Преглед НЦД 6 (2005), 69–77

Vesna Bižić-Omčikus, Miroslav Mitrović
(Etnografski Muzej, Beograd)
Zoran Cvetković
(Infotrend, Beograd)

MUSEUM INFORMATION SYSTEM – DESIGN METHODOLOGY, IMPLEMENTATION AND PERSPECTIVES

Abstract. Approved methodologies used to develop complex information systems and supported by available new generation software packages and tools, have given us the opportunity to create the basis of the Museum Information System (MIS). Starting from a strategic study of MISS, we have developed two information subsystems: the Central Register and the Photo Documentation Subsystem. This paper presents applied methodologies, a review of the implemented subsystems and further perspectives. In addition, and having in mind that the national cultural heritage is unique, we propose ways to integrate and link together information about different kinds of cultural heritage.
Key words: Museum Information System, application software, information system modelling.

1. Development Methodology

The overall work of any museum anywhere in the world contains many complex processes and tasks. Therefore, the first step in information system (IS) development is to understand and document, in a formal manner, a list of museum processes and the identification of those that are key to any museum (Fig. 1).

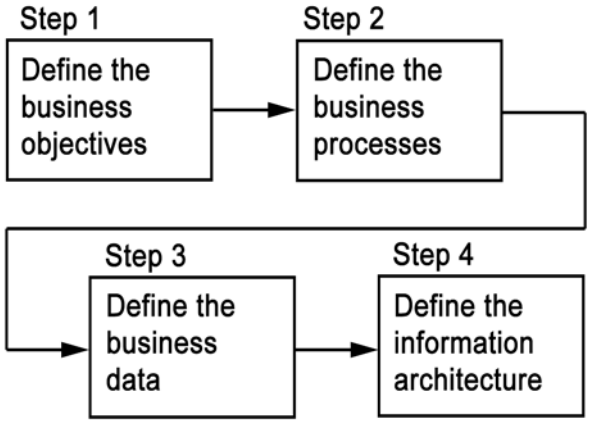

Fig. 1. General IS planning approach

1.1 Defining museum processes. Museum processes are groups of the logically related decisions and activities required to manage the resources of a museum. The project team

identifies processes without regard to the internal museum business organization. The reason for thus defining the processes is that doing so will provide or lead to:

- An information system that is largely independent of both the differences between museums and of any organizational changes within any single museum.
- An understanding of how the museum accomplishes its overall mission and objectives.
- A basis for defining required information architecture, determining its scope, making it modular, and setting priorities for its development.
- A definition of key data requirements.

In order to identify museum processes, a project team has to decide where it should start from. It is necessary to find some facts or things that are meaningful, long lasting, universal, insensitive to narrow personal interests and so on. It is best to start from the constraints on museum resources. This is because:

- A lack of resources is common to every museum;
- Change can be very slow – if indeed there is any change at all.
- All museum people understand these constraints.

Museum resources have a clearly-defined four-stage life cycle. This life cycle is here used to logically identify and group the processes. The life cycle stages are as follows:

1. **Planning and requirements** – i.e. activities that determine which resources are required, plans for getting them, and measurement and control in relation to the plan.
2. **Acquisition** – i.e. activities intended to provide the resources.
3. **Maintenance and control** – i.e. activities relating to the care, research and control of the resource.
4. **Retirement** – i.e. activities and decisions that terminate the responsibility of a museum and end use of a resource.

The result of resource analysis is a list of the museum resources.

1.2 Defining museum data. Defining museum data involves the identification of entities (things that are significant to the museum) and the grouping of data about these entities into logically related categories called data classes. This classification, and its subsequent modification during follow-on projects, helps the museum develop databases over time with a minimum of redundancy and in a manner that allows systems to be added without a major revision of the databases.

1.3 Defining Information Architecture. The definition of information architecture involves the relating of processes to data classes (Fig. 2). This enables the evaluation of data sharing within the museum(s). The architecture also provides the foundation for follow-on resource and tactical planning, which enables the orderly implementation of the information architecture.

The museum processes, data classes, museum information architecture and implementation plan have been published in The Strategic Study of Museum Information System of Serbia[1]. Regarding the results of a Study, Museum Information Architecture consists of eleven interrelated information subsystems, sorted by priorities

into three priority groups. The implementation plan allows us to develop the complete and consistent MIS systematically, beginning with subsystems from the first priority group.

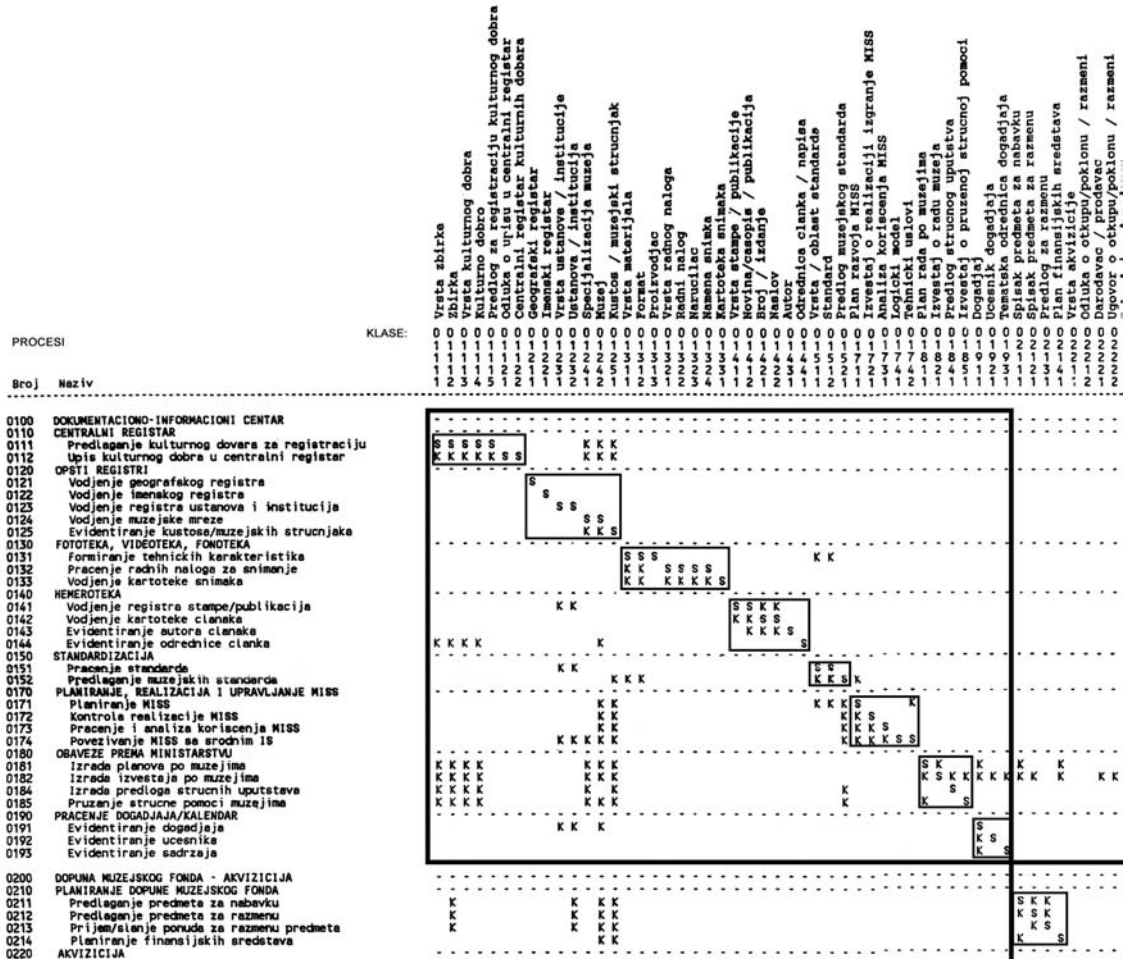

Fig. 2. Information architecture matrix (Processes/Data classes)

1.4 Information Subsystem Design. Information subsystem design consists of a set of procedures for data normalization. Design results are logical and physical IS models, called entity-relationship models. These models are the basic documents for creating database structures, data relationships and other parameters needed for database definition. At the same time, entity-relationship models are the basic for development reliable and scalable application software solutions (Fig. 3).

Due to unavoidable delays, we do not yet have any computer program. Therefore, it might be said that the presented design levels and documents will have only one result: a huge quantity of paper, ready only for an archive. This would, however, be a wrong conclusion. Creating design documents is the only way to obtain a well-designed database and software solutions – both for now and for the future.

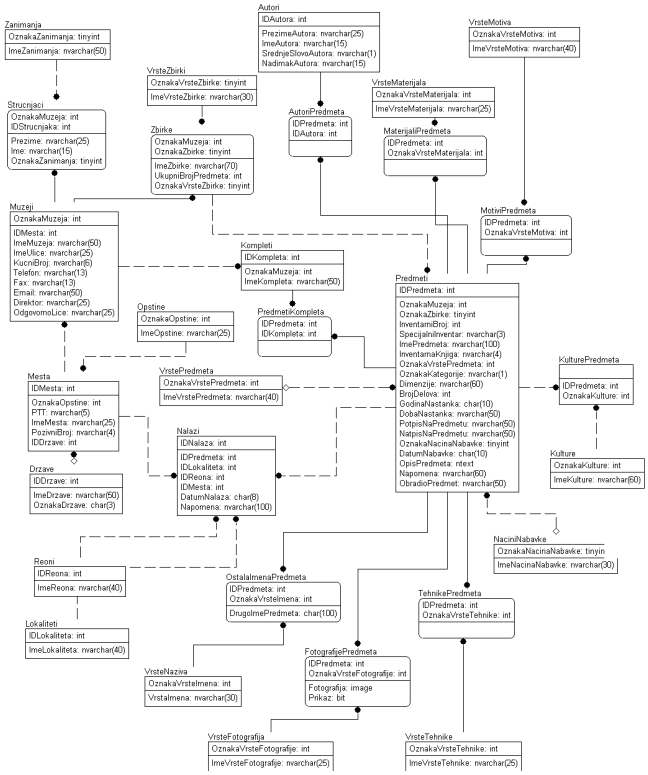

Fig. 3. An example of a subsystem's physical entity-relationship model

1.5 Design documents ready for implementation. Efforts on creating MISS had begun in 1995, when Serbian museums accepted some of several finished design solutions:

- The Strategic Study of Museum Information System of Serbia (verified and accepted).
- The main and detailed design documentation of the Museum Central Register Subsystem (verified and accepted).
- The main and detailed design documentation of Acquisition Subsystem (not to be dealt with today
- The main and detailed design documentation of Depot subsystem (not to be dealt with today).
- The main and detailed design documentation of Scientific Study Subsystem (not to be dealt with today).

These documents, although written some seven years ago, are ready to be implemented, after necessary verification and perhaps improvement. They are generally as accurate today as they once were. The nature and logic of museum resources has not changed.

2. System Implementation

The system implementation started in 1996. The first implemented subsystem was The Central Register. According to the official program, solutions were distributed to more than a hundred Serbian museums in order:

- to make a unique software and database structured ambience in every museum;

- to start activities on museum's database creation;
- to form an integrated and a complete database of all Serbian museum collections at the one site – in the National Museum in Belgrade.

There were several benefits of using the program:

- the possibility of creating an integrated museum database;
- the possibility to search and research museum collections;
- the possibility to check on the completeness of an existing, traditional official paper museum documentation.

The results of the system implementation have been variable. Some of the museums have accepted this opportunity and have finished the database creation work; some others have not yet started. Having in mind that one operator can enter no more than 30 records about museum articles daily, it is easy to predict the total time necessary for database creation in any museum. The responsibility for doing or not doing that job was only on a manager of the museum, and nobody else.

The first programs were on the base of the DOS platform and written in the Clipper, as the most acceptable solution, regarding the cost-benefit analyses. As time passed, software and hardware technologies were changed considerably, thereby sounding a warning signal.

2.1. How to convert threats of technology-changes into new opportunities. The existing program solutions seemed to be at the end of their life cycle and problems became evident. However, the problems were solvable. After a detailed analysis at the Ethnographic Museum in Belgrade, we concluded:

- The database was complete and existing data were available for further use.
- The logic and the nature of the museum system's recourses were unchanged.
- We had the complete design documentation, based on the logic and nature of the museum system's resources.
- The completeness of the future solution must support museum articles' image storing and presentation. As it is well known that every article could be presented with more than one image, or more then one photo negative, or other multimedia materials, this objective really means something different. This means that it is necessary to develop and integrate two subsystems: The Central Register and the part of The Documentation Subsystem that deals with multimedia materials.

Therefore, a decision was taken to develop software solutions, using the new Microsoft operating systems, the database management system - SQL Server 2000 (DBMS) and the .NET ambient as an integral Windows component that supports building and running the next generation of applications and XML services (Fig. 4).

The new software and hardware technologies allow us to start to develop new applications, less constrained than before.

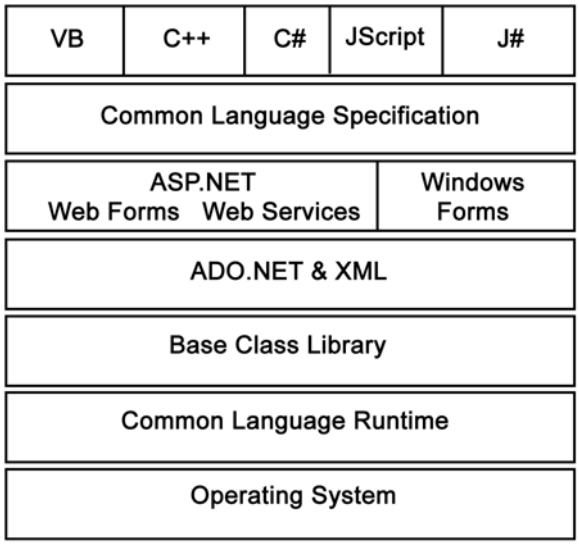

Fig 4. The .NET Framework architecture

During the planning phase, several elements affect the design of the application. Some of these elements might be non-negotiable and finite resources, such as time, money, and workforce. Other elements, such as available technologies, knowledge, and skills, are dynamic and vary throughout the development life cycle. While these elements influence the design of an application to some extent, the museum business plan dictates the capabilities the application must have for a satisfactory solution.

A data access strategy is the manner in which applications store, retrieve and manage data. Performance, deployment, and scalability, which factor into the planning and implementation of a data access strategy, can ultimately affect the architectural model. The MIS data access strategy uses the SQL Server to optimize performance, deployment, and scalability. Specifically, the strategy in MIS focuses on the following design:

- Move processing to the data, and not data to the processing.
- Pass all data back to the client in a method call.
- Hold database resources for a minimum length of time.

2.2. New application solutions. The main development activities started at the end of the year 2003. The activities were almost finished after four months, when applications were ready for the testing phase, on the site in the Ethnographic Museum in Belgrade. The old Clipper Museum's database was moved into a new SQL Server database, without losing any existing data. This means that the new program solutions and the new technologies are not a reason to start from the beginning. It is rather a chance to continue in an approved ambient and to move on to a higher level in the use of computer services. The main characteristics of program solutions are:

- The full computer support of the subsystems' logical models, which were generated to cover all kinds of every museum's collections and all kinds of multimedia materials;
- The complete integration and data transparency created by different subsystems;

- Possibility to join different museums' databases into one - the central database;
- Unlimited database search possibilities;
- Logical, effective and self-explanatory man-machine interfaces are designed, based strictly on the logic and nature of museum's recourses. The central form obtains unique identification data about any kind of a museum article, as the central object of the MIS. Other, depending data are reachable by self-explanatory tab links. This approach allows the system to have scalability with any new subsystem, without changing the main screen's look and design (Fig. 5).
- Applications requests are satisfied by any modern computer configuration and adequate system software etc.

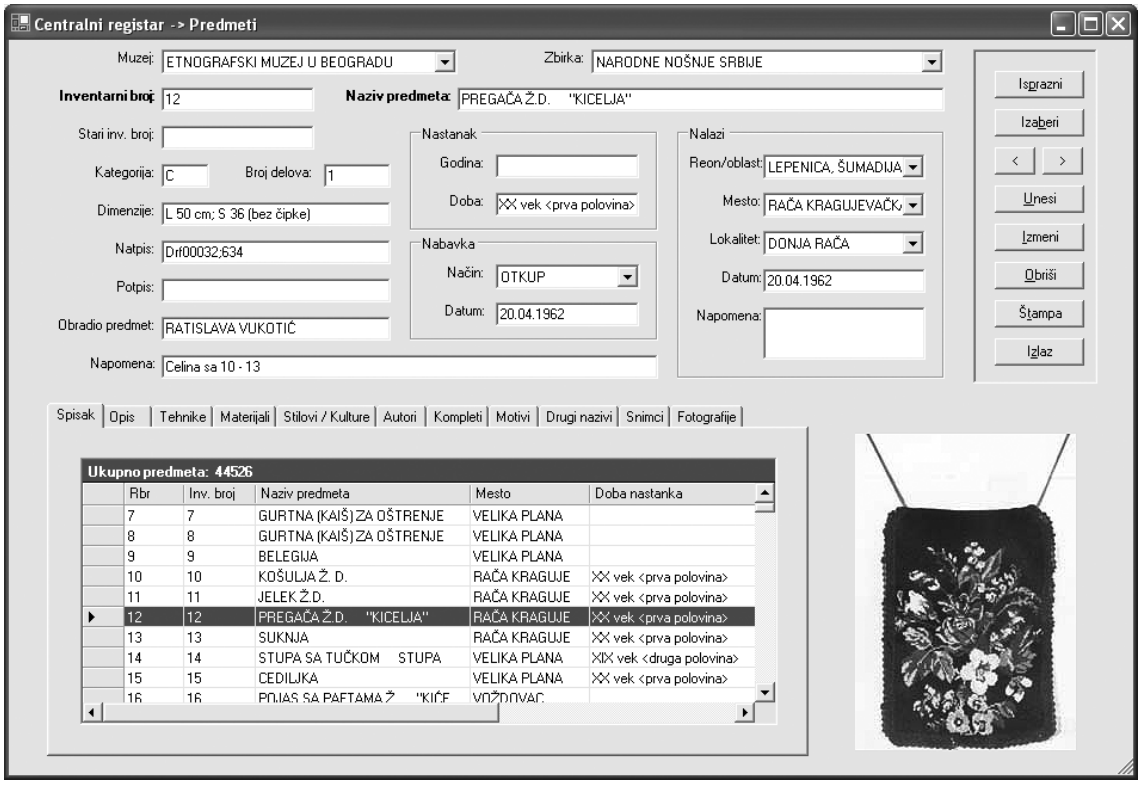

Fig. 5. The form of the main screen

3. Perspectives

Building a successful information system requires both clear strategy and vision. Strategy depends mainly on applying experience to existing methodology. However, the vision is unstructured by nature, and it mostly depends having a degree of creativity. It is possible, combining strategy and vision, to imagine and to define MIS perspectives.

The first priority is to continue with the development and integration of the rest of the MIS subsystems with the existing applications, in accordance with The Strategic Study of Museum Information System of Serbia. The best way to complete the MIS is to move systematically – to develop application by application. Although it might be

said that this is never-ending work, it is easy to predict the absolute duration of the project. Success depends only on a decision – to go forward or not to begin the work. An integral part of any information system study consists of lists of neighbourhood information systems. The neighbourhood information systems are the systems with some degree of interaction and data exchanging between them. Regarding the MIS, several neighbourhood information systems are identified:

- IS of the Institute of the Heritage Protection (SINS)
- IS of the National Library
- IS of the historical archives (JAIS)
- IS of the Yugoslav Film Archive, or IS of the Film News, and some others.

Table 1 illustrates an example of benefits of such cross-system connections.

Actor	Semantic definition of a query	Database
Museum	**Our famous Roman statue** was found at the archaeological site of the Gamzigrad ...	records from MIS
Institute of the Heritage	... At the archaeological site of the Gamzigrad, was found a **famous Roman statue**, at the position that and that ...	records and **digitalized maps** from the SINS
Historical Archive or/and SANU Archive	.. We have the complete documentation from the site researches at Gamzigrad, and about the **famous Roman statue** ...	records from JAIS or SANU Archive's IS
National Library or/and SANU Library	... There are several very representative books and articles about Gamzigrad and especially about the **famous Roman statue** ...	records from the National Library's IS
Yugoslav Film Archive or/and The Film News	... Perhaps, there are some related film materials in the Yugoslav Film Archive or in the found of the Film News about the **famous Roman statue**...	records from the related IS

Table 1. The linked query about "the famous Roman statue from the Gamzigrad"

3.1 Can imagination become reality? On paper, the schema (as presented in Table 1), works very well and the circle is closed. That is a good starting point. The solution is on the paper – into system design documents. The "secrets" are methodologies described in the first section of this paper – the design institutions' information systems around their resources. Using design results (identified processes and data classes), it is easy to recognize cross-connecting classes and processes. Knowing that, the realisation is a matter of various available techniques and technologies (Web components and Web services, the .NET technology, use of the XML database system, transparency etc.). To do that, there are several conditions to be fulfilled for each of the concerned systems:

- available design documents should be put into a recognisable and standard form;
- the existing program solutions must be at a professional level;
- the existing databases must contain more than several test records in, as usually happens;
- the project team (system designers, programmers, system engineers and users) should have enough knowledge and skills;
- finally, there should be enough stakeholders who really want such a system.

If this is achieved, the project activities could start, and first results would be within very acceptable period.

3.2. Can reality destroy an idea? Only a few projects out of several hundreds have been finished within the planned time. The reasons for this are well known and they are not a matter for this article. The most important facts are:

- The design documents are missing or they are not in a recognisable and standard form (they do not use normalized logic and physical data models, for example);
- Bad or missing design solutions have led to unreliable source codes of the existing program solutions;
- The existing databases are empty;
- The project teams are often inspired by enthusiasm, not by knowledge and skills;
- There has sometimes been a lack of interest.

4. Conclusion

The three sections of this article briefly present the MIS from different points of view. Starting from the well-designed documents, presented in the first section, we safely passed through the most risky events of the information systems' surrounding: dramatically technological changes.

Describing the new program solutions, we did not want into detailed discussion, for example, looking at the forms from field to field or considering the promotion, advertisement and sale of our software. We have left these topics for later, perhaps less public discussion. Instead, we have tried to present the concepts, constraints and necessary ambience needed to complete a correctly-tuned Museum Information System.

It is very true that an information system provides never-ending work. Therefore, the key to success is to have a vision. The place of the vision is at the top, at the strategic management and decision level in every institution. Only then, can imagination become reality.

Acknowledgment. Special thanks to Ph.D. Anthony D. Buckley for the correction of this manuscript in English.

Reference

[1] Neda Jevremović, Zoran Cvetković, *Museum Information System of Serbia,* Narodni muzej, Beograd, 1996 (in Serbian)