

INFORMATION SYSTEMS FOR FINANCIAL AND ADMINISTRATIVE
MANAGEMENT – CASE STUDY ON BABEȘ-BOLYAI UNIVERSITY

Alina Andreica*, Püsök István**,
Daniel Stuparu, Florina Covaci***

Abstract

The paper focuses on information systems as means for increasing organization competitiveness and overcoming the financial crisis effects. Information systems for financial and administrative management significantly increase activity efficiency, providing global and on-line information regarding the organization's characteristics and future development strategies. We present the case study of Babes-Bolyai University, describing the architecture and design principles of ManageAsist system, which was developed within BBU IT's department as an ERP system, as well as the system's implementation characteristics and organizational impact. We reveal the advantages of on-line management information facilities at various levels and of global management assistance facilities of the system

Key words: Integrated information system; software system for financial and administrative management; management information systems, system flexibility, organizational impact, organization competitiveness

* Alina Andreica is Associate Professor within the Faculty of European Studies, Babes-Bolyai University – BBU and Head of BBU IT Department, E-mail: alina@staff.ubbcluj.ro

** Püsök István is Head of BBU Financial-Accountancy Department, E-mail: ipusok@direcon.ubbcluj.ro

*** Daniel Stuparu and Florina Covaci are PhD students and analyst-developers within BBU IT Department; E-mail: [dstuparu, fghetie}@staff.ubbcluj.ro](mailto:{dstuparu, fghetie}@staff.ubbcluj.ro)

1. Introduction

Information systems have important roles nowadays in increasing organization competitiveness and require systematic implementation solutions, adapted to organizations' characteristics.¹ Therefore, efficient implementation of information systems is a good solution for improving organization efficiency and overcoming the global financial crisis' effects.

The universities' case is quite complex, since their activity covers a wide range of areas: education and learning, research, administration. Therefore, an efficient system implementation has to pursue systematic design and goal-oriented principles. Academic management systematically pursues strategies for increasing university competitiveness.² Regarding the information systems' implementation, organizations face today the challenges of integrating their systems in order to ensure advanced management facilities at a global organization level.

The paper deals with these topics and presents the case study of Babes-Bolyai University - BBU, Cluj-Napoca, Romania in implementing its dedicated information system for administrative management and describing the system's impact in the organization's financial and administrative management. The IT design and implementation principles of the system are detailed in a 2009 article³ from a software engineering point of view, while the present paper is mainly oriented on implementation and organization management aspects.

We describe in section 2 the most important types of management information systems and their advantages in organization management. Section 3 is dedicated to presenting BBU's ERP system ManageAsist, its component modules, functional structure and architecture principles. In this respect, we reveal the complex workflow that is modeled and the decision assistance facilities that are implemented. Within section 4, we

¹ Alina Andreica, "IT Strategies In Increasing Business Competitiveness", in *Studia Europaea*, LI, 3, 2006, pp. 139-148.

² Andrei Marga, *University Reform Today*, Cluj: Cluj University Press, 2004.

³ Alina Andreica, Daniel Stuparu, Florina Ghetie, "Design and Implementation of an Erp System for Universities", in M. Nunes, P. Isaias, P. Powell (eds.) *Proceedings of IADIS Information Systems 2009*, IADIS Press, 2009, pp. 315-322.

address the significant system impact on financial and administrative management, both for operational and management levels; we note that management levels strongly benefit from the on-line access facilities to relevant managerial information.

Section 5 addresses advanced integration principles of ManageAsist system into a larger information system framework that includes BBU's information systems for educational, research, administrative management and the e-learning portal. Conclusions reveal the most important directions and implementation principles stated in the paper, regarding the advantages of implementing an integrated ERP system for managing financial and administrative activities.

2. Management Information Systems and Their Advantages in Organization Management

Information systems, situated on the top of an IT (information technology) strategy can strongly increase organization efficiency; yet, appropriate implementations are required, in order to address the goals and requirements of the organization, and to adequately use its resources.⁴

Management information systems model daily transactions and ensure access to analyses and solutions for various types of users. The results are most often generated as reports but users may also interactively interrogate the system. Once implemented, management information systems provide dedicate reporting facilities for various user categories, with dedicated facilities for management levels.

Users have an important role in collaborating with the team that designs and implements an information system by: rigorously defining the problem, specifying the information to be processed and the specific rules or algorithms to be pursued and the final goal of the system.⁵ Most often, subsequent modifications to an information system prove to be extremely

⁴ Alina Andreica, "Strategies in Implementing Efficient Information Systems", in Gregory Papanikos (ed.), *International Research on Global Affairs*, Athens: Athens Institute for Education and Research, 2005, pp. 499-508.

⁵ *Ibidem*.

costly both for the development team and for potential user resources (effort, time, money).

Modern information systems involve:⁶

- ◇ **data processing** - collecting and processing organization's daily transactions (accounts, invoices, credits, rates, stocks, etc.). Such processes have been extended from local systems to distributed ones (shared in computer networks). Daily transaction processing provides information for tactical and strategic planning and is essential to the organization;
- ◇ **database management** - database management systems are software products dedicated to processing large data collections organized as databases. The data base organization is consistent, flexible and efficient, ensuring processing independence from data representation techniques. Databases also offer integrity protection mechanisms and may evolve in gradual phases.
Database management and extracting relevant information by specific queries (data mining) are important for all management levels: strategic, tactical, operational. Most information systems that are implemented in the economic environment rely on database management, as they involve processing large amounts of data;
- ◇ **interactivity** - since final users of information systems may belong to various user categories, the system must response in real time (directly and instantly) to any type of request. Once visual and accessible software has been developed, the use of computers and information systems has extended to the general public with basic knowledge in computer use;
- ◇ **distributed facilities** - nowadays, information systems function as multi-user systems, accessible from various locations, over computer networks or within the Internet. Internet applications have developed in a rapid pace and have become very popular since they are efficient, very accessible and easy to use. E-banking, e-payment or e-commerce facilities / systems have spread on the Internet, based on rigorous security mechanisms implemented for private information exchanges.

⁶ *ibidem*

The most important types of interactive management information systems are:⁷

- ◇ **ERP (Enterprise Resource Planning) systems**⁸ – model, in an integrated manner, the activities from all the organization's compartments. The initial significance of resource planning facilities in a strict sense presently extended as general resource management facilities for all compartments, in a large sense. We may state that ERP systems are today the most used management information systems as systems for overall organization management, based on compartments resource and activity modeling and processing. It is important that these systems offer more than processing and reporting facilities, but also advanced facilities for managerial assistance (see the dedicated description below), in order to model not only operational activities, but also management level activities.
- ◇ **decision assistance systems**⁹ - are focused on assisting managerial decisions based on current operation processings, and supporting management decisions by providing specific analyses, predictions or finding the optimal solution under certain constraints, consequent to data processing. These systems are interactive systems dedicated to managers, and used in modeling the decisional process; the assistance provided by these types of information systems leads to solving managerial problems.

The main applications of these facilities regard modelling, choice analysis and decision taking, the implementations being interactive and mainly dedicated to managers. A decision assistance system must integrate a data / knowledge base, a software which processes it and specific decision assisting modules: modelling and simulation

⁷ Dumitru Oprea, Dinu Airinei, Marin Fotache, *Sisteme informationale pentru afaceri*, Iași: Ed. Polirom, 2002; Terry Lucey, *Management Information Systems*, Channel Island: The Guarnsey Press. Co., 1995.

⁸ Daniel O'Leary, *Enterprise Resource Planning Systems*, Cambridge University Press, 2000.

⁹ G. M. Carter, M.P. Murray, R.G. Walker, W.E. Walker; *Building organizational decision support systems*, Boston: Academic Press, Inc, 1992.

packages, analysis and prognosis facilities, linear and non-linear programming, regression modeling, risk analysis, expert systems, etc. Decision assistance systems are usually applied for supporting key decisions, based on complex information processing from a consistent database. Automated processing brings important efficiency advantages, being indispensable when managing a large volume of data and high complexity processings),¹⁰ as the case of managerial assistance support.

- ◇ *expert system facilities* - ensure an advanced mode of assisting decisions, since they include experts' knowledge on a certain field as a knowledge base, which tends to be exhaustive for modelling that field (ideally, an expert system replaces human experts in a certain field).¹¹
- ◇ *executive information systems*¹² - are data retrieval systems which ensure selecting relevant information syntheses for the top management level. Usually, processed information refer to critical areas of the organization's activity and are extracted from the integrated database of the implemented management information system . Executive information systems must be user-friendly, must ensure fast access to information and efficient exploration of the database - "data mining", adequate data analysis (tendencies, prognosis, data integration) and must generate clear outputs .

ICT implementation has an important impact on organizations within:

- ◇ *human resources policy and skills* by
 - modifying the requested personnel skills and the work style, the interactions among employees and the departmental interactions, as well as outer-organization interactions, with suppliers and

¹⁰ R. Watson, *A Design for Infrastructure to Organizational Decision Making*, Los Alamitos, California: IEEE Computer Society Press, 1990.

¹¹ See for details George F. Luger, William A. Stubblefield, *Artificial Intelligence – Structures and Strategies for Complex Problem Solving*, Addison Wesley Longman, 1998.

¹² Ido Millet, Charles H. Mawhinney, "Executive information systems: a critical perspective", in *Information and Management*, vol. 23, no. 2, 1992, p.83-92.

- clients. Information representation, processing and communication means are changed; these features induce modifications in the organization's structures: certain jobs may be transformed and others may appear, based on ICT facilities;
- reducing manual work and physical routine since various operations are transferred into IT; work productivity is therefore increased. On the other hand, computer use and data processing skills become necessary for almost all personnel. Therefore, knowledge in operating office automation software becomes indispensable for most jobs;
 - inducing mutations in professional responsibilities by combining assignments from several traditional jobs and enlarging decisional levels by integrating tactical management and extending the operational level's responsibilities;
- ◇ **operational impact**, mostly for the organizations which use distributed database systems. Client interactions or external communication also change and move towards ICT facilities. Information systems which implement electronic means of performing activities, such as e-jobs, e-banking, e-commerce and so on, have a major social impact;
 - ◇ **organizational impact** by reducing the traditional number of levels, based on superior management's capabilities of administering more directly the organizational activities. Certain traditional departments of manual workers are transformed while an increasing number of activities is taken over by information systems.¹³

The major impact that ICT has within organizations has to be taken into account by the organizational management.

3. Design and Implementation of BBU ERP System

Taking into account its goals and resources, BBU adopted since 2003 the strategy of developing and implementing its own systems, with important autonomy and manageability characteristics in system development and extendibility. This strategy pursues the principles

¹³ Lucey, *op.cit*; Andreica, "IT Strategies in ...".

characteristic to large organizations, with consistent IT and professional IT resources, as well as high flexibility and manageability requirements.¹⁴ Three integrated information systems have been developed and implemented since, in order to manage the university's main activity directions: education – **AcademicInfo** system, research – **Research Management**¹⁵ system and administrative management – **ManageAsist** system.¹⁶

We further describe the implementation of ManageAsist system.

3.1 ManageAsist Modules and Functional Structure

ManageAsist system is the integrated software system for administrative management that has been developed for our university. The system can be viewed as an ERP system; within its design and implementation, we integrated systematic efficiency principles in software design: multi-layer architecture and layer autonomy,¹⁷ advanced object oriented design based on systematic abstraction principles,¹⁸ design patterns,¹⁹ flexibility in module integration and communication, systematic workflow management, efficient database access and design.²⁰

¹⁴ *ibidem*

¹⁵ Alina Andreica, Paul Serban Agachi, "Design and Implementation of an Integrated Software System for Managing Research Activities in Universities", in Emil Cebuc (ed.), *7th RoEduNet International Conference - Networking for Research and Education*, UT Press, 2008, pp. 90-95.

¹⁶ Andreica, Stuparu, Ghetie, *Design and...*

¹⁷ ***, *Client/Server and the N-Tier Model of Distributed Computing*, Micromax Information Services Ltd.1999, [<http://www.n-tier.com/articles/csovervw.html>]; K. Hoganson, M. Guimaraes, "N-Tier Client/Server Course", *Consortium for Computing Sciences in College Conference*, Dunwoody, Georgia, 2003.

¹⁸ Ian Sommerville, *Software Engineering*, 8th edition, Harlow: Addison Wesley, 2007.

¹⁹ E. Gamma, R. Helm, R. Johnson, J. Vlissides, *Design Patterns*, București: Teora, 2002.

²⁰ M. Berry, G. Linoff, *Mastering Data Mining*, New York: Wiley, 2000; Daniel Stuparu, Alina Andreica, Iulia Mantu, "Comparing Access Techniques on Databases in Distributed Application Frameworks", *Proceedings of Collaborative*

ManageAsist's principles and facilities are adapted for high education institutions; the system contains the following modules: Document management, Assets, Warehouse, Cashier, Finance, Accountancy, Grants, Human Resources and Acquisitions, and decision assistance facilities. The first 7 modules are already in use; their implementation has pursued systematic and efficient principles.²¹ Each module contains management reports for the corresponding compartment. Relevant synthesis from each compartment will be integrated, together with global management tools into a decision support module.

In another article,²² we address the advantages of pursuing advanced design principles in the implementation stages of the system, and in designing a flexible framework for efficiently integrating the system's modules. We also deal with means of managing hierarchical data structures, together with efficiency issues in respect with processing them. Each module includes levels for specific document processing, operational facilities and reporting, level that provides management assistance information for the corresponding compartment.²³

We further describe module characteristics and functionalities:²⁴

The *log on module* – performs authentication and verifies user permissions. Data availability domains and user permissions are modelled at the database level, specific operations being granted according to user permissions. Permissions are managed in respect with the organization chart, as well as with data availability domains and operation types (operational, reporting, full access – including configuring facilities)

The *Acquisitions module* – models acquisitions according to public acquisition regulations. Primary documents are processed in a dedicated flow, containing order specifications, orders, invoices, receipt, payment orders (processed by the Finance module). Reporting facilities are available at different user levels. Acquisition operations are automatically pre-registered in order to be processed by the Accountancy module.

Support Systems in Business and Education, Babeş-Bolyai University, Cluj-Napoca, 2005.

²¹ Andreica, "Strategies in Implementing...".

²² Andreica, Stuparu, Gheţie, "Design and....".

²³ *ibidem*

²⁴ Andreica, "Design and ...".

A dedicated module selects acquisition ordering facilities, tracing and adequate reporting facilities that are available for all system's users; management levels have available dedicated reporting facilities;

The *Warehouse module* – models warehouse activity: product delivery receipts, product registration, transfer operations, internal ownership. Products are retained in the integrated database

The *Assets module* – models asset management, specific input / output / transfer operations, internal ownership (compartment). Reporting facilities are available at different user levels. Specific operations are automatically pre-registered in order to be processed by the Accountancy module

The *Cashier module* – models the cashier activity based on: cash payment orders, cheques, cashier reports, etc. The module communicates with the Internal finance / accountancy processing module, which performs the internal finance operations for the corresponding internal account and adequate accountancy pre-registrations;

The *Finance module* – models the financial activity of the organization in respect with its bank accounts and internal compartment accounts (based on the organization's chart). The module processes payment orders, cheques, etc. and provides specific reporting facilities. The module communicates with the Internal finance / accountancy processing module, which performs the internal finance operations for the corresponding internal account and adequate accountancy pre-registrations, for the Accountancy module. A dedicated module selects adequate reporting facilities available for all faculty / department managers;

The *Accountancy module* – models the accountancy activity of the organization: accountancy operations / registrations, ledger reports. The module uses an Accountancy plan management module. The Accountancy module is based on pre-registered accountancy operations performed by other modules. Reporting facilities are consistent and cover various documents required by accountancy regulations for public institutions

The *Internal finance / accountancy processing module* – belongs to the business layer; performs internal financial operations within compartment accounts and appropriate pre-registered accountancy operations

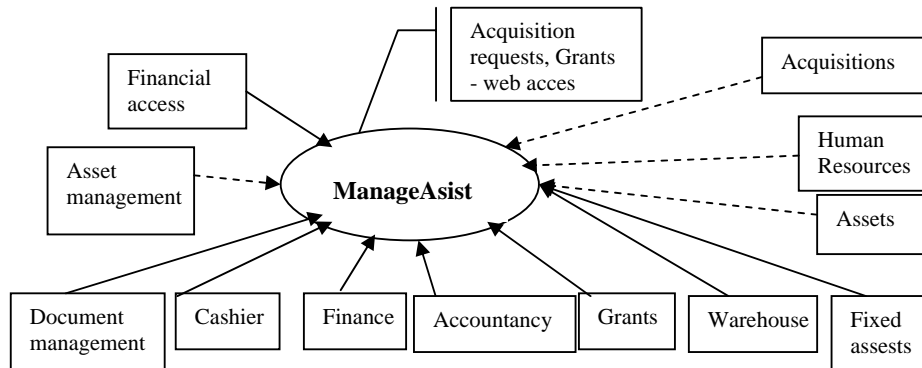


Fig. 1 ManageAsist – functional

The *Document management module* creates, retains, updates, erases and operates on documents in a uniform manner. Documents are further processed by other operational modules.

The *Grants module* processes financial operations on grants and includes adequate reporting facilities; a dedicated module selects adequate reporting facilities for all grant coordinators. The *Human Resources* module is also being developed.

Design and architecture principles of the system, as well as workflow management characteristics are presented in a recent work.²⁵ The system's functional scheme is presented in figure 1.

3.2 Framework for Module Integration - Architecture Principles

The workflow diagram of the modeled activities is represented in figure 2; we designed the system modules in order to describe this workflow diagram. The workflow management is implemented by the interaction between the application modules – application components and database interaction modules, according to the workflow diagram.

²⁵ Andreica, Stuparu, Gheție, *op.cit.*

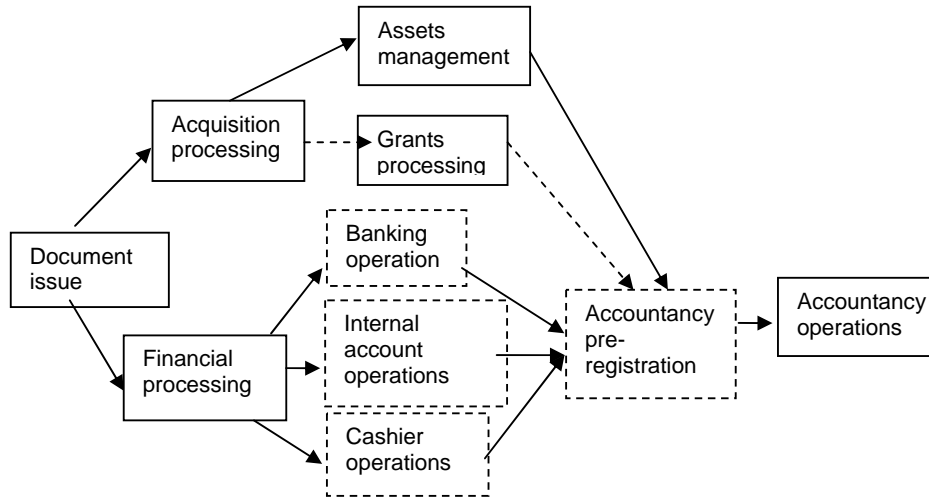


Fig 2. Workflow management

The integration of the system's modules can be represented as a workflow framework containing modules as entities and corresponding communications – see figure 3. We note that the document module interacts with all other modules but we used a simplified graphical representation in order to keep the focus on the most important module interactions.

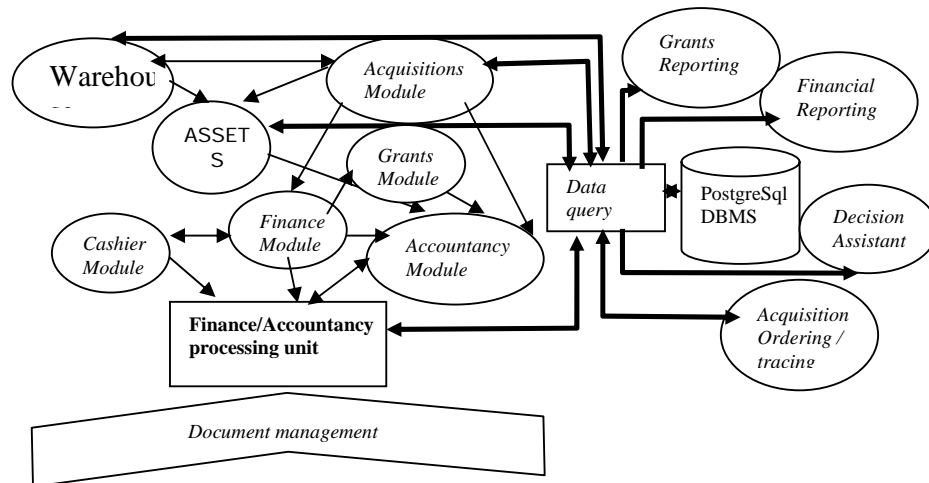


Fig 3: Module integration framework

Specific decision assistance facilities are currently included “on top” of the Finance, Accountancy, Acquisitions modules;²⁶ the layer structure of the modules is presented in figure 4.

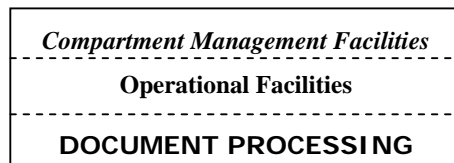


Fig 4: Module levels

The *Financial, Grants* and *Acquisition modules* have dedicated reporting and decision assistance facilities available for all corresponding management levels. Access permissions are

managed in respect with the organization chart (including all descendant units of a certain compartment).

We are going to further develop global decision assistance facilities (mainly for the top organization management) in order to proficiently support management processes by means of relevant information obtained on-line from the system’s integrated database.

4. System Impact in Financial and Administrative Management

ManageAsist implementation has important advantages in efficiently managing financial and administrative information and processes, and in ensuring *global access to analyses and syntheses* in this respect. These characteristics induce:

- ◇ Increased competitiveness & efficiency at compartment and organization levels;
- ◇ Impact on administrative management and faculties by increasing administrative processing transparency and proficiency;
- ◇ On-line access facilities to all relevant information, based on user permissions according to the organization chart

The implementation *impact on the operational level* was significant, since, on one hand, induced increased processing automation and therefore simplified operational activities, but on the other hand, *increased job responsibilities and trans-compartment influences*. Compartment processing interferences are modeled according to the specific information workflow (fig 3); yet, this characteristic enhances work responsibilities,

²⁶ Andreica, Stuparu, Gheție, “Design and....”.

since results are transmitted to other compartments in order to be further processed. The implementation of certain operational modules improved the quality of certain activities, by eliminating delays during public relation hours (for example, Document management and Cashier modules).

The implementation *impact on management levels* is even more important, since global syntheses facilities benefit from all operational modules, by providing *on-line access to global information*, to correlated data and analysis possibilities. The system provides an overall compartment & organization view to management levels, as well as significant correlation & synthesis advantages. We may state that management assistance facilities at compartment, faculties and organization levels are essential advantages of the system in increasing activity competitiveness and administrative proficiency. Financial, asset and other specific reports are available at any time, for compartment, faculties' and university's management.

5. Global System Integration

We have designed an advanced system integration framework, in order to ensure the integration of BBU's e-learning portal²⁷ with BBU's dedicated information systems AcademicInfo, ManageAsist, Research Management System.²⁸ Integration principles are based on an integrated

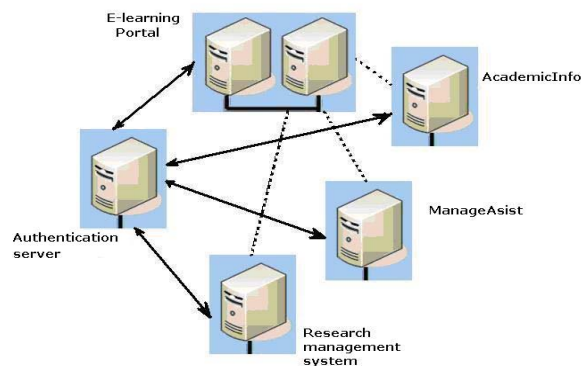


Fig 5 Framework for advanced system integration

authentication solution, which maps facilities from the dedicated information systems into the portal, for each user category (see fig. 5).²⁹ The integration solution is also designed to ensure database synchronisation among AcademicInfo, ManageAsist, Research Management System and

²⁷ Andreica, "Design and ...".

²⁸ Andreica, Agachi, *op.cit.*

²⁹ Andreica, "Design and ...".

Portal databases based on matching the following data:³⁰

- ◇ portal – AcademicInfo: users (all categories), curricula, study contracts, grades, fees;
- ◇ portal – AcademicInfo – ManageAsist: organisation chart, units, human resources, managers, financial information;
- ◇ portal – AcademicInfo – Research Management System: research activities, PhD students;
- ◇ portal – ManageAsist– Research Management System: organisation chart, units, human resources, grants & corresponding financial information .

In order to implement the authentication server we have installed MS Identity Lifecycle Management server, which has advanced integration facilities with our e-learning portal, and we are in train of configuring the necessary permission mappings from the dedicated information systems into the authentication server in order to complete the integration facilities.

6. Conclusions and Future Work

The paper focuses on information system development and implementation as tools for increasing organization competitiveness, and the impact of implementing an ERP system in this respect. Efficient implementations of dedicated information systems increase proficiency in financial & administrative management. In this context, we address the specifics of designing and implementing an ERP system for BBU.

Organizations face nowadays the phase of system integration, in order to ensure advanced management facilities at a global organization level. The universities' case is quite complex, since their activity covers a wide range of areas: education and learning, research, administration.

In the study framework, of information systems for financial and administrative management, we present the case of Babes-Bolyai University, Cluj-Napoca, Romania, by describing its dedicated information system for administrative management – ManageAsist, its component modules, functional structure and architecture principles. The system was designed and implemented by applying proficient development principles.

³⁰ *ibidem*

We underline the complex workflow that is modeled and the decision assistance facilities that are implemented. The system implementation reveals the advantages of flexible & proficient design strategies in development stages. We are further going to develop the system's decision assistance facilities, in order to systematically support global management.

We also address the significant system impact on financial and administrative management, both for operational and management levels; we note that management levels strongly benefit from the on-line access facilities to relevant managerial information. System's advantages in workflow & management levels facilities are revealed, as well as its benefits in overall activity management.

7. References

1. Andreica, Alina (2005), "Strategies in Implementing Efficient Information Systems", Gregory Papanikos (ed), *International Research on Global Affairs*, Athens: Athens Institute for Education and Research, pp. 499-508.
2. Andreica, Alina (2006), "IT Strategies In Increasing Business Competitiveness", in *Studia Europaea*, LI, 3, pp. 139-148.
3. Andreica, Alina, Agachi, Paul Serban (2008), "Design and Implementation of an Integrated Software System for Managing Research Activities in Universities", Cebuc, Emil (ed.) *7th RoEduNet International Conference - Networking for Research and Education*, UT Press, pp. 90-95.
4. Andreica Alina, Stuparu Daniel, Gheție Florina (2009), "Design and Implementation of an Erp System for Universities", Nunes, M., Isaias, P., Powell P. (eds.), *Proceedings of IADIS Information Systems 2009*, IADIS Press, pp. 315-322.
5. Andreica, Alina (2009), „Design and Architecture of an Integrated E-learning Environment. Case Study on Babes-Bolyai University, Cluj-Napoca, Romania”, *Proceedings of V International Conference on Multimedia and ICT in Education (m-ICTE2009)*, Lisbon, Portugal, 22-24 April.
6. Berry, M., Linoff, G. (2000), *Mastering Data Mining*, New York: Wiley.

7. Carter, G. (1992), *Building Organizational Decision Support Systems*, Cambridge Academic Press.
8. *** (1999), *Client/Server and the N-Tier Model of Distributed Computing*, Micromax Information Services Ltd., [<http://www.n-tier.com/articles/csovervw.html>], 9 June 2009;
9. Dhawan, P. (2002), “.NET Remoting Performance”, *Building Distributed Applications with Microsoft .NET*, MS Press.
10. Gamma E., Helm R., Johnson R., Vlissides J., (2002) *Design Patterns*, București: Teora.
11. Hoganson, K., Guimaraes, M. (2003), “N-Tier Client/Server Course”, *Consortium for Computing Sciences in College Conference*, Dunwoody, Georgia.
12. Larson, B. (2006), *Delivering Business Intelligence with Microsoft SQL Server 2005*, McGraw-Hill/Osborne.
13. O’Leary, Daniel (2000), *Enterprise Resource Planning Systems*, Cambridge University Press.
14. Lucey, Terry (1995), *Management Information Systems*, The Guernsey Press CO Ltd.
15. Luger, George F. , Stubblefield William A. (1998), *Artificial Intelligence – Structures and Strategies for Complex Problem Solving*, Addison Wesley Longman Inc.
16. Marga, Andrei (2004), *University Reform Today*, Cluj-Napoca: Cluj University Press.
17. Mawhinney, C.H., Millet, I. (1992), “Executive information systems: A Critical Perspective”, in *Information and Management*, no. 23.
18. Oprea, Dumitru, Airinei, Dinu, Fotache, Marin (2002), *Sisteme informationale pentru afaceri*, Iași: Ed. Polirom.
19. Somerville, Ian (2006), *Software Engineering*, 8th edition, Addison Wesley.
20. Stuparu, D., Andreica, Alina, Mantu, I. (2005), “Comparing Access Techniques on Databases in Distributed Application Frameworks”, *Proc. of Collaborative Support Systems in Business and Education*, BBU, Cluj-Napoca, pp. 1-10.
21. Watson, R. (1990), *A Design for Infrastructure to Organizational Decision Making*, Los Alamitos, California: IEEE Computer Society Press.
22. Microsoft Learning Gateway,

[<http://www.microsoft.com/education/learninggateway.aspx>],
November 2008

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.