THE USE OF GIS TECHNOLOGY IN CULTURAL HERITAGE

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ABSTRACT:

In the last years, GIS technology became a usual tool for heritage managers, conservators, restorers, architects, archaeologists, painters and all other categories of experts involved in cultural heritage activities. More and more central and local authorities responsible for cultural heritage embarked on creating complex and integrated information systems, having GIS as one of the main infrastructure component. This paper is a report that attempts to describe the current status of the use of GIS in cultural heritage. The data provided by the national CIPA delegates represent the main source of information the report is based on.

1. INTRODUCTION

Recent advances in the field of GIS offered the appropriate instruments for the central and local authorities responsible for cultural heritage to build corporate information systems having this type of information technology as one of the most important infrastructure component. More and more countries started to implement such complex information systems. Besides the well known pioneer example in Italy, other nation-wide systems at different implementation stages were reported in United Kingdom, Romania, and South Africa, to name just a few.

This paper is a report that attempts to describe the current status of the use of GIS technology in cultural heritage. The main objective of the paper is to facilitate the exchange of information between the actors involved in the implementation of such systems in different countries.

The data provided by the national CIPA delegates represent the main source of information the report is based on. Another important information source consisted of the papers presented at the recent CIPA International Symposia, since the XVIIth edition in 1999. Inevitably, due to lack of access to all relevant information sources, the data presented in the paper is not complete. In this context, the report does not include data about the current situation in USA, China, and India, to name just several cases where the author had no relevant information.

In order to provide accurate and actual data, maintenance of the information included in this report is possible by writing new versions periodically. This might be done based on the feedback from the national CIPA delegates who represent the most important relevant information source of the report.

2. GIS IN CULTURAL HERITAGE

The experience of 22 countries concerning the use of GIS in cultural heritage is presented in the following.

2.1 Australia

The Australian national CIPA delegate reported several applications of GIS technology in cultural heritage. Most of them are related to Australian aboriginal communities. The current situation may be characterized as follows:
- Level of implementation: regional, local
- GIS technology included within the information infrastructure
- GIS application for internal use
- GIS applications not (yet) public
- No data model reported
- Main field of application: aboriginal communities
- References: (Ogleby, MacLaren, Starkey, 2003), (Ogleby, 2007)

2.2 Austria

There are many GIS applications devoted to archaeology and historic monuments in Austria. The current situation may be characterized as follows:
- Level of implementation: regional, local
- GIS technology included within the information infrastructure
- GIS application for internal use
- GIS applications are available to the public
- No data model reported
- Main field of application: archaeology, historic monuments
- References: (Doneus, Scharrer, 1999), (Csaplovics, Herbig, Borner, 2001)
- Special mention: Kulturgüterkataster application in Vienna (http://service.wien.gv.at/kulturkat/)

2.3 Cyprus

The national CIPA delegate in Cyprus reported (Stylianidis, 2007) that the use of digital technologies, including GIS, is still at the beginning. One example of implementation of a database of archaeological objects is the system under current development at the Pierides Foundation Museum.

2.4 Czech Republic

Currently, in Czech Republic a national project is under development: "Database of Historical Monuments in Czech Republic", that has been started at Czech Technical University in Prague. This database aims at integrating many results obtained at local level. The current situation may be characterized as follows:

- Level of implementation: national, local
- GIS technology included within the information infrastructure
- GIS application for internal use
- GIS applications not (yet) public
- No data model reported
- Main field of application: historic monuments
- References: (Pavelka, Chromy, Soucek, 2003)

2.5 Germany

The literature proves that Germany is one of the countries where information technology tools are used systematically in cultural heritage protection. GIS technology makes no exception. The current situation may be characterized as follows:

- Level of implementation: regional, local
- GIS technology included within the information infrastructure
- GIS application for internal use
- GIS applications not (yet) public
- Data models available at application level
- Main field of application: archaeology, historic monuments
- References: (Grote, Heckes, Hornschuch, 2000), (Hosse, Schilcher, 2003), (Reitz, Haist, Wigg-Wolf, 2006)

2.6 Greece

The Greek national CIPA delegate reported that there are many GIS applications currently used for cultural heritage protection all over the country. The use of GIS technology was also studied from a methodological point of view. One of the main trends consists in using the Internet within the projects dedicated to cultural heritage (e.g. www.ims.forth.gr/rg_gis.html, www.ics.forth.gr/islr-d-activities/deltos.html, web.auth.gr/temper/gis_en.html, odysseus.culture.gr/index_en.html, www.ics.forth.gr/isl/projects/projects_individual.jsp?ProjectID =20). The current situation may be characterized as follows:

- Level of implementation: regional, local
- GIS technology included within the information infrastructure
- GIS application for internal use
- GIS applications available to the public
- Data models available at application level
- Main field of application: archaeology, historic monuments, cultural itineraries.
- References: (Patias, Stylianidis, Tsioukas, Gemenetzis, 1999), (Styliadis, Paraschakis, 1999), (Anastasiou, Georgopoulos, Makris, Chatziparassidis, 1999), (Papakonstantinou, Christodoulou, Soulakellis, 2006), (Balla, Pavlogeorgatos, Tsiafakis, Pavlidis, 2006), (Georgopoulos, 2007)

2.7 Iraq

World Monuments Fund and Getty are assisting Iraq in developing a spatial database in order to record the archaeological sites and historic monuments of the country. The current situation may be characterized as being at an initial status:

- Level of implementation: national
- GIS technology included within the information infrastructure
- GIS application for internal use
- GIS applications not public
- Main field of application: archaeology, historic monuments
- References: (Palumbo, 2007), http://gaialab.asu.edu/home/ prod02.htm

2.8 Italy

Italy is one of the countries where GIS technology is present in cultural heritage at all levels. At the same time, the literature proves that the scientific community is very active on both the research side and the practical side of historic monuments protection process. The current situation may be characterized as follows:

- Level of implementation: national, regional, local
- GIS technology included within the information infrastructure
- GIS application for internal use
- GIS applications available also to the public
- Data models available at application level
- Main field of application: archaeology, historic monuments, cultural itineraries.
- References: (Accardo, 1998), (Dequal, Lingua, 2003), (Brumana, Achille, 2003), (Barrile, Cacciola, Cotroneo, 2006), (Cinnirella, Faralli, Labella, Maurelli, Pierro, Rosa, 2006), (Brumana, Prandi, 2006)
- Special mention: "La carta del rischio del patrimonio culturale" project coordinated by Instituto Centrale per il Restauro (www.icr.beniculturali.it/rischio00.htm).

2.9 Japan

There is a high degree of use of information and communication technologies in Japan. One can assume that the same happens with GIS technology. During the documentation phase of my work I found out a very good example of GIS use in cultural heritage that confirms the previous assumption. It is related to a complex project dedicated to the famous city of Kyoto; the project aims at the reconstruction and visualization of 4D-GIS of Kyoto, provides 3D-GIS of the city, starting from the present times and going back to the 8th century. Due to the poor number of information sources I had access to, the present version of the report cannot include a characterization of the current situation in Japan. Nevertheless, due the high complexity of the project dedicated to Kyoto there is no doubt that there should be many other cases where GIS technology is applied in Japan for cultural heritage purposes.

- References: (Takase, Yano, Nakaya, Isoda, T. Kawasumi, Matsuoka, Tanaka, Kawahara, Inoue, Tsukamoto, Kirimura, Kawahara, Sho, Shimiya, Sone, Shiroki, 2006)
- Special mention: "Kyoto Virtual Time-Space" (www3.rits-coe.jp/ritsumei_kyoto/main.html)

2.10 Kazakhstan

The national CIPA delegate of Kazakhstan reported that the use of GIS technology in cultural heritage is at the beginning in the country. Nevertheless, there is a pilot project concerning Otrar oasis in Southern Kazakhstan that stands as a good starting point. The current situation may be characterized as follows:
- Level of implementation: local
- GIS technology included within the information infrastructure
- GIS application for internal use
- GIS applications not available to the public
- Data models not yet available
- Main field of application: archaeology, historic monuments.
- References: (Baipakov, Savelieva, Voyakin, Akylbek, Antonov, Sorokin, Voyakina, 2007), (Voyakin, 2007)

2.11 Malta

Institute for Conservation and Restoration Studies, Malta Centre for Restoration embarked on a complex project aiming at defining the way from "e-culture" to "e-heritage". The objectives of e-heritage are to "enable students, conservators, documentation specialists, museum curators, heritage managers and members of the general public to plug in anywhere in Europe (indeed in the world) and study and work together in the cultural heritage sector which is striving to preserve the common heritage of mankind" (Cannataci, Rivenc, Zammit, Borg, Guidi, Beraldin, 2003). Because of the small number of information sources I had access to, the present version of the report cannot include a characterization of the current situation in Malta.

2.12 Morocco

The Ministry of Culture and Communication of Morocco, through CERKAS - one of its offices, is currently creating an inventory on cultural heritage at the national scale. The inventory is carried out using GIS technology too. The current situation may be characterized as follows:
- Level of implementation: national, regional
- GIS technology included within the information infrastructure
- GIS application for internal use
- GIS applications available also to the public
- Data models not yet available
- Main field of application: archaeology, historic monuments.
- References: (Kölb, Boussahl, Hostettler, 2003)

2.13 Peru

GIS technology presence in cultural heritage of Peru includes a data model. The model is dedicated to the GIS analysis of the Nasca lines at Palpa. It was drawn up by specialists from Switzerland within a long-term project dealing with cultural landscapes in Peru (Lambers, Sauerbier, 2003). Due to the small number of information sources I had access to, it is not possible to characterize the current situation in Peru.

2.14 Poland

The use of GIS technology in Poland includes a research project entitled "Polish Cultural Heritage Promotion and Preservation Spatial Information System". The project is coordinated by the Warsaw University of Technology. During the documentation

phase of the present report I had no access to other information regarding the use of GIS technology for cultural heritage in Poland. That is why, no characterization for the current situation in this country is provided.
- References: (Nowak, Happach, 2006)

2.15 Romania

There are several projects that use GIS technology for cultural heritage protection in Romania. The most important is eGISPAT – National Programme of Implementation of a GIS for the Protection of national cultural heritage (archaeological heritage and historic monuments)". The project is coordinated by the National Institute for Historic Monuments and, recently, some of the results were also published via Internet using GoogleEarth facilities. Another relevant application was developed by CIMEC – Institute for Cultural Memory (www.cimec.ro). The current situation may be characterized as follows:
- Level of implementation: national, regional, local
- GIS technology included within the information infrastructure
- GIS application for internal use
- GIS applications available also to the public
- Data models not available
- Main field of application: archaeology, historic monuments.
- References: (MCC, 2005), (Petrescu, Murariu, 1999), (Petrescu, Murariu, 2002).
- Special mention: e-GISPAT (www.inmi.ro)

2.16 Russia

The use of GIS technology in Russia includes GIS HCH SO - Historical Cultural Heritage of Sverdlovsk Oblast (Pushchina, Litvinenko, 2003). This is a project developed by Ural Regional Centre of Geoinformation located in Ekaterinenburg. Taking into account the research and development potential of Russia, it is reasonable to assume that there are other similar projects in the country. Nevertheless, due to lack of relevant information the present version of the report cannot include a characterization of the current situation in Russia.

2.17 Slovak Republic

As the national CIPA delegate reported, the Monuments Fund of Slovak Republic embarked on creating GIS MF SR – Geographical Information System of Monuments Fund of Slovak Republic. The system is under implementation at national level as well as at lower levels. GIS MF SR is designed to be used in state administration bodies at all levels. It addresses many other types of users who are interested and involved in cultural heritage protection, from municipalities to tourists and from academic and education institutions to investors and entrepreneurs. The current situation may be characterized as follows:
- Level of implementation: national, regional, local
- GIS technology included within the information infrastructure
- GIS application for internal use
- GIS applications available also to the public
- Data models available
- Main field of application: archaeology, historic monuments.
- References: (Pincikova, 2007)

2.18 South Africa

As the national CIPA delegate reported, the South African Heritage Resources Agency initiated a project entitled SAHRIS – South African Heritage Resources Information System that includes a GIS referenced inventory of heritage sites. The project will result in an integrated and comprehensive web-based heritage information system. The current situation may be characterized as follows:

- Level of implementation: national, regional, local
- GIS technology included within the information infrastructure
- GIS application for internal use
- GIS applications not yet available the public
- Data models not yet available
- Main field of application: moveable and immoveable heritage resources as well as living heritage.
- References: (Hart, 2007)

2.19 Spain

As the national CIPA delegate indicated (Lerma, 2007), Spain is one of the countries where GIS technology is applied in many fields of activity, at all levels, national, regional and local. For the time being, this seems not to be true for cultural heritage applications. Due to lack of relevant information the present version of the report cannot include a characterization of the current situation in Spain.

2.20 Syria

As indicated by the national delegate of Finland (Lonnqvist, 2007), Syria is the beneficiary of SYGIS – Syrian GIS, a project using modern remote-sensing methods in archaeology. The project (www.helsinki.fi/hum/arla/sygis) is financed by Finnish institutions and is coordinated by the University of Helsinki.

2.21 Turkey

Based on the literature, there are many projects that use GIS technology for cultural heritage protection in Turkey. Most of them are at regional and local level. The current situation may be characterized as follows:

- Level of implementation: regional, local
- GIS technology included within the information infrastructure
- GIS application for internal use
- GIS applications not yet available to the public
- Data models not available
- Main field of application: archaeology, historic monuments.

References: (Yastikli, Alkis, 2003), (Basagac, Kösgeroglu, Güçhan, 2003), (Duran, Garagon Dogru, Toz, 2003), (Karsli, Ayhan, Tunc, 2003), (Guney, Duman, Uylu, Avci, Celik, 2003), (Reis, Nisanci, Yildirim, Inan, Yomralioglu, 2003), (Akcay, Altan, 2003), (Altan, Sivas, Alanyali, Gökce, Ayday, 2003), (Nayci, Bilgin Altinöz, Güçhan, 2003), (Bilgin Altinöz, 2003), (Klotz, 2003), (Muller, 2003), (Erdem, Durduran, Cay, Dülgerler, Yildirim, 2003), (Surul, Ozen, Tutkun, 2003).

2.22 United Kingdom

As the national CIPA delegate indicated, the most important GIS implementation in cultural heritage is developed in England: English Heritage's Corporate GIS. "Over 750.000 records, based in 6 databases are now accessible through a single gateway" according to Alice Froggatt, the co-ordinator of the project (Froggatt, 2006). The current situation may be characterized as follows:

- Level of implementation: national, regional, local
- GIS technology included within the information infrastructure
- GIS application for internal use
- GIS applications available also to the public
- Data models not available
- Main field of application: archaeology, historic monuments.
- References: (Bryan, 2007), (Froggatt, 2006a), (Froggatt, 2006b).
- Special mention: English Heritage's Corporate GIS

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