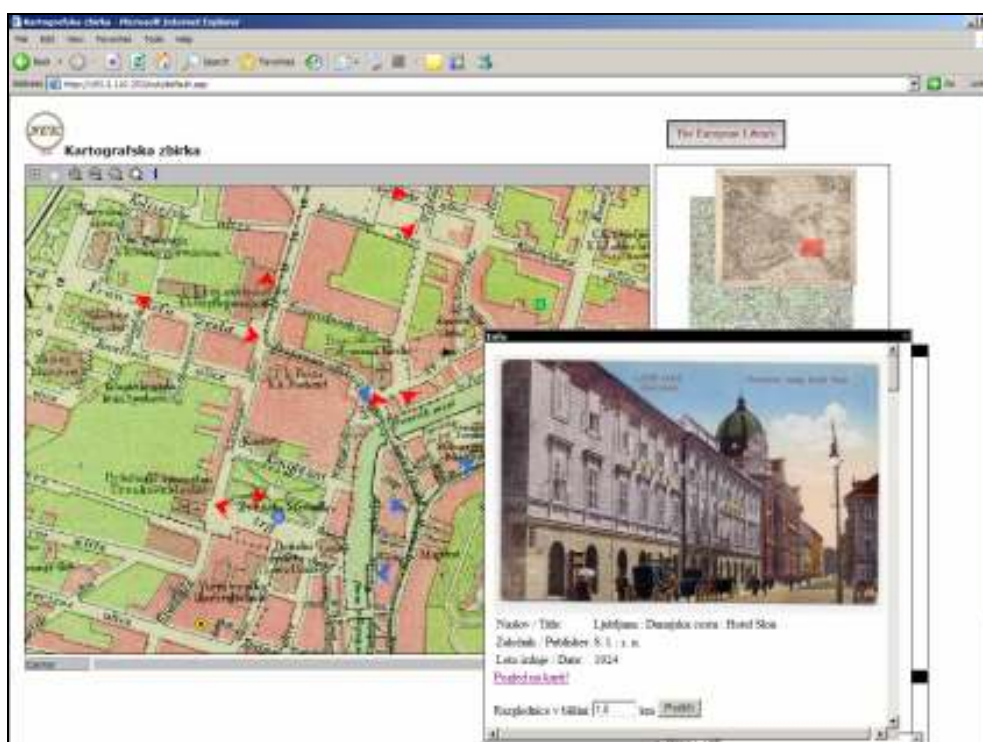
Figure 4: Search results with short bibliographic records and display of their specific locations on the map.

By clicking on the option *See on the map* on the selected item, the spatial location of the building, square or street with the angle from which the object is photographed, is displayed on the map (Figure 5).
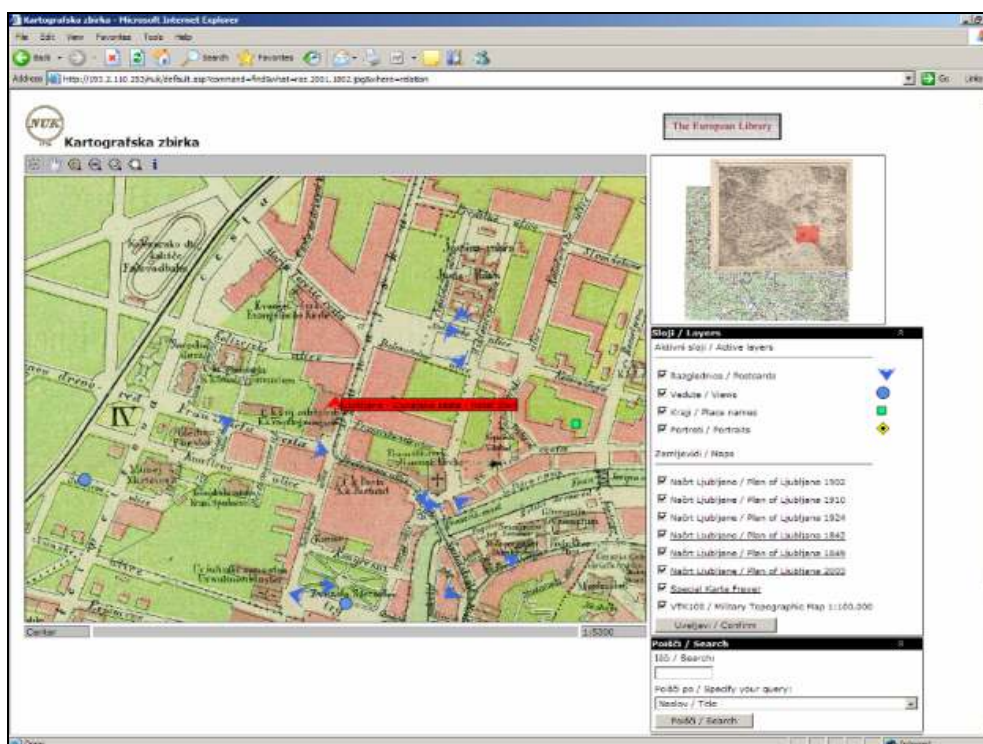

Figure 5: Spatial location of the depicted item with the angle from which the object is photographed

Discussion and possibilities for future development

The described development of GIS prototype represents a novel and interdisciplinary presentation of the national library treasures. It has a potential to integrate GIS services into the European Library where the technology is used as a tool for creating a virtual collection of diverse materials on a map-based access model. At present, GIS creates a new opportunities to display and link traditionally static prints. It creates additional value for the cartographic material by overlaying and comparison of historical hypermaps.

One of the open questions is, why GIS is not broadly used in national map libraries portals?

Georeferencing and the use of GIS require a basic knowledge of programming, the use of databases as well as *ArcGIS*. Thus, libraries will have to either provide adequate training in GIS for their staff, or hire GIS specialists, a solution that has become widely used in the map collections in the USA. Map librarians have use advantages of cross-institutional cooperation with various spatial research institutions. Excellent projects can be realized if they can share a common interest.

Costs are also very important for the development of such a technically rather demanding applications. A key financial question is whether money from state budgets (the most common way of funding the national libraries) intended for digitization projects will be sufficient for such applications, or will projects need extra funding. The need for additional funds for such projects is predicted to force libraries to search for new ways to generate income. Establishment of contacts with official representatives of ESRI and possibilities of donations can be useful.

Another question is how to integrate georeferenced information into bibliographic metadata, and enable their access through national libraries portals?

In the described GIS prototype coordinates were added to bibliographic records manually. Thus, they were not generated directly from bibliographic field which represents the spatial coverage of any library object. Therefore, connection of the field to the gazetteer protocol is necessary. Gazetteers are useful as aids to cataloguing and indexing when coordinates are to be added to metadata. For this purpose, there is a gazetteer lookup stage, selection of the appropriate gazetteer entry, and the transfer of coordinates from the gazetteer to the metadata. This process can be accomplished by embedding a protocol to search a gazetteer in the cataloging software, and then processing the information that is returned from the gazetteer query (Hill 2006).

The general development of spatial information infrastructures in Europe is fraught with policy barriers. Government organizations are spatial data producers, so that the regional and national datesets and gazetteers generated by the government agencies have attached intellectual property rights. Despite these drawbacks, several projects, most of them funded by the EC, do show the vision to achieve interoperability of European mapping and other GI data (for example: The EuroSpec Programme, EuroRoads, EuroGeoNames, EuroRegionalMap, ..). Building of the base of the European Spatial Data Infrastructure (ESDI) has been in progress. We suggest that national libraries and their map collections should take an active part and add value to the spatially oriented projects.

Finally, what is the future of georeferenced digital libraries and the map based portals?

K. Dragland (2005) said: "There will be a golden age for georeferenced digital libraries if people learn to solve problem in the spatial paradigm, and if they are aided by georeferenced digital libraries and georeferenced collections that are publicly available and easy to comprehend and use." Clearly, map librarians supported by other geoscientist have to make their contributions.

References

Alexandria Digital Library. In digital form, http://www.alexandria.ucsb.edu/

Angelaki, G., Šolar, R., Janssen, O., Verleyen, J. (2007). Old postcards of Ljubljana : a small feasibility study to examine a possible application and availability of Geographic Information Systems with a view to integrating this approach into The European Library : Project Report. In digital form, http://www.edlproject.eu/membersonly/wp1.php

Bäärnhielm, G. (1998). Digital cartography in the Royal Library - National library of Sweden. In digital form, http://liber-maps.kb.nl/articles/baarn11.htm

Campbell, T. (2000). Where are map libraries heading? Some route maps for the digital future. In digital form, http://liber-maps.kb.nl/articles/12campbell.html

Dixon, J.B. (2006). Essential collaboration: GIS and the academic library. *Journal of Map & Geography Libraries* 2 (2): 5-20.

Dragland, K.T. (2005). Adding a local node to a global georeferenced digital library. In digital form, http://www.diva-portal.org/diva/getDocument?urn_nbn_no_ntnu_diva-645-1__fulltext.pdf

Dupont, H. (1998). Legal Deposit in Denmark - the new law and electronic products. In digital form, http://liber-maps.kb.nl/articles/dupont11.htm

EDL project. In digital form, http://www.edlproject.eu/about.php

Ferguson, A.W. (2002).'Back talk--GIS induced guilt. *Against the Grain* 14(5): 94.

Fleet, C. (1998). Ordnance Survey digital data in UK legal deposit libraries. In digital form, http://liber-maps.kb.nl/articles/fleet11.htm

Fleet, C. (2002). The legal deposit of digital spatial data in the United Kingdom. In digital form, http://liber-maps.kb.nl/articles/13fleet.html

Fleet, C. (2004). Web-mapping applications for accessing library collections: case studies using ESRI's ArcIMS at the National Library of Scotland. In digital form, http://liber-maps.kb.nl/articles/14fleet.html

Fleet C. (2006). Locating trees in the Caledonian forest': a critical assessment of methods for presenting series mapping over the web. *e-Perimetron* 1(2): 99-112. In digital form, http://www.e-perimetron.org/Vol_1_2/Vol1_2.htm

French, M. (1999). The ARL Literacy Library GIS Project: Support for Government Data Services in the Digital Library. In digital form, http://iassistdata.org/publications/iq/iq24/iqvol241french.pdf

GIS prototype. In digital form, http://www.theeuropeanlibrary.org/portal/?coll=collections:a0246&q=postcards

Goodchild, M.F. (1998). The Geolibrary. *Innovations in GIS* 5: 59-68.

Goodchild, M.F. (2000). Cartographic perspectives on a digital future. *Cartographic Perspectives* 36: 1-19.

Goodchild, M.F. (2004). *The Alexandria Digital Library Project.* In digital form, http://www.dlib.org/dlib/may04/goodchild/05goodchild.html

Häkli, E. (2002). Map collections as national treasures. In digital form, http://liber-maps.kb.nl/articles/13hakli.html

Hill, L. (2006). *Georeferencing: The Geographic Associations of Information.* Cambridge, London: MIT.

Jablonski,J. (2004). Information literacy for GIS curricula: an instructional model for faculty. *Journal of Map & Geography Libraries* 1(1): 41-58.

Kildushevskaya, L. Kotelnikova, N. (2002). Problems of preservation and accessibility of cartographic publications in the National Libraries of Russia. In digital form, http://liber-maps.kb.nl/articles/13rus.html

Kotelnikova, N. Kildushevskaya, L. (2000). Electronic maps and atlases in the Russian State Library and the Russian National Library. In digital form, http://liber-maps.kb.nl/articles/12kotelnikova.html

Kotelnikova, N. Kildushevskaya, L. (2004). Development of geographic information systems and their use in national libraries of Russia. In digital form, http://liber-maps.kb.nl/articles/14kotelnikova.html

Kowal, K.C. (2002). Tapping the Web for GIS and mapping technologies: for all levels of libraries and users, *Information Technology and Libraries* 21(3): 109-114.

Martindale, J. (2004). Geographic Information Systems librarianship: suggestion for entryl evel academic professionals. *The Journal of Academic Librarianship* 30(1): 67-72.

Šolar, R., Radovan, D. (2005). Use of GIS for presentation Map and Pictorial collection of the National and University Library of Slovenia. *Information Technology and Libraries* 24(4): 196-200

Tedd, L.A. Large, A. (2005). *Digital Libraries : principles and practice in a global environment*. Munchen: K.G. Saur.

The European Library. In digital form, http://www.theeuropeanlibrary.org/portal/index.html