INFORMATION TECHNOLOGY IN RESCUING WOODEN RELIGIOUS BUILDINGS – THE POSSIBLE FURTHER STEP

KOSZEWSKI, KRZYSZTOF; SLYK, JAN; WRONA, STEFAN
Faculty of Architecture, Warsaw University of Technology
krzysztof.koszewski@arch.pw.edu.pl
jan.slyk@arch.pw.edu.pl     wrona@arch.pw.edu.pl

Abstract. Preservation of architectural monuments is the discipline, which encountered recently many theoretical problems due to its emerging international character and globalization issues. In this paper we try to point some relations between these problems of the discipline itself and usage of information technology. The need of using appropriate tools and methods related to cultural variety and diversity is discussed according to certain relevant problems of contemporary preservation of monuments of architecture.

1. Discipline interference – contemporary preservation and information technology.

Digital technology and rapid development of communication techniques have influenced AEC industry already. Architecture, as a part of it, benefits from these changes. But architecture is not only industry, but also a part of culture, and both aspects combined together create a whole picture. Architecture has and always had strong roots in heritage and tradition. Exploring the potential of new technologies and their consequences, like globalization, in the field of architectural heritage is a vital task for today’s creation and research. In fact, “past and future are merely a mouse-click apart” (Martens, Uhl, Tschuppik, Voigt 2000).

2.1. THEORETICAL BACKGROUND

Preservation of architectural monuments is the discipline, which encountered recently many theoretical problems due to its emerging international character and globalization issues. In this paper we will try to point at some relations between these problems of the discipline itself and usage of information technology. To do this we need a short introduction to contemporary preservation problems. We will show also the possible application on an example of the project of „Rescuing European Wooden Religious Buildings” – a cooperation of several European countries with application of information technology.

Theoretical preservation background, as treated to the late 80ties of XX century, was derived from European tradition. This tradition, as defined at the eve of XX century by Alois Riegl, George Dehio and Max Dvorak, was based on the authenticity of material substance (Tomaszewski 1999). This
term – authenticity - although undefined, is used in 1964 in the preamble of the Venice Charter. But the problems emerged when UNESCO started to establish common criteria for objects eligible to the World Heritage List and put authenticity (understood in the mentioned western manner as physical evidence) as the one which is indispensible. It occurred, that in Asia, Middle East, South America this criterion would not work as applied solely to the material – physical substance. The historical value in these cultures relies rather on the traditional form, design, function, tradition and used techniques. Shortly speaking: we have two different attitudes and philosophies: western concentrated on substance and eastern concentrated on form and spirit. So the problem of establishing common criteria was raised as authenticity is recognized in a different manner depending on cultural understanding (Tomaszewski 1997). The great discussion was held during Nara conference in 1994, Mexico and Krakow in 1999 and still continues.

2.2 MERGING INFORMATION TECHNOLOGY INTO THE PRESERVATION AREA

In the same time preservation began to be multidisciplinary. Various specialists, including not only architects and art historians, but also chemists, geologists, even sociologists and economists. As a result of rapid development and common usage of information technology specialists from this field joined the team. The most obvious and most common usage of their knowledge is to develop new ways of documenting the heritage. Usage of databases for storing heritage-related data has become very popular and sometimes even overestimated path to success. Many databases emerged, but most of them are intended only for internal and very specialized, narrow usage. Undoubtedly however they bring new quality by possibility of endless multiplying of gathered data and theoretically unlimited remote access.

Relating to the authenticity problem in contemporary preservation we want to pose two problems:

What is the impact of the differences in the understanding of monument’s value on possible usage of databases and other tools to record and disseminate preservation data and knowledge on the global level? Is it possible to use information technology and in the same time to deal with these substantial theoretical incoherencies in preservation theory?

What is the relation of Digital Cultural Heritage (Virtual Heritage) (Bianchi 2006) to the authenticity problem in preservation?

The first question will be discussed later; here is a short comment to the second one. We are equipped with better and better tools to create and explore virtual worlds. The experience of intercourse with the architectural monument recreated in the virtual world is limited mainly by the interface. But if we assume further development of more and more excellent interfaces, will this be – even in a limited way – intercourse with the monument itself? Will the values like spatial disposition, function etc. be represented there in a sufficient way to recognize them? The answer could be – yes.

Moreover, there is no other answer than “yes” in many cases when the original building does not exist and the only way to explore it - is it’s “virtual comeback” (Martens, Uhl, Tschuppik, Voigt 2000).
2. Specifics of wooden religious architecture and the need for recording

The heritage of wooden architecture is the one, which clearly unveils the questions and doubts mentioned earlier. While western architectural preservation thought focuses mainly on buildings from solid materials, the eastern concerns impermanent materials, like wood. If the western thought had been applied to monuments of the east, they would not survive till our times.

Thanks to the special role and care, mainly wooden religious buildings from the past survive. On the list of potential dangers for old wooden buildings are: funguses, aggressive climate, vandalism and theft, insects and fires. Especially the last one is danger, because it could even demolish all wooden structures, building detail and furnishing in 20 minutes.

Therefore existence of full and detailed documentation (inventory) is so important. In the last decades a new digital tool enriched a set of traditional methods of preservation of all kinds of documents and inventory drawings: databases, scanning and 3D printing.

The existence of digital precise and detailed information, describing sometimes complex spatial wooden structures or wooden building details, brings new possibilities in rescuing buildings by saving information about them. Databases also allow for continuous updating information coming from monitoring equipment, like digital live cameras and various kinds of sensors. All these facts lead us to the redefinition of the term “preservation”, especially when dealing with such a fragile area as wooden architectural heritage (Koszewski, Wrona 2006). These new tools brought to the area of preservation by information technology allow basically for three kinds of activity regarding historical building:

a. continuous preservation maintenance based on various kinds of gathered information and knowledge recorded in the bases
b. physical reconstruction of the building (or a part of it)
c. virtual reconstruction of the building

3. Rescuing Hidden European Wooden Religious Heritage – project description

The aim of the international project „Rescuing hidden European wooden religious churches: an international methodology for implementing a database for restoration projects“ was to create a database which can be a source of information for restoration projects (the project was an international cooperation in the framework of Culture 2000 programme co-financed by EU, project leader: Romualdo del Bianco Foundation, participants from Italy – Florence, Czech Republic – Brno, Slovak Republic – Bratislava, Poland – Krakow and Warsaw). The database would serve as a source of information for conservators, but also as a tool for disseminating knowledge about architectural heritage among young generation. It can also serve as a platform for cultural interchange between cooperating parts.

The project consisted of three main stages: 1. Developing the strategy and defining the database structure based on its objectives; 2. Selecting several least known or abandoned wooden churches to describe them with the tool
defined earlier; 3. Discussing the results, creating the database and
exchanging the experiences.

The first step required cooperating parties to establish common schema
for the description of buildings to be implemented in the database. Due to
the fact, that gathered information will be used in different contexts we
deided to adopt international standard for the description of historical
monuments: Core Data Index to Historic Buildings and Monuments of the
Architectural Heritage (Core Data Index 1995, Thornes, Bold 1998). The
standard includes all the very basic information about objects, but had to be
broaden with the sections connected with the preservation profile of the
database. The basic information is recorded in the fields like: name of the
building, related records from other disciplines and from documentation,
administrative location of the building, the owner, main construction
material, dating etc. Preservation data was represented by botanic species of
the timber used, kind of connections, tools used, local customs connected
with construction process etc. These two groups together created the
description schema to be used in specialized database of preservation of
wooden religious heritage.

In the last step all the information was gathered according to developed
scheme and the database was created.

4. Database for restoration projects as a part of larger data structure

Gathering data and creating database in the field of architectural heritage is
always a big issue. It demands careful preparing of the data structure to
reflect future needs of users and administrators of the data. Then it requires
laborious archival or field research on the item itself. Then, again, all
gathered data has to be worked out to meet the requirements of storing and
retrieving. All this together comes to a big enterprise, the bigger the better
the database is to be.

The required amount of effort, people and time sometimes is very big in
relation to the projected range of users. On the other hand we still suffer
from the lack of dissemination of the knowledge related to the architectural
heritage. These two reasons lead to the conclusion, that we shall render
gathered data accessible to the wide public whenever it is possible. But in
the form that is acceptable by such audience.

Very specialized databases (like the one concerning wooden religious
European architecture) should become a part of a larger system, and we call
it knowledge system (differences between information and knowledge,
databases and knowledge bases are discussed later). There are several basic
conditions to be fulfilled to make such situation possible:

a. Each database structure should be planned carefully to ensure its
interoperability. Practically it means adopting commonly recognized
standards. This requirement seems to be obvious, but the state-of-the-art in
this field is still different.

b. The database in the operational state should be equipped with tools for
making data accessible, and the system should contain tools for retrieving
accessed data.
c. All the data kept in the database should be understood in the way it was meant by the authors. This condition is not obvious when we describe cultural properties and share the descriptions between different cultures.

All above requirements will be shortly discussed here.

Ad. a. There are common standards of description developed, one of them is already mentioned here Core Data Index, which was used in the wooden religious heritage project. Various other standards in the related fields (for example description of documents) can be used and adopted, like Dublin Core developed by Dublin Core Metadata Initiative, library cataloguing standards or other description standards. Usually these are the basis since specialized databases demand specialized data to be recorded. In our case we added preservation-related fields to mentioned database.

Ad. b. There is a variety of tools, starting from file-format translators and ending with low-barrier metadata aggregation tools. One of the tools worth mentioning here is Protocol for Metadata Harvesting developed by Open Archives Initiative (Lagoze, Van de Sompel, 2001). Deploying this protocol enables metadata to be harvested from the repositories. The protocol itself is designed with the implementation in mind. The currents stage facilitates exposing metadata in XML format, but the development of the protocol may lead to exposing other kinds of data. Implementation relays on installing this protocol on data-provider’s server and a mechanism for harvesting exposed metadata by service-providers, who create solutions on this basis.

Ad. c. Common understanding of the terms used is very complicated problem, which we encountered during our work. The terms used to describe complicated wooden structures were hard to translate, the concepts and their meanings merged sometimes and this made our work more difficult. The tool that is needed is not only simple dictionary or thesaurus. In fact in this kind of projects, especially treated as a part of larger structure, implementing of common, flexible semantic network is needed. Such network has been defined by the International Committee for Documentation of the International Council of Museums as Conceptual Reference Model (CRM) (Crofts, Doerr, Gill, Stead, Stiff, 2005). Still, the document is concentrated on European attitude to cultural heritage.

While the above conditions are fulfilled we can draw a scheme for such knowledge system, where information (or knowledge) can be used in a kind of dispersed structure. This may consist of specialized databases, but also even virtual data sources represented by data warehouse-like structures (Kabata, Koszewski 2005). The structure built in this way is hierarchical and can cover larger parts of reality. The heritage data can be obviously used in the process of creation – architectural design, together with the other aspects of this activity.

5. Implementing knowledge – creating knowledge base

There is no single and commonly accepted definition of knowledge. We may say that knowledge is what is known. It is not objective, however. From knowledge management point of view knowledge is treated as information within certain context (Koszewski, Slyk, Wrona, in print). This approach can be adopted to solve problems with preservation issues.
Natural consequence of the development of information technology and employing it in the field of history of architecture (or preservation of architectural monuments) is striving for recording not only information, but also knowledge. The problem of methodology of building knowledge bases (recording knowledge representation) is the solution that makes usage of large amounts of data possible in reasonably way. Today’s state-of-the-art, however, is rather concentrated on building simple databases covering very specialized areas. The experts’ knowledge in these areas is, as for the time being, implemented in the databases in declarative form (diagnostic and activity description proposals mainly). So we may say that knowledge is implemented here, but it is not a knowledge base. To build a knowledge base we need an attempt to formalize at least a part of this knowledge (Koszewski, Slyk, Wrona 2006).

There are various knowledge representations – formalisms and methods, which are developed in the field of knowledge engineering and management. We can speak about semantic networks, predicate logic, representation languages etc. One of the basic could be relation systems and rule-based representations. These methods link gathered data and apply certain rules to it, recording experts’ knowledge in this way. In this way we have the database and the set of rules (or other knowledge representation connected with information). The nature of knowledge in the area of cultural (so architectural as well) heritage is its subjectivity and cultural context dependence. It can be observed in situations mentioned at the beginning of this article. Proposed knowledge base structure, however, separates facts from their interpretation. The database should consist only of basic and objective data like name, location, related documentation links. This is mainly what Core Data Index consists of while historical buildings are concerned. Any interpretation should be recorded as a part of knowledge representation. If our knowledge changes, we can change representation and leave objective data about the object intact.

In fact in this way we separate information from its context. The facts we provide may have some level of certainty, as long as it is clearly stated. The context – interpretation - is what we can do with facts, but is independent from them.

In the case of knowledge base about preservation of wooden religious buildings this scheme may look like this: basic facts according to used data scheme and knowledge formalized in set of rules, applied to facts. The following examples show gathered information (not all of them) and, in the second point, areas, where formalized knowledge may be applied. There are suggested actions, but they are recorded in declarative form, as effects of experts’ analysis.
TABLE 1. Information (facts) gathered in the wooden religious churches database and issues, where rules can be applied

<table>
<thead>
<tr>
<th>Database - examples of recorded fields, showing gathered facts about the building</th>
<th>Issues where rules can be applied – proposals based on experts’ knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Photographic reference</strong></td>
<td><strong>Possible immediate intervention needed</strong></td>
</tr>
<tr>
<td>Name of Building: parish church of S. Andreas in Brwilno</td>
<td>Strengthening of the slope</td>
</tr>
<tr>
<td>Ownership and juridical status: property of the roman catholic church</td>
<td>Drilling the well to let the water go through to the second water-bearing layer.</td>
</tr>
<tr>
<td>Building category: sacral</td>
<td>Drainage leading water out of the slope in the second phase. (based on the geological data and measures taken during several years)</td>
</tr>
<tr>
<td>Detailed architectural typology: church raised on the outline of rectangle, one-aisled with three-sided presbytery not separated from the church volume. No tower, oriented. Under presbytery masonry crypt located. Square vestibule from the west, second one from the south. Rectangular vestry form the north side. Flat, beam ceiling, pulpit roof with eaves.</td>
<td><strong>Possible conservation works</strong></td>
</tr>
<tr>
<td>Dating – century: 18</td>
<td>Necessity of foundation change to former stonework (based on the data about current solution and the knowledge that concrete transmits humidity to wooden elements), alteration of bearing beams (based on their actual state), change of the roof covering to spruce shingles (based on the climate and the characteristics of current roof covering, also of former presence of wooden covering of the roof). De-assembly of planking and assembly the new one (based on the recorded state of the element). New alarm and electric installation (based on the recorded state).</td>
</tr>
<tr>
<td>Roof covering: zinc tinware</td>
<td><strong>Possible future uses of monument</strong></td>
</tr>
<tr>
<td>Foundation: concrete</td>
<td>Parish church (based on the local tradition)</td>
</tr>
<tr>
<td>Structural system: log blockwork, planked, rafter roof</td>
<td>Responsible persons/institutions</td>
</tr>
<tr>
<td>Roof construction condition: little damage of the tips of roof construction beams</td>
<td>Parish rector</td>
</tr>
<tr>
<td>General condition: good, moderate humidity in foundation and wooden elements near the ground (sole plate). Planking with some traces of insects, smouldering in some areas.</td>
<td>Local Conservation Authority (based on the local law)</td>
</tr>
<tr>
<td>Structural instabilities: moving slope about 6 m from the church presbytery wall, risk of building catastrophe, church construction stable.</td>
<td><strong>Possible conservation works</strong></td>
</tr>
</tbody>
</table>

6. Possible impact of different cultures on the methodology of creating knowledge base - finding common ground

The wooden religious heritage project concerns, however, only Central Europe. What happens if we try to adopt the solutions to the other cultures? Concerning mentioned differences in the understanding of cultural values, the terms of autenticity and integrity, the experts’ knowledge implemented into the knowledge base would differ in different cultures. The procedures,
which are to be introduced when managing the monument, especially wooden one, will be different in western and eastern preservation philosophy.

In this way trying to adopt hypotetic knowledge base of wooden religious heritage in Europe to help preserve eastern wooden architecture would make no sense. But when we introduce already mentioned clear division (sometimes difficult to put into force, but this is another issue) between facts and their interpretation, at least this basic part may be useful and agreed. The objective description will remain the same, the recorded knowledge will differ. Such approach may help with efficient usage of information technology (or more specific: knowledge management and engineering) and bringing new quality in the exchange between different cultures.

References


Tomaszewski, A., 1999, Towards a Pluralistic Conservation Philosophy of the Twenty First Century, materials of the XII General Assembly of ICOMOS, Mexico 1999


Core Data Index to Historic Buildings and Monuments of the Architectural Heritage. 1995, Recommendation R (95) 3 of the Committee of Ministers of the Council of Europe to member states on co-ordinating documentation methods and systems related to historic buildings and monuments of the architectural heritage. Council of Europe, Strasbourg.


Koszewski, K., Slyk, J., Wrona, S., in print, Knowledge bases in architecture (in Polish), Center for CAAD, Faculty of Architecture, WUT