General Information System for Religious Italian's cultural resources

Agata LO TAURO

(Agata Lo TauroUniversity of Trieste, Faculty of Engineering, P. le Europa, Trieste, omar3@mail.gte.it)

ABSTRACT

General Information System for Religious Italian's cultural resources *is a nation-wide geographical information system of Italy implemented from 1996 for the* Ecclesiastic cultural heritage *(CEI) and still under implementation. It contains spatial and descriptive data on areas of cultural, environmental, scenic or public value protected by law. The information system realised two different tools to retrieve information, produce maps and reports and implement the database at three different levels: getting easy information on religious cultural resources, administrative use of central and local offices to control and manage protected areas, study and definition of new areas to protect and implementation of database with new or more detailed information.*

The GIS is designed to link Italian's cultural resources inventories through a user-friendly map interface. The primary system data consist of the inventories of historic properties and architectonic sites, the statewide record of architectural survey coverage, the National Register of Historic Building by the ICCD (Istituto Centrale del Catalogo e della Documentazione). Digital topographic quadrangle maps, county topographic maps, and infrared aerial orthophotos serve as base reference layers. The GIS is defined and discussed in terms of its potential costs and benefits for Cultural Heritage preservation, valorisation and risk analysis. The system is being designed to facilitate the staff responsibilities in the areas of research, review, and compliance.

1 INTRODUCTION

The Division of Historical and Cultural Programs launched a major initiative in late 1996 with its development of a General Information System (GIS) for Religious Italian's cultural resources. The Ecclesiastic Authorities under the "Conferenza Episcopale Italiana" (CEI), the Italian Ministry of Culture (MiBAC) and ICCD (Istituto Centrale del Catalogo e della Documentazione) amended the guidelines for a Community Initiative concerning the listing of cultural heritage intended to encourage the General Information System for the Ecclesiastical cultural heritage (Ministrerial Communication of 14 Jenuary 1998 Prot. N. 286/A 14). The project is jointly financed by the "Qtto per Mille" Programme and by private and public grants. The GIS is designed to link Italian's cultural resources inventories through a user-friendly map interface. The primary system data consist of the inventories of historic properties and architectonic sites, the statewide record of architectural survey coverage, the National Register of Historic Building by the CEI. Digital topographic quadrangle maps, county topographic maps, and infrared aerial orthophotos serve as base reference layers. The system is being designed to facilitate the staff responsibilities in the areas of research, review, and compliance. A publicly accessible workstation in the GIS has been established, and the data will be distributed on disk so that outside planners and researchers will have ready access to current information.

On the other hand the GIS is one important component of a comprehensive computerization project for the practical holdings. The General Information System in Italy serves as the repository of records on more than 70,000 cultural heritage (historic buildings, monuments, medieval architectonic sites, etc) recorded throughout the region. As a whole it gathers data, documentation, information sequences, that highlight, even if only in general terms, situations of danger for monuments. These stand for a support the Ecclesiastic Authorities (CEI - Conferenza Episcopale Italina) to help them to plan, together with the Italian Ministry of Culture (MiBAC), program and address the financial fluxes for restoration and maintenance interventions on single assets. Under the Italian Presidency a scientific research on "Territorial Information systems for the Preservation, Conservation and Management of Cultural Heritage" was developed also for the Ecclesiastic Cultural Heritage under the MINERVA Programme (http://www.minervaeurope.org). In particular the section 3.3.3 of the Minerva Good Practice Handbook describes the important role of geographic information in the context of cultural heritage, e.g. archaeological sites, historical patterns etc., and proposes strategies to bring together Europe-wide actions in the field.

2 THE CASE STUDY: ARCHITECTONIC CULTURAL HERITAGE

The Department of Cultural Resources is the CEI department responsible for preservation of cultural heritage collections and their documentation. To ensure availability for researchers and the public, cultural heritage collections and records should be retrieved, processed, stored and handled in ways that will contribute to their long-term preservation and mainteinence. Requests for using the Generic Information System's collections storage and research facilities should be submitted to the Ecclesiastic Authorities (Conferenza Episcopale Italiana -CEI). The determination of what will be accepted rests with a Ecclesiastic committee appointed by the CEI, on behalf of the National Office for Ecclesiastical Cultural Heritage.

The survey project provides a local base of information about community history and architecture. Ideally the surveyor and the survey serve as a prism--gathering information from many different religious places.

Survey files, organized by county, are maintained at the local "Curie Arcivescovili" at the Cultural Heritage Office, and at the regional offices of the Regional Councillorships of Cultural Heritage, along with survey project reports and detailed maps showing the locations of every recorded property. The extensive collection of survey files, maps, photographs, and reports constitutes a research and reference source, as well as providing private citizens, preservation organizations, and government agencies with a guide to the historic places that merit recognition and protection.

The survey data base includes as primary research modalities the following sources: Inventories, Pre-catalogue and Catalogue of architectonic properties. The inventories of architectonic properties give the general information of the architectural survey and is organized by the following data categories:

1.2 Accession Numbers

All artefacts must be marked with accession numbers supplied by the CEI, except in cases where lot accessions or an alternative accession system have been authorized in advance.

1.3 Provenience Information and provenience designations.

1.4 cronology- diachronic and synchronic analysis

1.5 conservation and maintenance issues - A statement indicating whether conservation treatment was performed, and a list of objects with a description of their treatments should accompany conservation strategies. If conservation has not been completed and is still a work in progress, it provides an itemized list of those objects needing treatment.

All architectonic properties are also organised in files (records), which provides the project name, county, site number(s), accession numbers and number of containers for each project, bibliographic and archive sources, etc; other provenience data, special sample identifiers, handling instructions and related information are required also for the identification of each single record.

A complete accession catalog or artifact inventory are also included. All architectonic properties are placed in appropriate sealed file and labelled with ICCD Standard plus sample-specific CEI identifiers. Accurate, informative labels are required for individual specimens, containers, inventory forms, etc. In general the Standards for mobile cultural heritage includes: Archeological artifacts (record RA-CEI); artistic artifacts (record 0A-D-CEI); artefacts of contemporary art (record 0AC-CEI). The CEI standard for immobile cultural heritage includes: architecture (A-CEI), parks (PG), urban and sub-urban areas (SU/TP), monuments and archaeological materials (MA-CA). The standards for cultural heritage of the territory includes: archaeological sites (record SI); historic centres (CS-CEI).

In particular the architectural survey (records A-CEI) analyses three research modalities: single architectural buildings (church, tower, etc); aggregation of architectural buildings (convents, monasteries, etc) and urban patterns (city centres or historical patterns).

The data systems are being designed to provide access to records through different methods: keyword search, structured database queries, and computerized map query and display. As components of the system are finished, they are being made available at the "CEI central workstations". In order to provide better access to records, the computerization effort involves scanning forms and photographs and editing of scanned text, and database development.

The system will have a modular architecture of the client-server type and will be organized in two levels: a central one (the CEI Central Unit) and a local one (the Peripheral Units – "Curia Arcivescovile" Units). The CEI Central Unit has the function of analysing and developing models in order to handle both cartographic and alphanumeric information and data on a national level, regarding all degradation factors characterizing the territory as well as assets' consistence and distribution. The peripheral units have the task to control and collect exact information about the state of conservation of cultural assets, so - about the "vulnerability" at territorial level of respectively regional, provincial, municipal competence. A numeric base cartography has been worked out at the Central Unit which permits a selection of the information levels received (roads, rivers, lakes, communication networks, level curves) according to the chosen scale of representation, and it represents the reference grid for all processing, facilitating the comprehension and reading of the phenomena on the territory. At present the ecclesiastical municipality (such as the Parish) has been established as the minimum reference unit of the system.

3 THE DAMAGE "EVENT" AND THE CONSERVATION STRATEGIES

The adopted model has been decisive for the design of the architecture and for the project realization. To be well acquainted with the risk of damage to which the elements of a particular "statistic population" are subject, means to relate the damage quantity that an event causes over a certain object or individual of the population under consideration, with the probability that that event could occur.

In order to apply this kind of approach to the Ecclesiastical Cultural Heritage, historic-artistic assets have been considered as "units" of the population subject to risk, whose risk level must be calculated. Assets typologies like paintings on wood, canvases, archaeological finds, etc. (some authors prop a subdivision in different classes) being pieces of art that cannot be geographically referred to, have been considered associated to an asset-container, that corresponds better to the above-mentioned scale.

If the variety of historic-artistic assets forming the Ecclesiastical Italian Culture Heritage is taken actually into consideration, as well as the fact that the damage event is the effect of a process of deterioration which cannot be subdivided in "elementary" events to be expressed only in probabilistic terms, that the mechanism according to which the damage event occurs, involves an elevated number of variables connected among each other in an articulated and complex way, it is easy to notice that the application of a rigorously statistic model is impossible, as far as it's necessary to define preliminarily both the damage "event" and the "probabilistic mechanism" generating the event.

Therefore, since the historic-artistic framework does not permit a probabilistic measure of the risk, it is possible to identify the physics and social variables that influence the deterioration process with the aim of using these "measures" or "factors" in the process of quantifying the risk establishing a functional relation between "the Risk" and "the Risk Factors ". By the term "Risk" I indicate the susceptibility of a given monumental structure to the exposure to the occurrence or lasting of degradation processes.

In a nutshell, the difficulty of a pure probabilistic measure of risk has actually brought to the construction of "Risk Indicators" to express the risk level measure through indexes of that level, independently from of a possible correlation with a real evaluation of probability. The measure of different "Risk Factors" has been in the same way expressed in terms of " Risk Factors Indicators".

In particular, linking the terms "risk", "vulnerability", "hazard" and "value", corresponds to that adopted by UNESCO, that is:

$Risk_i = f\,(Value, Vulnerability, Hazard)$'.

In other words, risk is directly proportional to the monument's value, to its characteristics of vulnerability and to the hazard of its context. For the relation I refer to this particular case-study, risk factors can be subdivided into two areas or components, being characterized respectively by:

- the asset Vulnerability (V), in the sense of a condition which is contrary to safety, was assessed considering the individual ecclesiastical monument's architectural and constructive characteristics; the dimensional data about rooms and structures; building history, the nature of materials it is made of and their possible condition of mechanical, physical-chemical and biological degradation; the presence of painted or sculpted decorative systems and their specific characteristics.

- the asset Danger (D), i.e. by a function indicating the level of potential aggression typical of a given territory, independently from the presence or absence of assets. In this cathegory It is possible to include Value (V) and Hazard (H). In particular, the hazard depends on the possibility that potentially damaging dynamics could develop in the monument's environment. The hazard scenarios can belong to two main typologies: the physical-environmental and the anthropic one.

In this way it has been possible to express Risk, as a function of these two components and, to measure its intensity through the measure of physical sizes contributing to the determination of above-mentioned parameters. Other variables such as time (t) and the spatial location (x, y, z) can also be introduced with the aim of knowing the space/time distribution of the phenomena to be analyzed and allowing their geographic representation throughout the territory. This model allows to express the Risk as a general function of the vulnerability components relating to each population unit and of the danger components - relating to any geographical area where the asset is:

$$R = R(V_1,V_2,....V_m; D_1,D_2,...D_n)$$

On this purpose three spheres of vulnerability V have been defined according to the characteristic size of the asset's conservation state and in respect to:

the surface outlook V_1 ;

the constructive and static-structural characteristics V_2 ;

utilization and safety V_3 .

Analogously three Danger dimensions have been identified according to the sizes by defining the degradation mechanisms. In particular we may say that:

climatic, micro-climatic factors and air-pollutants have been used to describe the environmental/air sphere;

the geomorphologic characteristics of the soil and sub-soil level have been considered in order to define the static/structural sphere;

The demographic and social-economic dynamics have been finally regarded to define the anthropic sphere.

In conclusion we may say that the implementation of the Generic Information system for ecclesiastical cultural heritage make it possible to relate the structure's vulnerability to the risk degree of the area in order to create a risk scenario.

The GIS is the most suitable information model for supporting analysis of area management aiming at the established objectives, the first of which is the minimization of the environmental degradation impoverishing the site. In this work-in –progress phase, thus, the objective of the research is to analyse the factors causing the structures' degradation and vulnerability degree in detail, as well as the risk degree for the entire area if the current environmental situation persists.

4 BENEFITS AND COSTS

A cost-benefit analysis must consider all kinds of benefits and costs wether they are accrued by the implementing organisation itself or by potential additional users of the GIS products provided. The cost-benefit analysis must reflect the social benefits and costs and the impacts on other governmental programmes and policy goals.

From a general overview to the literature review, several authors described classification schemes for GIS benefits. Born (1992) differentiates primary and secondary benefits, Knepper (1990) tangible and intangible benefits, Prisley (1987) and Clarke (1991) efficiency, effectiveness and intangible benefits, Antenucci (1991:67) Type 1 to Type 5 benefits. A main emphasis on external benefit can be found by Smith (1992).

In the study of Ecclesiastical cultural heritage the following, a classification based on four benefit categories, is used (Behr 1994):

- benefits due to increased efficiency (achieved by enhancement of productivity);
- operational benefits (capacity enhancements by higher human or technical resources);
- strategic benefits (correlated with the strategic goals of the Ecclesiastic organization such the decentralization of electronic data processing, optimization of business processes, compliance with laws, regulations, and standards - protection of the environment, support of ecological applications).
- external benefits (by easier access to information and faster data distribution).

The difficulty in the case of GIS applications for Ecclesiastical cultural heritage is that there are no market prices for a lot of services provided. Hence, the benefit of GIS based services must be estimated during the survey. However, it is essential for external benefits that "they exist if people who benefit in this way pay for these benefits or not" (Smith 1992).

The first two benefits - efficienty and operational benefits - deal with the management of information, the CEI Documentation Center's primary responsibility. The last two benefits look at the bigger picture of Heritage site monitoring, maintenance and planning, for which MINERVA, States Parties of the Convention and even the public share a joint responsibility.

On the other hand the cost estimation was a vital link in the success or failure of the General Information System project.

The costs of implementing the GIS were primarily in the areas of hardware and software, database development, and training and support. However, the price of a GIS (hardware and software) was not the most important cost factor. Issues such as usability, learning and training cost, support, as well as data compatibility all affect the decision for the General Information System.

In general the principal components were: hardware; software (base software, base GIS and GIS modules); maintenance; services (resources to fulfil the GIS project objectives, e.g. customisation); training, data.

In particular the user interface of the GIS application affected many of these key elements of the study especially when we take the time to measure how long (or using how much effort) to get the job done. This section can only give an overview and expert advice while the subject "cost-benefit of GIS projects" could be described in further researches.

5 SOME FINAL CONCLUSIONS

Explosion of new applications of GIS in Ecclesiastical cultural heritage shows that GIS can be a powerful tool for heritage conservation and valorisation. As the vision of heritage preservation is evolving to consider sites and their context holistically, preservation will inevitably involve a greater use of electronic tools such as GIS. Adoption of this tool among researchers and conservationists will increase in the coming years, particularly for the documentation of larger sites. By adopting this technology as quickly as possible, MINERVA and its partners in Cultural Heritage preservation and valorisation can play a leading role in the development of data standards and spatial databases related to the GIS, and advance the adoption of the Generic Information System as a tool in Ecclesiastical heritage preservation and valorisation.

It is important to anderline that the Generic Informtion System's aim isn't to replace the ICCD institutional site, neither to take his functions, it may assume some of its general contents and make it easier to accede to them, while the ICCD's National Register still keeps its public services and functions and those internal to the Ministry itself. In its actual configuration the GIS (General Information System) assembles a first, nevertheless incomplete determination of the consistence, typology and geographical distribution of the Architectural Cultural Heritage at least in its emergencies. In the near future it will be capable of exploring, overlapping and processing information about the potential risk factors that invest the material configuration of the Ecclesiastical Heritage itself.

The development of the gerarchical DBMS into a new platform by integrating GIS and RDBMS would serve two crucial purposes. Firstly it would allow the user to operate the system without having to grapple with the underlying "intricacies" the GDBMS technology. Secondly, it would allow sharing of information and technical expertise among a wide range of users.

The assessment of costs and benefits also plays an important role during decision making concerning the implementation of geographical information systems (GIS). It is important to underline that only some of the benefits were introduced into the cost-benefit ratio, and not all likely benefits were recognized by potential GIS users and Ecclesiastic authorities. A methodology of assessing benefits has the aim to apply to all categories of benefits in order to assign monetary values to different information products.

The General Information System can be considered a work-in-progress: the contents of the database could be able to be implemented on line in real time from everywhere by the allowed users as the GIS has been designed to be dynamic and interactive. The access is allowed to the ecclesiastic authorities and staff through different search modalities, predefined and free itineraries and through a topographic approach with the geo-referenced repository of information to be matched to the implemented Generic Information System. The objective of the risk analysis is a *sustainable management* of the religious site, allowing an increase of visitors and the achievement of optimal conditions for the preservation of ecclesiastical cultural heritage at the same time. The model I have chosen could serve as a platform for all future expectations for the layout of the area of Italy.

6 REFERENCES

Antenucci, J. C., Brown, K., Croswell, P. L., Kevany, M. J., Archer, H., 1991: Geographic Information Systems: a guide to the technology. Van Nostrand Reinhold, New York, 301 S., ISBN 0-442-00756-6

Behr, F.-J., 1994: Erhebung von Nutzenaspekten bei der Einführung geographischer Informationssysteme. Geo-Informations-Systeme, Vol 7, No. 2, 1-8

Born, J., 1992: Ist die Einführung von GIS durch Kosten-/Nutzenanalyse entscheidbar? in: Proceedings AM/FM/GIS European Conference VIII, Montreux, 49 - 56

Clarke, A.L., 1991: GIS Specification, Evaluation, and Implementation. in: Maguire, D.J.,

DCGM III Working Group 2001: Urban Geoscientific Data of East and Southeast Asia – GIS data sets of 11 cities, Second Edition, Digital Geoscience Map G-8, Geological Survey of Japan.

Eveden, G.J., 1990: Cartographic Projection Procedures for the UNIX Environment-A User's

Knepper, W., 1990: Allgemeiner Nutzen- und Kostenrahmen für Aufbau und Fortführung eines Netzinformationssystems mit Hilfe der GDV. Wasser - Abwasser gwf, 13 Nr. 7, 342 - 347

Manual, USGS Open-file report 90-284.

Prisley, S. P., 1987: Cost-Benefit Analysis for Geographic Information Systems. Proc. Second Annual International Conference, Exhibits and Workshops on Geographic Information Systems GIS '87. American Society for Photogrammetry and Remote Sensing, Falls Church, VA

Raghavan V., Masumoto S., Nemoto T, Shiono K., 2000: Development of SISGeM - An online system for 3D geological modeling, vol. 11, no. 2, p. 110-111.

Raghavan V., Masumoto S., Shiono K., Noumi Y., Fujita T, 2001: Development of an Online Database System for Management of Landslide Information, Proc. UNESCO/IGCP Symp., Tokyo, Japan, p. 165-173.

Salvemi, M. 2004. Proposte per azioni orientate all'effettiva realizzazione delle infrastrutture di Dati Territoriali (IDT) e dei database per i Sistemi Informativi territoriali(SIT) di interesse generale per gli Enti Locali LABSITA "LA Sapienza" University of Roma