

PRACTICAL ASPECTS OF THE INFORMATION SYSTEM REENGINEERING

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ABSTRACT

The information system transition from the local and client-server financial and management information systems to n-tier information system is a very painful process, especially for academic and NGOs with a limited budget for computer equipment and software modernization. If such organizations area of activities are financial and project management, integrity, consistency and security become the key factors for information system development and implementation.

The article presents results of the analyses, development and implementation of n-tier Oracle-based information systems for a NGO. Organizational and management problems, current technological infrastructure, financial resources availability, software platforms and developers solutions, local and headquarter offices requirements were analyzed.

The systems were developed within the following requirements: financial and management information confidentiality and appropriate availability improvement and systems integration; organizational information and procedure standards development; incomplete and inconsistent information elimination from the data flow; transparency of the projects activity for public evaluation and information technology resources utilization by the non-for-profit, academic and NGOs for the project activity within Internet components.

The first system prototype was presented at the European Foundations Center (EFC) Information Technology Conference in Brussels, Belgium, 24-25 June 1999. During 2000-2001, the system was migrated into Oracle Portal environment and development process was completed.

Keywords: Oracle-based information systems, NGO

1 INTRODUCTION

A modern information system requires that the organization recognize the strategic role of information and begin actively to manage and plan for information as a corporate resource. This means that the organization must develop a data administration function with the power to define information requirements for the entire company. An organization needs to formulate an information policy that specifies its rules for sharing, disseminating, acquiring, standardizing, classifying, and inventorying information throughout the organization. [Laudon and Laudon, 1995]

As a rule, many organizations, seeking to avoid large commitments and organizational change, begin (and end) by buying a local DBMS package and placing it in the hands of low-level database group in the information system department. Small database systems will be developed for various divisions, functional areas, departments, and offices. Eventually this results in incompatible databases and data throughout the company [Laudon and Laudon, 1995].

On the other hand, decentralized structure of information system has certainly facilitated organizations and individuals to work with shared data environments and with capture, use and control of growing, complex and diversified volumes of data and information. These networked computerized information systems produce errors. It is this alarming reality that requires attention to questions of errors in information systems, of poor integrity of information systems and of finding methods,

technologies and techniques for maintaining and improving integrity [Mandke and Nayar, 1998].

The usual methods for boosting performance into an organization – process rationalization and automation – haven't yielded the dramatic improvements companies need. In particular, heavy investments in information technology have delivered disappointing results – largely because companies tend to use technology to mechanize old ways of doing business. They leave the existing processes intact and use computers simply to speed them up [Hammer, 1990]. Unfortunately, such methods are common for many organizations, which just started the implementation of a new computerized information technology eventually. The organizational top managers and executive staff understand the correct ways of the information system implementations and information integrity problems after some disappointing results.

The Figure 1 shows the structure of a typical decentralized information system for academic and NGOs before the complex reengineering of the information system. Such an information system has many errors and data anomalies, and problems mentioned earlier - because the dataflow is in hard copies (paper documents) and MS Excel and/or MS Word documents, and the main exchange is usually through e-mail system. Financial and Accounting Department, usually keep all information in MS Excel spreadsheets and in the local databases (such as Paradox, MS Access, Fox Pro and etc.), for reporting, budget planning and budget control.

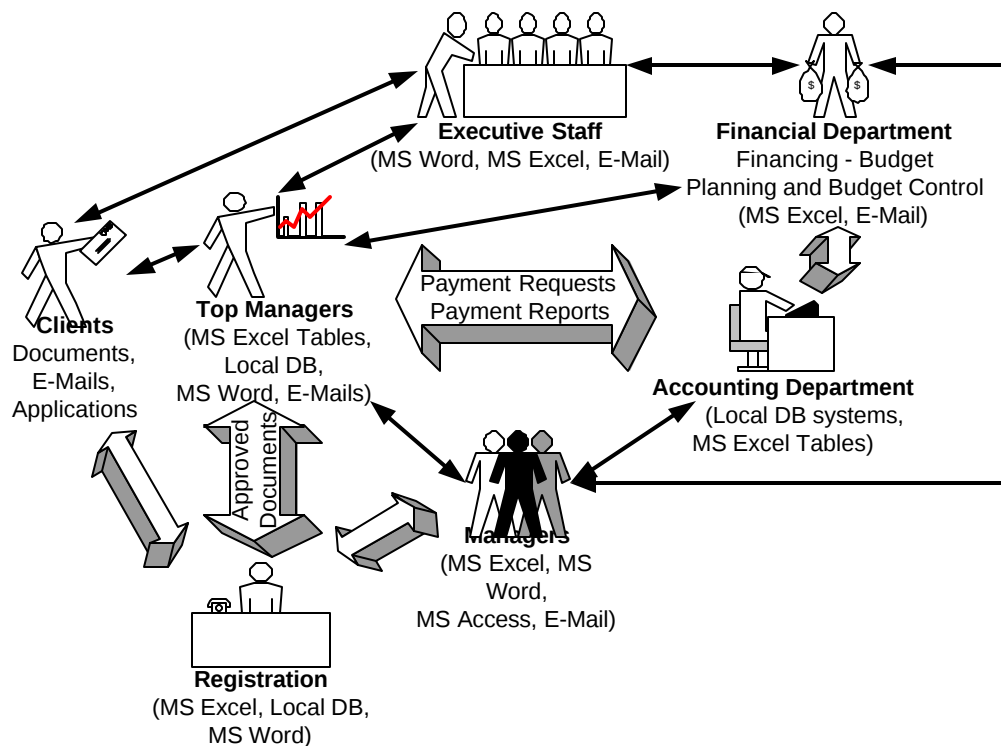


Figure 1 One example of a typical information system for academic and NGO s before complex reengineering

Numerous recent publications have indicated the seriousness of spreadsheet errors and their adverse effect or potential impact on businesses. There are also publications that clearly state those spreadsheet errors have caused serious disruption in business [Rajalingham and Chadwick, 1998]. The similar information systems architecture was discovered in many academic institutions of Boston area, MA, USA during past research project “Information Revolution and University Management” in 1997 [Khmelevsky, 1998a]. Due to better financing of the information system development, in many cases organizations were not using the local database systems, but database systems of the departmental level or divisional level. In any case, usually the academic institutions and NGOs have no centralized information system, nor centralized workflow and dataflow information system with thin clients [Khmelevsky, 1998b].

To perform reengineering of the NGO with the information system structure, presented on Figure 1, information was gathered about available document and workflow information system, financial system, and management information system on the Western/Eastern Europe and North America market. The new requirements were developed for the future information system model, which should have at least two main integrated parts: financial and project (grant) management, based on client/server and n-tier information models with thin clients. The “Critical Success Factors” strategic analysis was used to develop

criteria for the software of the information system and main requirements for the main components [Rockart, 1979; Rockart and Treacy, 1982].

Some requirements for the main components of the new information system:

1. Develop organizational information, procedure and security standards.
2. Reorganize organizational structure.
3. Integrate all organizational data in one information system.
4. Improve financial and management data integrity and consistency.
5. Improve financial information confidentiality.
6. Improve management information and appropriate financial information availability.
7. Eliminate incomplete and inconsistent information from organizational data flow.
8. Open organizational activity for public evaluation with appropriate security.
9. Use organizational resources not only for internal use, but also for project activities of the non-government, academic and other NGOs.

The specific criteria for financial (Table 1) and project management systems (Table 2) were developed. Through open competition several financial (Table 3) and project management systems (Table 4) were analyzed by the team, which included international experts as well.

Table 1 The evaluation criteria for the accountingsystems

#	Criteria
1.	RDBMS Platform
2.	Menu customization
3.	Statistical and security logs (login – logout, enter-edit-delete transactions, elements of the subconto)
4.	Several chart of accounts for one company
5.	Analytical tools (balance, passive and etc.)
6.	Set-up of an account (structure of number of the account for example: XX.XXX.X.XXX)
7.	Quantity of kinds subconto, connected to each account (for example ORGANIZATIONS / COST CENTRES / EMPLOYEES) (Subconto + References)
8.	The control for removal subconto, on which there are the transactions or documents
9.	Identification of posting under unique number
10.	Selection transactions and documents in journals on given criterion (several parameters)
11.	Construction summary and group of the reports on any objects with inclusion of conditions and additional proceedings
12.	Development of the forms of data input with use of various objects (lists, buttons, additional forms and etc.)
13.	Application by work with the program event of controlled processes
14.	Formation of the reports for any period
15.	Direct output of the reports in Excel, Word, Access and etc.
16.	Import/export tools
17.	Organization of a distribution database with administration and configuration from center
18.	Full enterprise administration
19.	Client-server
20.	Local Support
21.	Adopted to local accounting law
22.	Level of the local support
23.	Efficiency/price coefficient
24.	Presence of the errors in the accounting system
25.	Flexibility
26.	Multilevel financial analytics
27.	GAAP standard supporting

Table 2 The evaluation criteria for the Project Management System

#	Criteria
1.	Menu customization availability
2.	Statistical and security logs availability
3.	Flexibility
4.	Local support availability
5.	Document flow realization
6.	Built-in E-Mail system
7.	Built-in Web-access support
8.	HTML Publishing availability
9.	Replication availability
10.	Customer development possibility
11.	Analytical tools availability
12.	Import & export tools availability
13.	Security level

14.	Integration with financial systems possibility
15.	Selection transactions and documents in journals on given criterion (several parameters)
16.	Client/server architecture
17.	Multilevel analyze availability
18.	Project management systems design experience of the developer company
19.	Customer support availability
20.	Cost of support

Table 3 Selected accounting systems for the tender

#	Accounting Systems
1.	1? 6.0
2.	1? 7.5
3.	Concord
4.	SunSystems
5.	Virtuous
6.	Fin Expert 4.1

Table 4 Selected Project Management System for tender

#	Project Management Systems
1.	Miritech (Lotus Notes/ Domino platform)
2.	Fortech -Latvia (Oracle)
3.	ONYX - Budapest (Btrive)
4.	IDM Ltd Co – Ukraine (Btrive)
5.	Earnst & Young – USA (Lotus Notes/ Domino)
6.	ULYS Systems – Ukraine (Oracle)
7.	NPO ORGRAPH – Ukraine (Lotus Notes/ Domino)

As a result of the information systems and software platforms analysis, the decision was made:

- Select SunSystems as base financial system within MS SQL server 7.0 (cheapest configuration).
- Develop Project Management System in-house with external programmers based on Oracle RDBMS 8i and Oracle Application Server 4.x. with 20 licenses for unlimited access to the information resources through Internet.
- To use prototyping method of software development, instead of generating volumes of detailed specifications and sign-off documents, rapidly generate an experimental working model of a system for the end users to evaluate.

2 INFORMATION SYSTEM PROTOTYPE DEVELOPMENT

During several meetings and brainstorming sessions with the NGO staff, developers and external information systems consultants the information system General Vision (Figure 2), the General Scheme of Processing Applications/Documents (Figure 3), and the first prototype of the Project Management System were developed with accordance to the Traditional System Development Cycle [Hofman and Rockart, 1994] by using case tools from Oracle – Oracle Designer 2000. The Detailed Scheme of Processing Applications/Documents and “Table of Document

Statuses” are not shown here because of space limitation.

The first Grant Management System (GMS) prototype was entitled "Public Evaluation of Projects through Internet". This project was programmed with HTML and PL/SQL languages by using Oracle Designer for Oracle 8i RDBMS and Oracle Application Server. The project was concerned with creating Web pages with brief information about projects and a registration

form for the public feedback on projects, which are stored in Oracle database.

All applications/documents and related data (for the last three years) were transformed from Excel spreadsheets and local database systems (Figure 1) into new Oracle database (Figure 2). During the data transition from local database systems to one centralized system validation was performed for data integrity and consistency.

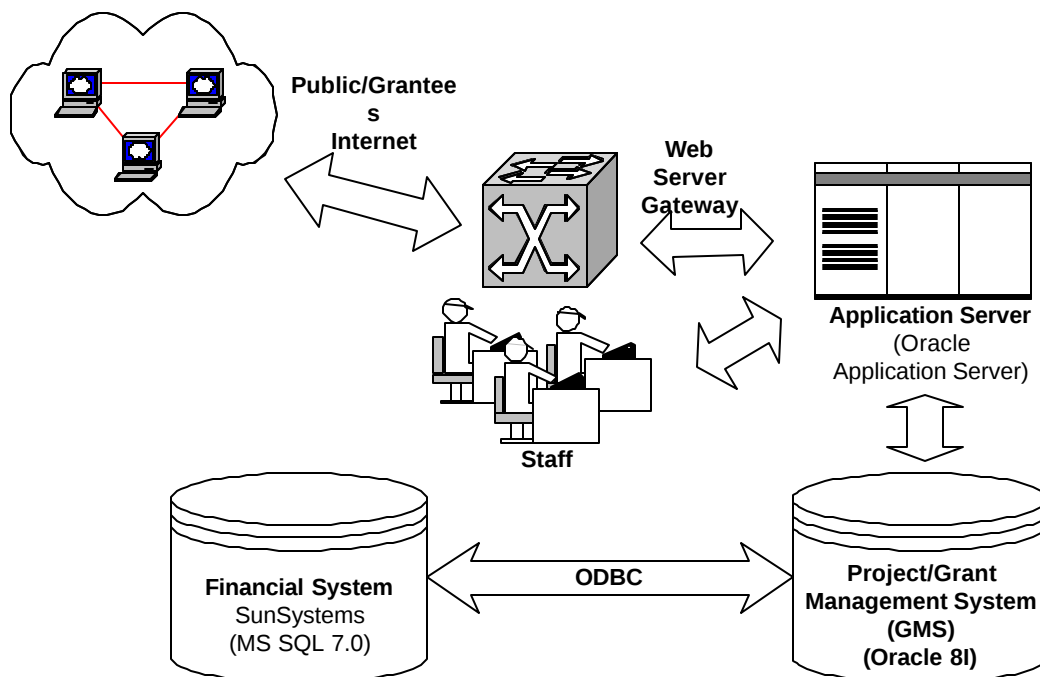


Figure 2 Organizational General Vision of the information system

For the administrative purposes special look-up dictionaries were developed: organization, grantees, organizational staff, Board's meetings, country regions, Program directions, competitions, programs, organization types and etc. The database contains complete information about the projects and related financial information. To input new project information and correct information about old projects several special modules were developed: Request and Project Registration; Information Letter about Registration; Review and Correction References and Feedback from Internet; and a Translation Module for translating information from the local languages into English.

The first prototype was developed in four months by a 3-person team.

In the same period of time, financial department staff and specialists from Robertson&Blums Company implemented the financial system, based on MS SQL 7.0 and SunSystems software.

3 GMS DEVELOPMENT (SECOND STEP)

After the first prototype (Public Evaluation of Projects) implementation, during the maintenance period, the NGO top staff and managers formalized the main organizational and information system structure, goals and workflow producers (Figure 3).

The new project was developed to cater for the administrative needs of the organization with annual budget up to 16 million USD, specializing in the grants for academic and NGOs. The system facilitates query handling and report generation, with minimal time for training to operate the system. The GMS is mainly menu driven for easy navigation covering the following areas: application registration, application evaluation by managers and experts, program board meeting, grant agreements preparation, grant activation, grant monitoring, financial and narrative report collection.

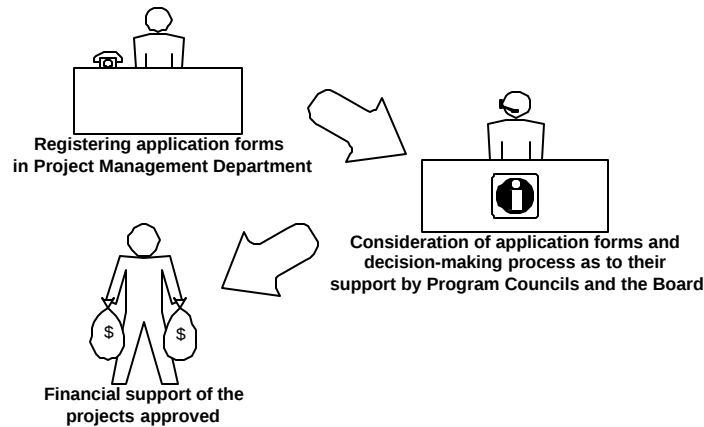


Figure 3 General Scheme of Applications/Documents Processing

The system has been developed to provide top management and middle-management staff with the project information at any point in time: project budgets, current status of projects, schedule of project payments, project manager personal information, project organization information, financial and narrative reports and etc.

For internal purposes additional modules were developed: staff proposals about database modification and correction module; Human Resource Module; Region Representative's module and Contact Information about Staff. The information system was integrated with the financial system SunSystems, based on MS SQL, to transfer financial information from financial system to project database.

4 GMS INTEGRATION (THIRD STEP)

Redevelopment was organized for tight integration with financial system, SunSystems to optimize current grant procedures, deeper financial monitoring of grants and improvement of the data confidentiality. All steps of the workflow processes are registered and monitored by top managers. All of important changes in the database are registered in the special Status Tables and are controlled by top managers and database administrator. Brief project information and project results are available for public evaluation from the Internet. Additional security procedures were developed for the financial and document transactions (Figure 4).

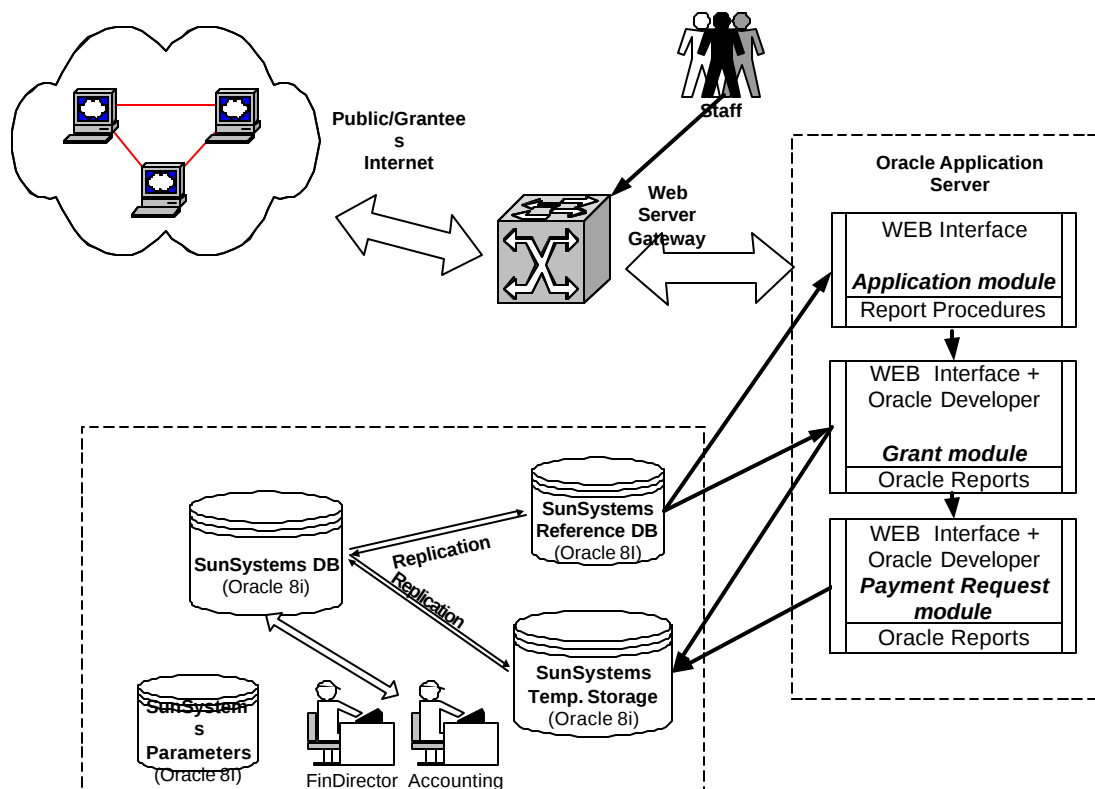


Figure 4 Logical Schema of the Information System

European headquarters experts and experts from most information technology developed branch offices (Moscow, Hungary and Bulgaria) took part in a redesign of the functionality and have approved a prototype of the integrated system.

All top staff and managers of the NGO took part in the procedures development and testing of the new developed information system.

5 CONCLUSION

This article deals with real information system and organization information system reengineering. The main problems of the real NGO with inconsistency and unavailability of financial and project data were solved practically, by implementing central database architecture and jointed all data in an integrated information structure. In this way were eliminated humans factors in data transfer, and many unnecessary official internal documents were decreased.

In the same time, integrity of the financial and project management information gives new opportunity to managers and top administrative staff for analytical and managerial solutions in the main business area.

The results of the information system mentioned above were presented at the regional financial and project management conferences.

It's very important to stress, that during two years of real life reengineering of the information system, theoretical management solutions were used in practice of many software consultants and development companies. To reduce financial expenses and workload for staff during their everyday activity the following strategy was selected:

1. Collect available information about similar information systems during the first year of the information system transition to n-tier architecture with a thin client.
2. Discuss all current problems with the managers and experts to develop several internal expert recommendations about current information system and requirement for the new information systems.
3. Select two main components of the system: financial (including accountant system) and grant management system.
4. Use Critical Success Factors strategic analysis to develop criteria for the software of the information system and main requirements for the main components.
5. Organize competition for local and international companies for system transition and development new management and financial systems components.
6. To develop a new information system in 2-3 steps and in parallel mode.
7. The first step should have prototype of the external part of the management system and the centralized financial system with historical data migration. In the same time the management procedures should be developed for the n-tier information system.

8. During the second step should be realized all management procedures in the management information system and realized integration with financial system. Finalize all financial and management procedures in the organization from the point of view of the new information system.
9. The third step should eliminate all inconsistency and data anomaly from the information system and procedures. Elimination all software bugs and some redevelopment of the user interface with accordance of staff feedback.

Some additional notes:

- All development and redevelopment steps took about of 3-5 months of 2-3 development staff and external contractors.
- It was additional unplanned one redevelopment step (Forth step) for migration from Oracle Application Server 4.x to Oracle 9i Application Server. It should be present in any project development plan.
- The staff adaptation time to any new system should be about 5-7 months before new development and improvement.
- In any case, transition from the old local based information system to new centralized or n-tier system should have about 2-3 years, depending on staff qualification and time/finance resources .
- As a rule, it's impossible to find any box solution for centralized or n-tier management information system, especially with very limited financial resource, but it's not so big problem to find very qualified developers with case tools experience to build management information system in several steps for specific organizational requirements.

Achieved results :

- The integrity, consistency and security improvement. Data anomalies eliminated.
- The project and financial information availability from any place at any time via the Internet with unlimited client licenses.
- The user graphical interface customization by managers and support staff.
- Free client software (Internet Web-browser).
- Low cost support and improvement (by one information system administrator and customer support agreement with accounting system developers).

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