

BABEŞ-BOLYAI UNIVERSITY, CLUJ-NAPOCA, ROMANIA  
FACULTY OF BUSINESS MANAGEMENT AND ECONOMIC SCIENCES

# **DOCTORAL THESIS**

## **SUMMARY**

***CONTRIBUTIONS TO THE CONCEIVING, PLANNING AND  
IMPLEMENTING OF AN ERP TYPE INTEGRATED  
INFORMATION SYSTEM WITHIN AN INDUSTRIAL  
COMPANY***

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**Key words:** providers of new technologies, economic strategy, management paradigms, information technology, information systems, informatics systems, life cycle, planning, object oriented planning, object oriented modelling, UML (The Unified Modelling Language), ERP (Enterprise Resource Planning), SAP, SIVECO Applications 2011 , Microsoft Dynamics NAV, Clarvision ERP, Charisma ERP 2010, Enterprise Modelling, integrated information system prototype, information system auditing, CAAT

## **INTRODUCTION**

From the author's perspective, the present thesis would like to constitute a documented study regarding the ERP type integrated information systems, highlighting their role in endowing the production management with information technology.

In the present doctoral thesis we have integrated the largest part of the procedea resulting from the implementation process of the Microsoft Dynamics NAV solution within SC Farmec SA [Plc] Cluj alongside the study of the new challenges faced by the developers of modern software solutions. In order to reach a high performance, we consider that the companies should manage the resources at their disposal as carefully as possible since an inefficient management will certainly lead to their increased vulnerability in facing the competition of other companies.

During the period of uncertainties and instability we are passing through at present, the efficiency of a company's activity represents one of the protection means for its business. In this respect we consider that the company activity can be rendered efficient only by restructuring the management system, its subsystems and the management functions' operationalization modality.

On the other hand, the decisive, ever increasing role of information technologies and communication should be taken into consideration within the achievement of the process of attaining maximization. In this context, we bear in mind the fact that adopting modern information technology solutions at company level may contribute decisively to the improvement of management and the increase in performance along the leadership process.

Within this process, in most cases it is necessary that companies should update their less efficient applications or even replace these with others which are more effective, ones which can ensure real time, efficient foundations for decision making and thus for the management process. At present we consider that the implementation of ERP type integrated systems can contribute to rendering the activity of a company efficient. By achieving such systems the company is offered the possibility to get the existing applications integrated into the new information system along with the new applications that are specific to the domain in which the respective company develops its activity.

### **The objectives of the thesis**

The present doctoral thesis approaches the main modalities of employing the modern information technologies and their impact upon the company management as well as options of technology implementation within the current activity of the company. In this sense we

have considered that the integrated solutions may have a major impact upon the activity of the company with regard to management improvement and the increase of the performance of the leadership activity.

Starting from these findings we consider that the main objective of this work consists in the study of the theoretical and practical aspects regarding the use of modern information technologies within the management of the activity of companies in the industrial domain doubled by the conceiving of an integrated system prototype for the Farmec SA company in Cluj with the aim of contributing to the maximized efficiency of its activity.

Mention should be made that the information system prototype we propose is based on the one hand upon the pertinent analysis of the existing information system and on the other on the thorough knowledge of present day trends in the development process of the new information technologies. We consider, in this line of thought, that the proposed prototype will represent a powerful software instrument for analysis and management within the Farmec SA company in Cluj.

The work presents the main techniques and technologies of information system analysis and development, highlighting the novel approaches regarding the implementation of ERP type integrated systems.

The author's main contribution brought to the implementation domain of the integrated information systems is considered to be **an original implementation method**, entitled "**The Early Training Method**". This genuine method is presented from the point of view of the advantages it brings about, in the subchapter entitled "Conclusions and personal contributions" within the chapter: "Analysis and development technologies for integrated information systems".

From the perspective of practice, alongside the conceiving of the integrated information system prototype, the work also presents the author's own conception regarding the implementation process of the production module within the Farmec SA company in Cluj, that being one of the basic modules of the framework of the new system.

Another objective of the work is constituted by the presentation of the computer assisted audit techniques and their role in the assessment of the functionality of an application or information system. The author demonstrates the fact that there are a series of factors which may influence decisively the efficiency of the system if these are correctly perceived through the information audit process and they will implicitly bear upon the company's performance as well.

Directly connected to the audit process of the proposed system, the author also carries out an analysis of its economic efficiency in order to validate the implementation process of the new system. By adopting the analysis, under the circumstances of the present crisis, it is confirmed that it is necessary to quantify any expenditures and the impact of the implementation of the new system on the financial situation of the company as well as the consequent turning to good account modality of the results obtained following the functioning of the planned system.

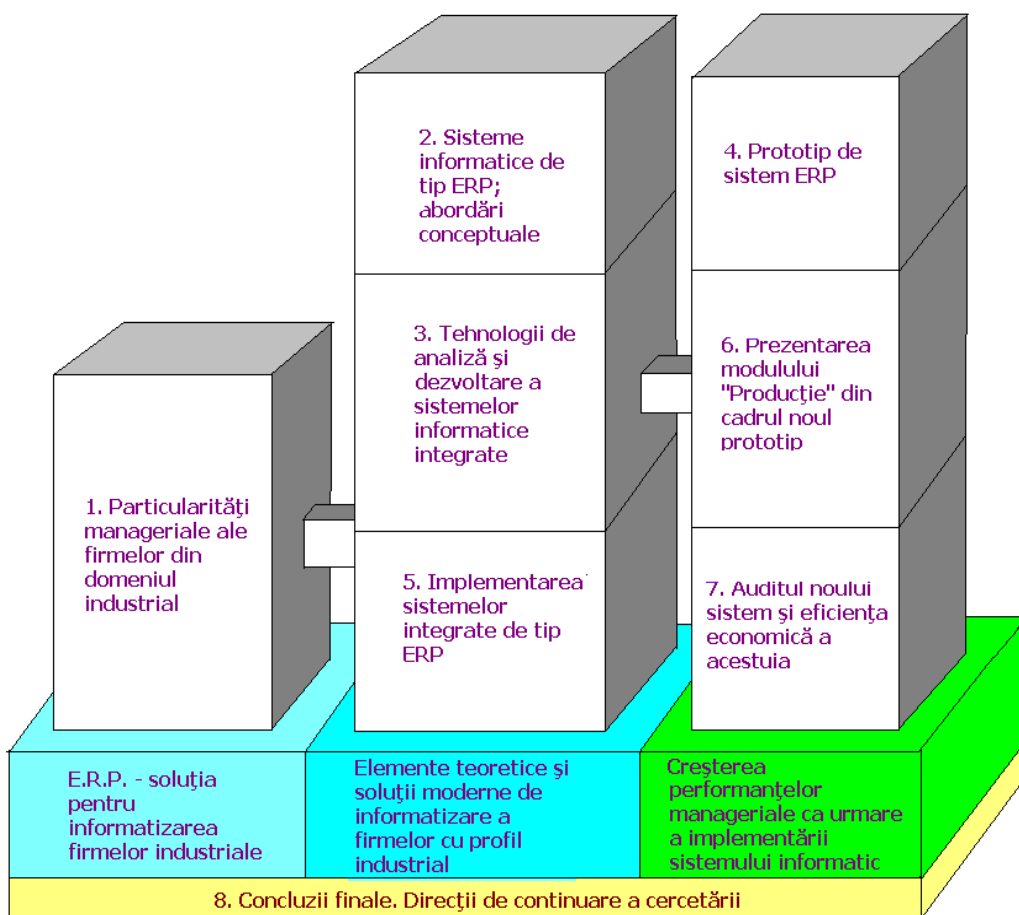
Beside the previously presented objectives, in his present work, the author also proposes attaining other objectives, among which we are mentioning the following ones:

- introducing the present day stage and trends in the analysis and planning of the information systems
- implementing adequate ERP solutions
- analyzing the ERP systems to be found on the Romanian market and highlighting their impact upon the management activity of the company
- bringing forward the risks in the functioning of the planned system and their management

- assessment modalities of the economic efficiency of the planned system

Taking into consideration the previously presented objectives, the work has the following structure: introduction, seven chapters specific to the domain researched, conclusions and personal contributions, and bibliographical references.

For a better understanding of the structure of the work, in what follows a chart is presented comprising the chapter titles and the connections among these (Fig. 1):



- [1. Management Peculiarities of the Companies in the Industrial Domain
  2. ERP Type Information Systems; Conceptual Approaches
  3. Analysis and Development Technologies for Integrated Information Systems
  4. An ERP System Prototype
  5. The Implementation of the Integrated ERP Type Systems
  6. The Presentation of the “Production” Module within the New Prototype
  7. The Audit of the New System and Its Economic Efficiency
- E.R.P. – the solution for industrial companies’ endowment with information

technology

Theoretical elements and modern solutions for endowing industrial profile companies with information technology

Maximising managerial performance as an outcome of the implementation of the information system

8. Final Conclusions. Directions for Further Research]

Figure 1. The Structure of the Work

A brief analysis of the chart presented shows that the work is structured according to eight main chapters, starting with the description of the present day level of knowledge and closing with conclusions and personal contributions brought to the domain under study, with the establishing of the objectives for subsequent research.

## **CHAPTER 1. MANAGERIAL PECULIARITIES OF THE COMPANIES IN THE INDUSTRIAL DOMAIN**

A study of the management of companies in the industrial domain, with reference to the concept, its functioning principles as well as of aspects regarding the impact of information technologies upon the managerial activity of a company is carried out in this chapter. All these aspects are analysed having in view the strategies of the company with regard to concrete modalities of resorting to new information technologies.

Within this chapter, the author depicts aspects regarding the development of the industrial sector at present with reference to the manufacturing of beauty products at SC Farmec SA in Cluj.

From the very beginning we should point out the fact that the industrial companies possess the most complex structure from an organizational point of view. Ovidiu Niculescu defines and describes the functions of a company as follows:<sup>1</sup>

1. **The research and development function;** it designates the assembly of activities carried out within organizations through which the scientific and technical progress is conceived and implemented. Three main activities can be identified within this function:
  - a. The activity of forecasting the functioning and development of the organization. This consists in projects, strategies and company policy elaboration translated into prognosis and plans, in establishing the periods and the main organizational subdivisions and in supervising these.
  - b. The activity of technical conception. It includes the assembly of applied research and the technical development carried out within the organization. The main concrete result of this activity can be seen in the *conceiving and assimilation of new and updated products and in the conceiving and implementing of new and updated technologies.*
  - c. The organization. This reunites the assembly of the processes of elaboration, adaptation and introduction of new concepts and techniques of an organizational nature.
  - d. The commercial function; it incorporates the assembly of processes regarding knowledge of the demand and offer on the market, of direct procurement of raw materials, materials, production equipment, etc. needed by the production development within the organization and by its product, semi-fabricated product or service sales. This function also comprises three main activities:
    - a. Purchasing. The technical and materials purchasing reunites the assembly of the attributions through which procurement of the raw materials, materials, fuel, production equipment and other material factors of

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<sup>1</sup> Ovidiu Niculescu, Ion Verboncu, Fundamentele managementului organizației, [Fundamentals of Organization Management] Ed. Universitară, București, 2008



production necessary for completing the goals of the organization is ensured.

- b. Sales. This activity reunites the assembly of attributions by means of which the passing of products and services from the domain of production to the domain of goods circulation is directly ensured.
  - c. Marketing. This activity comprises the assembly of attributions by means of which the study of the internal and external market is ensured as well as the knowledge about the necessities and behavior of consumers in order to establish the most adequate modalities of manufacturing orientation and of increasing the sales of finite products, semi-fabricated products and industrial works supplied by the company in order to satisfy consumer demand.
2. **The production function.** This function can be defined as the assembly of the working processes within the enterprise through which the objects of work are turned into finite products, semi-fabricated products and services and through which technical and material, organizational and service conditions are created directly in order to meet the needs of manufacturing development under proper circumstances.

The production processes which are developed within the industrial companies can be classified as follows:

- a. Basic processes. The activity through which objects suffer direct transformations which result in the creation of the finite products by the industrial organization this is specialised in.
- b. Auxiliary processes. With their help technical and material conditions are ensured necessary for the normal development of the basic processes. Typical examples of auxiliary processes: repairing and maintaining of machines and installations, producing thermal or electric energy, SDVs., etc.
- c. Service processes. They are meant to ensure organizational services. Examples: transportation of work objects, supplying the necessary elements for the production process to the work sites.

From an organizational point of view, that is of the nature of the targeted objectives and of the processes constituting it, the production function in an industrial company groups together five main activities:

- 1. Planning, preparing, launching and supervising of production
- 2. Manufacturing or exploitation
- 3. Quality control
- 4. Equipment maintenance and repair
- 5. Auxiliary production of energy, steam, compressed air, etc.

Within the production function there exists a group of attributions of a general character, organizational expressions of work processes regarding two or several activities. These are:

- a. Organizing the maximisation of the use of production capacities
- b. Reducing the technological deviations from the specific consumption
- c. Applying workplace safety norms, etc.

The defining characteristic for the management of the production activity in the domain of beauty products is that it is subject to extremely strict regulations, having its own

manufacturing standard. It is a European standard, regulated by law in Romania as well. The regulations are known as “Good Manufacturing Practice Guidelines (GMP)” in the European Union while in Romania as “Ghid pentru Reguli de bună practică pentru fabricație “( R.B.P.F).

Why was it necessary for the manufacturing activity management to be made subject to strict rules imposed by a standard ? The necessity was imposed by the fact that beauty products are situated at the border of pharmaceutical products since they are applied externally, directly on the skin.

The GMP guide for beauty products was created in order to assist the cosmetics industry in observing the European Directive for cosmetics EEC 76/768 ( art 7 a).

Maintaining the competition advantages is achieved at great pains due to the changes that appear on the market and the competitors’ early reaction. The strategic impact of the use of information technology upon the future evolution of an organization can be systematized as in Fig. 2.

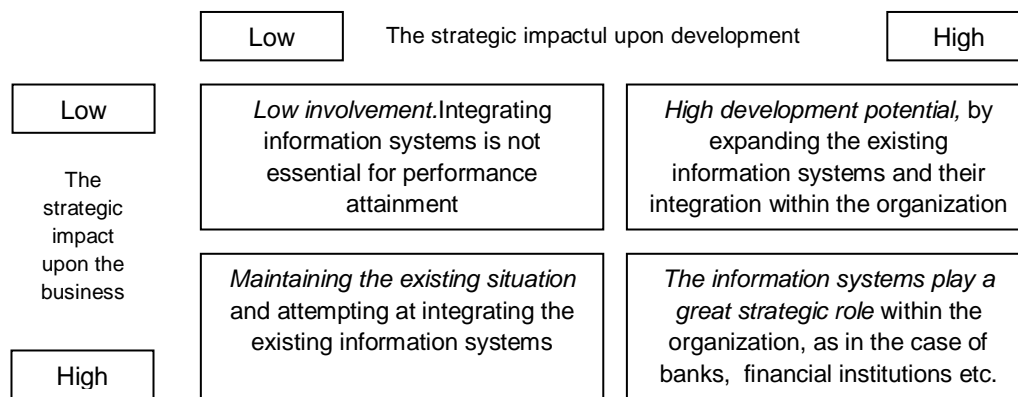


Figure 2. The strategic impact of the use of information technology  
 From: (Florian Bușe (ed.) et al, „Manual de inginerie economică. Tehnologia informației în domeniul managerial”, [Economic Engineering Textbook. Information Technology and the Managerial Domain] Editura Dacia, Cluj-Napoca, 2002, p. 33;)

The implementation of new strategies makes deep organizational changes a necessity. These strategic changes represent a solid sustaining basis for maintaining the competition advantages on the long term. They are not easily achieved since the organization resists changes to a certain extent, through its mid level management or even at the level of strategic management. Resistance to change represents the greatest obstacle for the strategic alterations. In the case of interorganizational information systems a resistance to change can be identified if the organisation perceives it as a threat if it accepts a strict coordination from another organization.

In the past information was considered a necessary evil being associated to the bureaucracy in the domain of planning, production or distribution of goods or services. In the 50’s of the 20th c a reduction of the processing costs of the data was intended by the use of the information systems. The costs were high due to the large paper consumption and labour especially in the accounting and finance domains. By the mid 80’s the information started to be perceived as a strategic asset or as a resource which the companies could use to confront their competitors. These conceptual changes regarding information mirror the progress achieved by the strategic theory and planning.

At present *organizations regard the information as a strategic resource similar to the capital and the labor factor*.<sup>2</sup>

All types of information systems are valuable because they support the organizations in solving a multitude of very important problems. These systems are powerful instruments which allow organizations to withstand competition; they are also called *strategic information systems*.

Their importance consists in the fact that they are capable of operating at any level of the organization. They may lead to the changing of objectives, processes, products, services or the relationship of the organization with the business environment. Moreover they help the organizations to obtain advantages in competing against their rivals. In some of the cases these systems brought about changes even at the level of the business portfolio of the organization, determining the company to assimilate a new behavioral model. In certain situations the organization has to change the modality in which it carries out its internal operations in order to obtain the advantages provided by the new technologies, specific to the strategic information systems. These changes may lead to searching for new managers capable of putting up with the new demands, to the employment of new categories of personnel and the configuration of tighter relationships with the customers and suppliers.

In our opinion the most important characteristic of an integrated ERP type information system, from a managerial point of view, is the one revealed in chapter 1.4, namely that the ERP systems observe the **holonic principle**.

One should bare in mind that the holonic principle (from the systemic approach of the company management) considers that each component part is regarded as a subsystem which, by achieving its objectives contributes to the fulfilment of the general company objectives.

Mention should be made that a holonic structure offers outputs towards other connex zones rendering the scalability of the system very easy to achieve.

In practice, the most frequent employment of this property is the connection to the **Decision Assisted Systems**. This represents a defining characteristic of the ERP systems, that of offering interfaces both for the data import from other systems, such as, for example, bar code scanners, industrial translators, measurement and control aparata as well as interfaces for information export such as other ERPs, EAI systems, government information systems (Ministry of Finance, The Pension Benefit Guaranty Corporation, Health Insurance Companies, etc)

By offering a set of validated, credible pieces of information and the possibility to trace it back to the source, the information systems, by means of the **business intelligence** application constitute an indispensable instrument for the management process of a company irrespective of the hierarchical level of the respective management.

## **CHAPTER 2. ERP TYPE INFORMATION SYSTEMS; CONCEPTUAL APPROACHES**

This chapter approaches the evolution and use of the ERP systems and the introduction of several studies regarding the present day situation of the ERP systems on the Romanian market. Thus according to the PAC (Pierre Audoin Consultants – a market analysis company) studies for the year 2009, the local ERP market registered a much stronger

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<sup>2</sup> Militaru Gheorghe, „Sisteme informatice pentru management”, [Management Information Systems] Editura BIC All, București, 2004

decrease than the one registered at the level of the entire software and IT service market in Romania. The Romanian offer of ERP solutions is also analysed in the present chapter, based on PAC studies as well. On the basis of these studies a group of ERP solutions takes shape, a group dominated by SAP. In what concerns the market share detained by the ERP solution vendors, the first place in the top made by PAC is held by SAP (23-24%) followed by Oracle (with an approximately 15% market share), while the third and fourth places are occupied by Siveco and TotalSoft (cca 11-12%), followed by Wizrom (approx. 7%) and Microsoft (under 5%). The largest growth in market share, according to the same source was attained by TotalSoft which succeeded in growing with almost 60% followed by Transart and Senior Software (market shares under 5%), which registered an encrease of 20% and 15% respectively. A significant decrease was registered by Siveco and Epicor. At the same time we have fundamented the planning and implementation of an ERP system by studying the development strategies of ERP systems, that is we have analysed the life cycle in creating and implementing an ERP. An outstanding accent was set on presenting several strategic alternatives in achieving ERP type information systems and on defining the trends in the evolution of integrated systems, although, according to some opinions, this evolution might get to an end through the incorporation of ERP systems into ERM - *Enterprise Resource Management*. Thus, the latter are seen as “the future” of the ERP systems bringing about the advantage of a perfect integration between the ERP and BPI - *Business Process Integration*. There are four main trends which are revealed; these are: integration and flexibility development, expansion to e-business applications, a wider cooperation with the new users and the adoption of the Internet technology.

Before 1998 the great majority of the large and very large companies had already installed ERP systems, so that their suppliers have reoriented their marketing efforts towards middle sized companies (with less than 1000 employees). These constituted a mature and profitable market. Figure 3 presents a sketch of the evolution of the ERP systems.

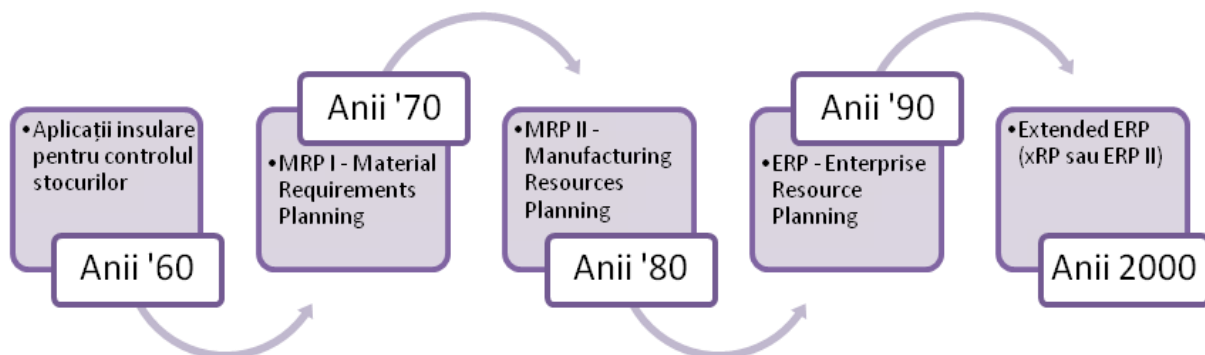


Figure 3. The evolution of ERP systems

(Fotache, D., Hurbean, L. – *Soluții informatice integrate pentru gestiunea afacerilor* [Integrated information solutions for business management] – *ERP*, Editura Economică, București, 2004, pag. 16)

Mention should be made of some of the several company problems which can be solved by means of ERP solutions:

- Allotting insufficient funds for the company strategies and initiatives

- Lack of vision and clearly defined objectives
- Inefficient communication regarding the company strategies and initiatives
- Low stimulus indicators for the employee sustainment in achieving objectives
- Lack of capability in precise establishing and planning of customer demand

Besides allotting funds, the objective defining and their communication solutions within the organization allow for an improvement in the administration of the relationships with the employees (ERM), benefiting of other technological solutions as well such as portal sites and self-service solutions for the employees.

Still in this chapter we present the role of the EAI and ERP systems within the Romanian economy, defining the concept of Enterprise Application Intergration (EAI) as one that is quite frequently used when the next step in e-Business is in question. EAI refers especially to ERP integration with the other information systems such as ECM (Enterprise Content Management – the unstructured information management), since the structured information, processed by ERP represents only 20% of the necessary information for making a business decision.

In the particular framework of planning an ERP type information system, the top-down analysis method is considered adequate due to the high complexity degree of a project, while the use of prototype creation combined with the participative approach and the phenomenologic approach are effective means of achievement.

Creating a prototype is resorted to since the ERP type software provide a test company simulating all the functions of a company and on the basis of the demo version data base both the operating modalities and the resulting centralised situations can be exemplified. After the key users have acquired the functions and the performance of the software, one can pass on to the stage where the software is modified, according to the particular necessities of the beneficiary.

The speciality literature considers that the solution has not been well chosen, that is the implementation is not cost effective provided the alterations brought to the standard form are in excess of 10% upon the implementation of an ERP.

There results the conclusion that in the anlysis phase of the real, concrete, and updated necessities of the company, which is the starting phase of an implementation, it is necessary that all the key users should define their requests very clearly and restrictively, so that during the selection process that software should be chosen which best models the business requirements of the company.

We consider that the major problems with which the paradigm of the creation of a prototype is confronted can be minimized through the intense presentation of the standard prototype (the result of the know-how accumulated in the product) as an initial module of the analysis stage (the “early training” method – the author’s contribution, see chapter 3.6).

We agree that the participative approach sets communication as the foundation of the entire process. For the maximization of the benefits brought about by this approach we consider formalysing to be benefic, including the use of ISO procedures. Thus, using standardised formulii, we consider that the ambiguity is done away with in expressing requirements and resolutions. At the same time, although we appreciate that maintaining the structure of the implementation team unaltered along the entire length of the process development is desirable, it is easier to pass on to integrating a new member in the implementation team by using standard operative formulii.

As far as the role of the EAI systems in economy is concerned, we agree that that represents the following stage in the development of ERP systems. Nowadays multinational

companies interconnect different ERP systems in operation in their different subsidiaries quite often; thus they gradually give up the classical method of imposing a single ERP model on all the companies in the concern.

### **CHAPTER 3. ANALYSIS AND DEVELOPMENT TECHNOLOGIES FOR THE INTEGRATED INFORMATION SYSTEMS**

The latest concepts in enterprise modelling are presented, that is: Enterprise Architecture, Enterprise Modelling, Enterprise Grid Computing and SOA services. Thus *architecture* is defined as a collection of principles, rules, standards, models and strategies for the drawing, construction and development of business processes, resources and information technology within an enterprise. One of the most important realities of today's enterprises is the fact that they are confronted with an ever changing environment, while the long term forecasts tend to bear to an ever larger extent the burden of uncertainty. In order to adapt to this transformation, enterprises have to develop and become reactive, such that change and adaptation should become a dynamic state and not only something occasional forced upon by the enterprise. This requirement imposes the integration of the company and the development of a new discipline which should organize all the necessary knowledge needed for the change and for achieving an efficient change. Thus *Enterprise Modelling* was born. *Enterprise Grid Computing* – EGC – signifies the setting to work several computers existing at the level of the organization and making them function as an integrated system.

*SOA (Service Oriented Architecture* - software architecture based on services). It is a flexible architecture that is standardised contributing to a better connection between the different applications. It facilitates the information exchange among these. SOA unifies the business processes structuring the large applications as a collection of smaller modules called services. These applications can be used by different groups of users both inside and outside the company.

The enterprise architecture may be described as:

**1. Conceptual architecture**

The architecture of the business

Generic software architecture

**2. Technical architecture**

The architecture of the information system

The implementation architecture

**Enterprise Architecture** details and reveals the structure of an organization including the business processes, the applications, technologies and data, as presented in Figure 4.

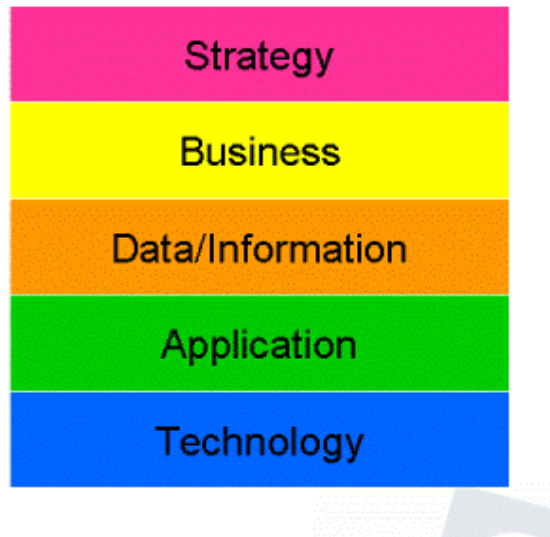


Figure 4. Common elements in Enterprise Architecture Structure

Source: [www.technology-training.co.uk/introductiontoenterprisearchitecture\\_30.php](http://www.technology-training.co.uk/introductiontoenterprisearchitecture_30.php)

A separate subchapter concerns the UML language both from the perspective of its apparition and evolution and of its characteristics. UML reunites the most adequate techniques and practices in the domain of programming engineering which have proved their efficiency in the construction of complex systems. The popularity of the UML language brought about the apparition of products – dedicated software of CASE type such as Rose (from Rational company), Rocase (The Technical University of Cluj-Napoca), GDPro (Advanced Software Technologie company), Visual Modeler ( Visual Studio, Microsoft). By using UML any type of application can be modelled which is destined to any combination of software, operating system, or programming language. The flexibility of this modelling language can be used for client-server, real time, tranzactional, distribution, and other applications. UML is quite compatible with object oriented programming languages (such as C++, Java, C#, etc.), but it can be used equally well with applications developed with procedural languages. By using the XML/XMI standards, the UML model created with a certain modelling product can be transferred to another product or a repository.

In the past programmers would develop software without a thorough analysis and an adequate planning of the respective programmes. The analysis and planning phase of a system should be ready before achieving the code in order to attract the heightened attention of the diverse developers.

These stages were ignored in the past, but at present any developer would acknowledge the importance of this phase since it has been proven that the production of adequate and competitive software depends on that.

Modelling languages have been created for the analysis and planning of systems. One of these modelling languages is the Unified Modelling Language – UML.

UML is not a simple object oriented modelling language; at present it is the standard universal language for software development worldwide. UML possesses an expressivity which helps in solving modelling problems and which the older languages did not have. At present, UML offers system architectures which function on the analysis and planning of

objects by means of a language corresponding to the specification, visualisation, building and documenting of software system artefacts. UML is a modelling language which offers a graphic expression for the structure and behavior of the software before initiating the planning and development of a system, especially if that is as complex as the ERP type information system.

My main contribution brought to the domain of integrated information systems is in my opinion a genuine method I have named “The early training method”. The method proposed by me has an intensive training module based on a standard model as an initial module of the system analysis stage (within the lifecycle of the implementation process). The arguments were detailed in chapter 4. I will mention below the main ideas. After having chosen the software solution which best fits (both from the point of view of observing the demand under the technical specifications as well as of the implementation costs) the future contract for supplying the information solution (not necessarily an ERP) will mention the obligation of initiating the implementation process by an intensive training using a standard model of the application. The advantages I foresee:

- key users will get accustomed to the logics of the new system
- they will get used to the screens for data introduction and result extraction, to the filtering modalities for the existant information
- they will see a functional model from A to Z, that is from set ups to statistical reports
- they will get familiar to the know-how the solution brings about
- they can fill in the series of questions asked during previous presentations during the session of visualizing information solutions
- they will establish cooperation relationships with the team of consultants from the company supplying the information solution in a climate with a much lower stress level than in the case of instructions held under the pressure of the effective work, in two simultaneous systems
- they can signal possible gaps or regions where further development might be needed
- in extreme cases it might become obvious from the very beginning that the chosen solution does not match the requirements and the contract can be terminated before the snowball effect of the implementation gets started and the costs pile up in the expenditure accounts

The disadvantages might be present especially in the implementation zone, namely:

- the necessity for a standard model to exist for the information solution which should be as close as possible to the object of activity of the client in order to ease the effort of the key users to extrapolate the “what they see” to “what the final solution will be like”
- keeping unchanged the composition of the consultant team along the entire duration of the implementation for fear the human bonds gained at the beginning of the implementation might be lost
- accepting the risk of an abrupt, amiable termination of the contract if the client considers that the development necessities (personalizations) which are to be executed by the supplier exceed 10% of the standard functions on offer

The disadvantages for the client could be the following:

- setting up a team of key users consisting in personnel who will work effectively with the new information solution and not of personnel who will



not participate directly in the maintenance of the system, but will be the beneficiaries of synthetic situations (department managers)

- the transfer of the implementation decisions from the top management to the future users – the risk is obvious in the case of manifest reluctance to the solution itself or to the act of changing the system
- the necessity to allot sufficient time for the key users to participate in the instructions on the basis of the standard model, presentations which should not be held on the client's premises, in order that the personnel be totally detached from their daily work responsibilities
- it presupposes a sustained intellectual effort for the assimilation of the new concepts encapsulated in the proposed solution in a reasonably short time; in order to stimulate this aspect I suggest that the early training period should conclude with a short grid test which might reveal the registered perception degree per module per key user and according to the result the analysis activity should be initiated or perhaps some modules/ presentations should be resumed

The reasons why I suggest the present method. Since I have noticed during the implementation of ERP Navision for Farmec Cluj that several of the functions brought by the “know-how” of the application were ignored by the key users both due to the stress they were under working already in parallel, in two systems, and to the fact that the instruction model did not have all the settings in place, settings which were carried out during the implementation process. This aspect has been also confirmed to me by the consultants of the ERP solution providing companies who also noticed during previous implementations in other companies the same superficial approach phenomenon with regard to the novelties brought about by the acquired system, the key users focusing on the identification of functions and facilities resembling as closely as possible the old system (which provided them with a sense of security, being familiar to those). We should also acknowledge that the supplying companies are also interested in carrying out developments in the range of profitability upon client request, developments whose costs may exceed even the cost of the software licence acquired by the client.

In conclusion, by making use of this early training a deeper knowledge of the “engine” of the proposed information technology and of the novelty brought along could be achieved. Thus the requests for developments would be treated with more responsibility. In some of the cases the client may give up the approach modality utilized in the old information system and he could accept using another model proposed on implementation. The statistic reports from the financial, costs and commercial domains provide a most eloquent example.

#### **CHAPTER 4. AN ERP SYSTEM PROTOTYPE WITHIN SC „FARMEC” SA COMPANY CLUJ**

It contains the analysis of the existing system, its critical evaluation which eventually justifies the necessity of implementing a new ERP type integrated information system. At the same time the solutions for improving the existing system and for applying the ERP paradigm are relieved. The architecture of the planned system and the requirements for implementing this new system are also presented.

The necessity of planning an ERP system prototype which should be at the basis of selecting a solution and its consequent implementation was a must due to the moral wear of the existing applications at that time in SC Farmec SA Cluj.

The databases were stocked extensively on local stations in dbf format and Fox 2.6 was used for their management. The Novell server hosted the main transaction bases still under a dbf format. These bases were for sales, purchase (procurement) and for the materials' management. MySQL databases were on the MySQL server. They were completed through data import from the dbf type databases received as attachments to daily emails sent by their commercial representatives, 13 in all. After taking them over in MySQL with a PHP application a centralised situation was generated for the sales covering a certain period.

The systems were also very rigid to the modifications imposed by the market economy requirements.

In depicting the requirements at the basis of the new system, those demands were insisted upon which were specific to the manufacturing activity in Farmec company. This aspect obviously generated an orientation towards an ERP solution. At the same time, the solutions for improving the existing system and for applying the ERP paradigm lead to the same conclusion, that is the ERP type integrated information system.

Bringing arguments for the necessity of the new system we have revealed the facilities brought about by an ERP system from among which only those completely missing from the existing system are mentioned; these are: quick reaction, flexibility and traceability, company process optimization and integration.

În prototipul NAVFARM am inclus ca module noi, față de o structură standard de ERP următoarele Compared to a standard ERP structure the following modules have been introduced as new ones into the NAVFARM prototype:

1. Transport management. The module has specific demands referring to the logistic activity of transports.
2. Maintenance management. This module needs to satisfy the management demands of the maintenance activity of the production facilities. The necessity for this modele to be introduced appeared due to the conditioning exerted by the maintenance activity of the production facilities on the manufacturing process managed within the "Manufacturing Management" module.
3. Prototype expanding possibilities. It can be connected to an SFA application for sales and to an SCM application for the purchasing (procurement) part.

## **CHAPTER 5. IMPLEMENTATION STRATEGIES FOR AN ERP SYSTEM**

At no times should an information system be perceived, whatever its name, as substituting the decision and management factors in an organization. The implementation of an ERP system in a well organized company brings about enormous benefits, but the same system may constitute a burden for an unprepared company.

Looking back at the ERP-Navision implementation process within SC Farmec SA and having exposed the methodological support in chapters 2 and 3, the following conclusions are drawn:

1. An ERP type integrated information system implementation process needs the support of an entire organization in order to be successful
2. Methodological implementation lends itself to modelling (see chapt.2).
3. An ERP solution needs to have a standard demo basis close to the specific activity of the client company.

4. *It is worthwhile to invest time in the early training of the end users since the development requests are subsequently optimized.*
5. Any possibility of data migration (export) in electronic format from the old solution towards the ERP has to be identified and encouraged; thus the final users will have more time to get accustomed to the new formats and possibly new validation rules.
6. The IT department of the client company responsible for the accuracy of the data transfer, installing and start-up settings has to be involved from the very analysis phase since *that department is composed of personnel specialised in different areas of the company's activity.* They can bring up nuances or corrections to the initial requests of the designated key users who manifest a natural tendency to ask for the new system to resemble the old one.

The implementation of an ERP type integrated information system is a very complex process which bears direct influence on the economic results of the company. Both during the preparation for implementation, the implementation proper and post-implementation, the beneficiary company will cover significant costs in connection with the process of changing the information system. One should not forget that the information system is a real time mirror of any company activity. *During implementation, the two systems will work in parallel for a period so that the people will be double charged and the stress will be threefold* due to the fact that they will be working in a new system they are learning on the go while performance is already expected. That is why the mixed team of councilors and key users will work in a sustained rhythm, will take part in trainings, will work many extra hours in order to cover for the necessary works and they will make efforts to learn by themselves using the documentation set at their disposal by the supplying company.

The success of a company is notable both for the beneficiary and for the solutions provider since the first one will benefit from the advantages promised when the solution was introduced, advantages on the bases of which the decision of selecting a certain solution was made, while for the implementor it will constitute a new page in his portfolio presented in the next bidding sessions. And obviously, the implementing company will benefit from the acquired knowledge perhaps in a novel economic domain, an aspect that will make a possible implementation in a similar profile company much easier.

The implementation of an ERP type integrated information system into an economic entity where an ERP has not been previously in use brings about both for the decision makers (The administrative council, The Management Committee, etc) and for the everyday users a different horizon regarding the information system, a different ruling over the economic phenomenon and not in the least a richer range of information at hand when decisions have to be made.

In conclusion the process of implementing an ERP type integrated system needs the support of the entire organization in order to succeed. And it certainly will provided the human and financial support exists. What is left to be done after passing on to the new ERP? The following versions of the chosen solution should be installed, versions bringing along other facilities which the new ERP beneficiaries will assimilate with ease, being already familiar with the logics of the entire system.

## **CHAPTER 6. THE PRESENTATION OF THE PRODUCTION MODULE WITHIN THE NEW PROTOTYPE; DEVELOPMENT AND IMPLEMENTATION**

The way “production management is endowed with information technology” (o.n.), generically named “Production” mode is functionally similar, irrespective of the software solution chosen. Any such module will have options through which the following actions can be executed:

- Setup – the working schedule, the number of shifts and working days are defined
- Defining the articles in the area of raw materials, packaging catalogue
- Defining the articles in the area of technological circuits (execution technology)
- Defining the articles in the area of production facilities (equipment, etc.)
- Defining manufacturing networks or operation plans
- defining activity calendars for production shops and equipment
- setting up production commands
- launching the execution of production commands
- supervising the execution stage of a production command
- final record of production results
- supervising the observing of technological discipline (observing normed consumption)

These functions are to be found in all ERP solutions which incorporate a production module such as: SAP, Microsoft Dynamic Nav (Navision), Clarvision, Socrate, Charisma, etc.

The main specific request of the project in Farmec company refers to the production process. This could be assimilated to the production carried out in the chemical or medicine industries from the point of view of its characteristics. Thus there are two phases of production: preparation and packaging. At present the company operates with the semifabricated notion. During preparation there exists a liquid semifabricated item with specific manufacturing networks and for packaging there is a Finite Product option in case this is packaged and sold as such, or there is a semifabricated packaging in case this enters the composition of a different product (for example: packages containing several products: cream, lotion and deodorant). Thus the application has to take into consideration the raw materials contained, the consumption in kilograms, the technological losses and especially the manufacturing networks that are of several kinds: informative, semifabricate, bulk, beauty parlours, metro, selgros, minisamples, with 10% indirect tax, with 50% indirect tax etc.

The specific requests of the project are synthetised in principle in an official document called technical specifications, a document at the basis of the analysis for ERP solutions providers in order to establish whether the product promoted by the respective companies cover the requests of the future beneficiary.

The information specified in the document also needs to allow for establishing the proportions in which these requests are satisfied by the offered solution. They are at the basis of the selection process of participating companies and ERP solutions providers.

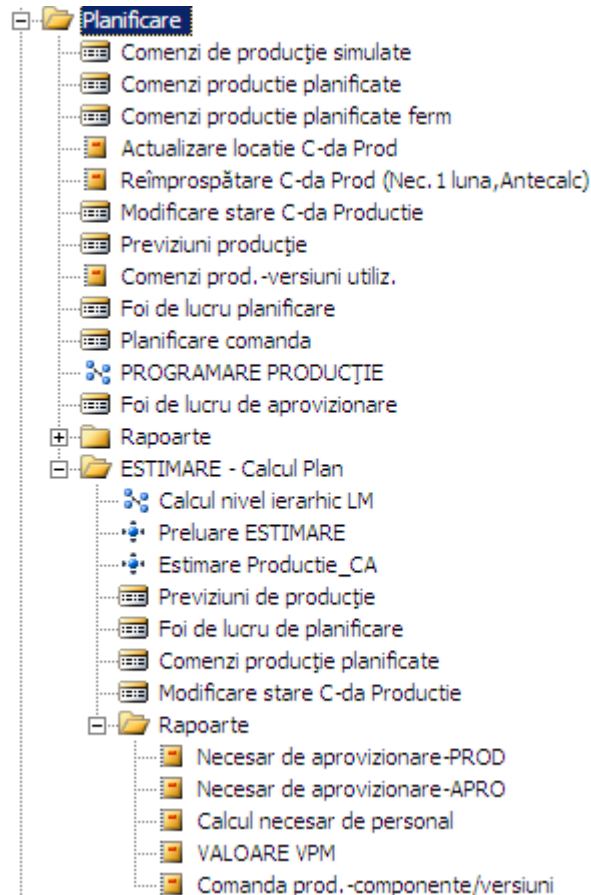
The content of the technical specifications is structured into several sections and within each section the main requireemnts offered by the ERP solution provider are mentioned.

Thus the major personalisation for Farmec is considered to be that of reconceiving of the technical tags (operation plans in the standard variant) in such a way that that should possess all the necessary elements for a manufacturing network.

Using the facility offered by Navision, that is the possibility to create new menus, we have regrouped the functions of the initial “manufacturing” menu by two new ones namely :

- “Manufacturing – Planning” (Figure 5)
- “Manufacturing – Execution”

Thus, out of the global activity developed within the **Preparation Planning-launching** and **Product Supervision** process, activities strictly connected to the meeting of manufacturing orders and production discount, activities developed in manufacturing workshops stand out. All the other activities are carried out within the Technical Norming Department.



## Planning

Simulated production commands

Planned production commands

Resolutely planned production commands

Actualization of prod. command location

Refresh prod. command (1 month, pre-calc.)

Production command state alteration

Production forecast

Prod. commands – user versions

Planned worksheets

Command planning

Planning command

**PRODUCTION PROGRAMMING**

Supply worksheets

Reports  
 ESTIMATES – plan calculus  
 LM hierarchical level  
 Taking over ESTIMATES  
 CA production estimates  
 Production forecast  
 Planning worksheets  
 Planned production command  
 Alteration of production command state  
 Reports  
 PROD supply necessities  
 APRO supply necessities  
 Personnel necessity calculus  
 MPV VALUE  
 Prod. command – components/ versions

Figure 5. Navision-Production (Manufacturing) Menu for the planning and launching of the production area, altered to comply with the requirements of the NAVFARM project

This reconsideration of the menus will allow for an easier management of the “roles” (from the point of view of the access security to the Navision resources). Actually the operators in the manufacturing shops will have strict access to the production commands launched where they will not be able to modify certain fields (for example the launched quantity). The operators in the Technical Norming Department will not have access in the area of execution of the commands and consequently they will not be able to get involved in disconnecting the production; they launch the production commands for this area.

I consider that the standard requirements comprised by the technical specifications pertaining to the production modality within the ERP prototype could be completed by the following activities:

Under the section concerning the programming and launching of production, it would be useful to introduce the following requests:

1. Organizing the production activity on the basis of projects and carrying out their development supervision (achievement deadlines, cost calculation)
2. Setting plans for new products
3. Creating product and technological files
4. Supervising the system procedea

Further on, in the production supervision section, I consider that a focus on the quality management requirements would be benefic. In order to achieve that function, I consider that the technical specifications should also include the following requirements:

1. The possibility to launch rectifying or rehabilitation commands (thus implicitly defining the rectifying technology) as well as supplementing the commands for scrap replacement
2. Drafting the minutes for quality and conformity (including nonconformity)
3. Follow up the quality claims

If we refer to the production mode in its wholeness, we might find the following:

1. ERP solutions the suppliers present on preview after consulting the requirements in the technical specifications; it is very rare that they cover the requirements 100%. This is the result of the different, otherwise totally legal approach of companies regarding their accounting organization. It is known that the Act of accounting for companies in the industrial domain demands that financial accounting is conducted which has as a result a mirror of the profits/losses (account 12 - Profit and losses) in the accounting balance. For the inventory accounting it is specified that the company may or may not conduct it. Since the inventory accounting a refined image of the expenditure occasioned by the production activity and those connected to it is obtained, (purchase, transport, etc...); thus cost calculations could be carried out in an ante calculus or post calculus, new product manner. The majority of the companies have such an evidence. The "Production" should offer all the necessary information for mirroring the production flux and processes by costs.
2. Another important aspect which constituted the object of the analysis of the implementation of an ERP system refers to the necessity of restructuring the standard functions of the product

It is obvious that the ERP solution acquired comes with that know-how generated by previous implementations. But alterations are always necessary or function addition which will generate, obviously a richer knowledge bank (for the implementing team) while the ERP product will be added new facilities/functions probably useful in a future implementation within the same industrial domain or a similar one.

Unfortunately the Navision system production modality proposed in the work did not have previous implementations in the cosmetics, chemical, petrochemical, food or to put it more briefly in the synthesis (or process) industries. That lack of know-how in the synthesis industry will impose the necessity of solving several gaps in order to respond as best as possible to the requests formulated by the company management.

As a future direction for the enrichment of the functionality of the production mode in the NAVFARM prototype I propose the construction of a module for "production optimisation" in order to suggest working with "optimally normed preparation charges" . Achieving this aim would considerably diminish the necessary time for transforming a "sales estimate" into production commands.

The conclusions of the research carried out with regard to the replanning and implementation of the production module makes us sustain the fact that for Farmec company, the restructuring process of the module, which could be considered a central element of the prototype fulfilled its role of answering more fully to the requirements of the production process within the company.

We also consider that there is a need for continuing the research from different angles, the effects of these pointing to the company under discussion as the main beneficiary, but not exclusively.

## **CHAPTER 7. THE AUDIT OF THE NEW SYSTEM AND ITS ECONOMIC EFFICIENCY**

It is obvious that nowadays when a huge volume of financial transactions is carried out by means of computerised systems, the auditors have to deal with all the aspects and risks connected to the use of computers and information systems.

The control and audit of information security require a systematic and methodologic approach. One of the standards guiding this approach is the CobiT™(Control Objectives for Information Technologies). This standard represents the methodological basis for the checking and information security control on the internet, extranet, intranet, data banks and on-line transactional processes.

According to ISACA (Information Systems Audit and Control Association<sup>3</sup>), a definition for the audit of information systems is the following: “The audit of the information systems presupposes the revision and evaluation of all the aspects connected to the automated data processing, including the manual processing connected to the interface between the two systems and the system itself.”<sup>4</sup>

The chapter also includes as it is natural the analysis of the results of the implementation of an integrated ERP type information system. First of all the concept of audit is defined for information systems and the resources of the projected system are identified. The benefic role of the continuous audit methodology is presented after that and the way its paradigms (of the continuous audit) can be integrated into the ERP modules. In the end the evaluation methods are mentioned with regard to the economic efficiency of an ERP system implementation. Special attention is paid to the computer assisted techniques known as CAAT (Computer Assisted Audit Techniques). The techniques and instruments are presented in Figure 6:

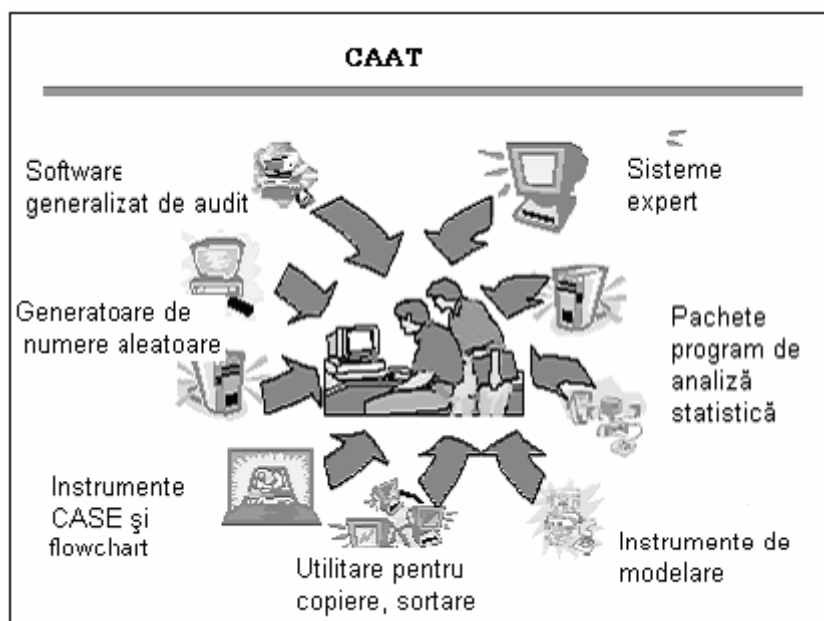


Figure 6. Computer assisted audit techniques and instruments  
Adapted from : Richard Baskervill – EDP Auditing, Georgia State University

CAAT  
Audit generalized software  
Random number generators  
CASE and flowchart instruments  
Copying, sorting utilities  
Expert systems

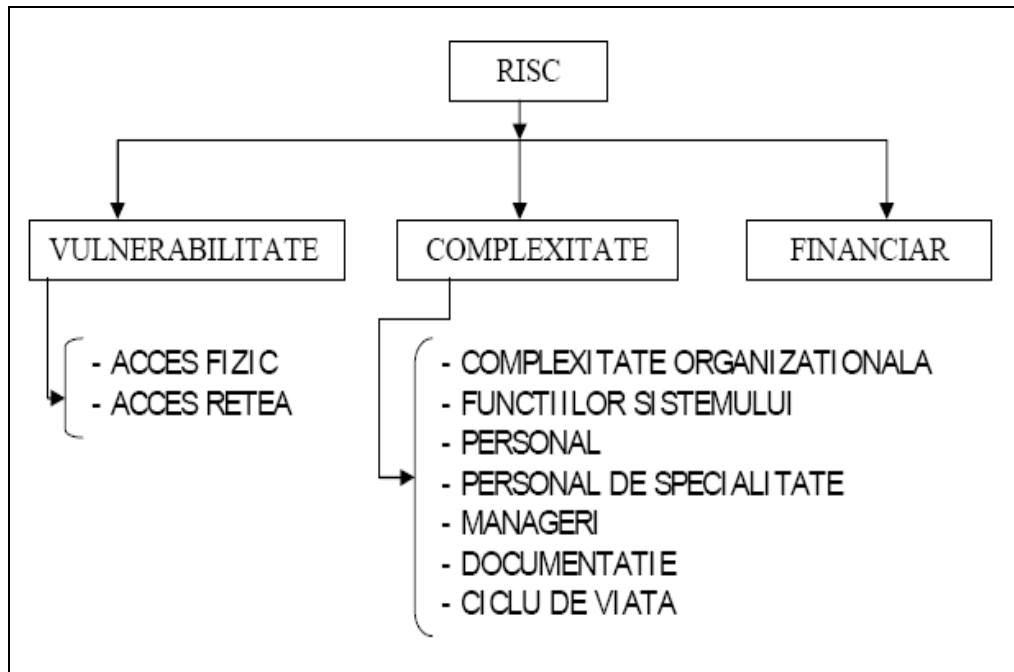
<sup>3</sup> [www.isaca.org/About-ISACA/History/Pages/default.aspx](http://www.isaca.org/About-ISACA/History/Pages/default.aspx)

<sup>4</sup> Weber, Ron, EDP Auditing--Conceptual Foundations and Practice at:  
[http://www.isaca.org/Content/NavigationMenu/Students\\_and\\_Educators/IT\\_Audit\\_Basics/](http://www.isaca.org/Content/NavigationMenu/Students_and_Educators/IT_Audit_Basics/)



The necessity to utilise information instruments within an audit mission has become vital, but a combination of the manual techniques and the computer assisted ones ensure their success in an optimum time at reduced costs.

A qualitative evaluation model for risk assessment is presented in Figure 7.



	RISK	
VULNERABILITY	THREATS	FINANCE
PHISICAL ACCESS NETWORK ACCESS	COMPLEXITY of ORGANIZATION SYSTEM FUNCTIONS PERSONNEL SPECIALISTS MANAGERS DOCUMENTS LIFE CYCLE	

Figure 7. Risk assessment model  
Source : ([www.theiia.org/itaudit/](http://www.theiia.org/itaudit/))

The efficiency of an information system is based on the comparison between the indicators regarding the economic activity, before and after introducing or improving/upgrading of the information system taking into consideration the effort invested by the company.

*Economic effect indicators* translate into direct and indirect results which appear in the current activity of the beneficiary unit.

The *direct* economic effects are a consequence of the influence exerted by the information system upon the economic system of the economic unit and it is reflected practically through the intermediary financial-economic factors.

The *indirect* economic effects reflect the increase in incomes, the possible reduction of costs, supplementary cash and hard currency economies achieved through the introduction, implementation and exploitation of the current system.

In a real case of an ERP implementation in an economic company all the steps detailed in chapter 7.3 “The Information system control“ are followed naturally; that is the information system has to mirror the business process as closely as possible.

In our opinion, the audit of an information system within an economic entity where an ERP implementation is desired, has two components:

- 1) The necessity audit which has the role of revealing the necessity (or lack of it) of changing the existing information system.
- 2) The continuous audit of implementation (provided that within the conclusions of the necessity audit it was suggested and the management of the economic entity has accepted, the implementation of an ERP).

Depending on the professional maturity reached by the IT department in the respective economic entity, I consider it is the first organism (which can be assimilated to the internal audit) which should periodically carry out an auditing of their own information system. Why?

1. They are the most knowledgeable regarding the risks induced by the existing information system. They know both the applications they manage and the operators (users) who feed the data into the system.
2. By the nature of their profession they should constitute the point of the spear with regard to the introducing into the economic entity of new technologies in the information domain.
3. If they pass through an information system implementation process naturally, vernacularly, they will pass through all the stages of an audit for an information system.

After having carried out the internal audit, due to the subjectivity of the opinions expressed by the IT department members, I consider that an annual external audit should be also carried out. Obviously, that is if the economic entity has not yet implemented an ERP ensuring through its nature a high degree of integration and a low degree of redundancy.

Has the economic entity implemented an ERP, due to the average utilisation span of 8 years, the audit of the information system may be left with the internal audit compartment in cooperation with the IT department.

In this latter case where new requirements appear, I consider the decision to develop collateral applications instead of purchasing a model to solve these demands, improper. In my opinion the unitary character of an ERP should be preserved and the separate development of applications will elude the ERP validation regulations (see chapter 7.3 Continuous audit and 7.4 The integration of continuous audit regulations into an ERP system).

The integration of the continuous audit rules into an ERP system.

In what concerns the economic efficiency of the planned system it can be noticed that the information systems may be characterised by a multitude of functional and economical peculiarities proving their efficiency and utility. These are subject to assessment according to their specificity. A comprising study on efficiency for an investment in information systems involves a process regarding the financial estimates of the aspects referring to the processes, practices and motives which are fundamental to it.

Appreciating the value of the investment may be carried out according to its potential benefits and the necessary resources in order to achieve and maintain it (exploitation costs). Economic efficiency indicators can characterise both an initial investment into an information system and an upgrading of a functional information system.

In conclusion we appreciate that the implementation of an ERP system into an economic entity will bring about extra speed and an awareness of the role detained by the users in data propagation throughout the system. We should note that the accidental errors registered by the system can be corrected only by means of other recordings in the system, recordings ensuring information traceability according to ISO standards.

## **CHAPTER 8. PERSONAL CONTRIBUTIONS AND CONCLUSIONS. DIRECTIONS FOR FURTHER RESEARCH**

The first aspect taken into consideration in the opening part of the work addresses the managerial particulars of companies in the industrial domain. In my opinion, the most important characteristic of an ERP type integrated information system, from a managerial point of view is the fact that ERP systems observe the **holonic principle**, a principle considering that every component part constitutes a subsystem which, by means of achieving its objectives contributes to the achieving of the general objectives of the company.

I consider that in practice, the most frequent employment of this property is its connection to the **Decision Assisted Systems**. This represents a defining characteristic of the ERP systems, that of offering interfaces both for the data import from other systems, such as, for example, bar code scanners, industrial translators, measurement and control aparata as well as interfaces for information export such as other ERPs, EAI systems, government information systems (Ministry of Finance, The Pension Benefit Guaranty Corporation, Health Insurance Companies, etc)

I also note that by offering a set of validated, credible information and the possibility to check it back to the source, the information systems, by means of the **business intelligence** application constitute an indispensable instrument for the management process of a company irrespective of the hierarchical level of the respective management.

### **Conclusions and proposals regarding the ERP type information systems**

In the particular framework of planning an ERP type information system, the top-down analysis method is considered adequate due to the high complexity degree of a project. At the same time as an effective means of achievement I propose the use of prototype creation combined with the participative approach and the phenomenologic approach as effective means of achievement. The arguments are the following:

- prototype creation is used as the ERP type software offer a test company that simulates all the functions of a company and on the basis of the recordings in the demo basis both the working mode and the resulting centralised situations can be exemplified
- we consider that the major problems with which the paradigm of the creation of a prototype is confronted can be minimized through the intense presentation of the standard prototype (the result of the know-how accumulated in the product) as an initial module of the analysis stage (the “early training” method – the author’s contribution, see chapter 3.6).
- on the other hand we agree that the participative approach sets

communication as the foundation of the entire process. For the maximization of the benefits brought about by this approach we consider formalising to be benefic, including the use of ISO procedures. Thus, using standardised formuli, we consider the the ambiguity is done away with in expressing requirements and resolutions. At the same time, although we appreciate that the maintaining of the structure of the implementation team unaltered along the entire length of the process development is desirable, it is easier to pass on to integrating a new member in the implementation team by using standard operative formuli.

As far as the role of the EAI systems in economy is concerned, we agree that that represents the following stage in the development of ERP systems. Nowadays multinational companies interconnect different ERP systems in operation in their different subsidiaries quite often; thus they gradually give up the classical method of imposing a single ERP model on all the companies in the concern.

### **Conclusions and proposals regarding the analysis and development technologies for integrated information systems**

I consider that UML is not a simple object oriented modelling language; at present it is the standard universal language for software development worldwide. UML possesses an expressivity which helps in solving modelling problems and which the older languages did not possess. At present, UML offers system architectures which function on the analysis and planning of objects by means of a language corresponding to the specification, visualisation, building and documenting of software system artefacts. UML is a modelling language which offers a graphic expression for the structure and behaviour of the software before initiating the planning and development of a system, especially if that is as complex as the ERP type information system.

The author proposes his own original method of implementation entitled “the early training method”. The method proposes starting the implementation process with an intensive training stage as close to the business model of the beneficiary as possible. The advantages of using this model are considered to be significant for the client leading to a high rate of success upon the implementation of the information solution. Still connected to this methodology some disadvantages are also revealed. The author foresees these in the practical implementation of his proposal. However since this methodology has as a substratum the experience acquired by the author following the effective implementation of an ERP, the author considers his intervention to be benefic.

### **Conclusions and proposals regarding the ERP system prototype within SC Farmec SA company in Cluj**

The model proposed by the author, the model which was at the basis of the selection process of the ERP solution implemented at this commercial company was named NAVFARM. I consider that the method adopted by the majority of the companies implementing information solutions, that of approaching remodelling of the standard product in order to satisfy the client and somehow to make the new product resemble the old system is rather detrimental for the beneficiary who takes advantage only to a limited extent of the know how bought together with the ERP solution.

### **Conclusions and proposals regarding the implementation of ERP type integrated systems**

The author presents the process of selection and implementation that has to be followed by an integrated ERP solution. The conclusion reached upon the experience gained is that the implementation of an ERP type integrated information system into an economic entity where an ERP has not been previously in use brings about both for the decision makers (The administrative council, The Management Committee, etc) and for the everyday users a different horizon regarding the information system, a different ruling over the economic phenomenon and not in the least a richer range of information at hand when decisions have to be made.

Moreover the process of implementing an ERP type integrated system needs the support of the entire organization in order to succeed. And it certainly will, provided the human and financial support exists. What is left to be done after passing on to the new ERP? The following versions of the chosen solution should be installed, versions bringing along other facilities which the new ERP beneficiaries will assimilate with ease, being already familiar with the logics of the entire system.

### **Conclusions regarding the development and implementation of the PRODUCTION module within the new prototype**

The author sets the problems raised by specific production management satisfaction demand in the foreground. The conclusions reached could be that a company in the industrial domain is identified by its production modality as belonging to a certain industrial branch.

The ERP solutions the suppliers present on preview after consulting the requirements in the technical specifications will be covered 100% only in extreme cases. This aspect appears as a result of the different, otherwise totally legal approach of companies regarding their accounting organization. It is known that the Act of accounting for companies in the industrial domain demands that financial accounting is conducted which has as a result a mirror of the profits/losses (account 12 - Profit and losses) in the accounting balance. For the inventory accounting it is specified that the company may or may not have it. Since the inventory accounting a refined image of the expenditure occasioned by the production activity and those connected to it is obtained, (purchase, transport, etc...); thus cost calculations could be carried out in an ante calculus or post calculus, new product manner. Consequently the "Production" should offer all the necessary information for mirroring the production flux and processes by costs.

### **Conclusions and proposals regarding the audit of the new system and its economic efficiency**

After an ample presentation of the legislation governing the domain of information system audit, the author analyses the risks these are subject to, after which he passes to presenting the principles of continuous audit and in the end he highlights several indicators for establishing economic efficiency.

The natural conclusion resulting from the analysis of the advantages and disadvantages presented in connection with the use of information technologies for the audit function may be expressed as follows: the necessity to use information instruments within an audit mission has become vital, but a combination of the manual techniques and the computer assisted ones ensure its success in optimal time and at reduced costs.

In a real case of an ERP implementation for an economic company, all the steps detailed in chapter 7.3 "The controls of the information system" are made naturally; that is the information system has to mirror as closely as possible the business process.

In our opinion, the audit of an information system within an economic entity where an ERP implementation is desired, has two components:

- 3) The necessity audit which has the role of revealing the necessity (or lack of it) of changing the existing information system.
- 4) The continuous audit of implementation (provided that within the conclusions of the necessity audit it was suggested and the management of the economic entity has accepted, the implementation of an ERP).

Provided the economic entity has implemented an ERP, due to the average functioning span of 8 years, the audit of the information system may remain as the responsibility of the internal audit compartment in cooperation with the IT department. This internal audit has the role of maximizing the utilization of all ERP functions (purchased upon implementation) or revealing new requirements.

In this latter case where new requirements appear, I consider the decision to develop collateral applications instead of purchasing a model to solve these demands, improper. In my opinion the unitary character of an ERP should be preserved and the separate development of applications will elude the ERP validations regulations (see chapter 7.3 Continuous audit and 7.4 The integration of continuous audit regulations into an ERP system).

### **Perspectives regarding subsequent research**

As long as production activities exist there will also be a preoccupation for rendering these more efficient, for minimising costs and maximising profit. From this perspective the author considers that one direction for further research (as it has already been stated in the work) is the study of the methods for an optimised production.

The optimization of production is a challenge both for the production manager and for the computer scientists developing applications in this domain.

Definitely, the ERP solutions offering these optimization facilities (see SAP) are considered superior to other applications with poorer options in this respect. Although Microsoft Dynamics NAV does not possess the module for optimizing the preparation melting stock or the wrapping batches, it still offers a powerful engine for the programming of manufacturing which can be considered to optimize the management of the production commands.

On the basis of his achievements in the domain of the production management and its optimisation modules (specific to the process industries), namely “calculus algorithms for the optimal melting stock” (in the manufacturing of beauty products), the author has approached the study of production management optimization methods.

### **REFERENCES**

1. Ambler, S.W. -, „In Search of a Generic SDLC for Object Systems”, in Object Magazine, 1994, pag.76-78
2. Andone, I., Țugui A. – Sisteme inteligente în management, contabilitate, finanțe-banci și marketing, Ed Economica, 1999
3. Ani, C., **Reș M. D.**, *Characteristics of ERP Software Maintenance*, Annals Of The „Tiberiu Popoviciu” Seminar, vol. 6, Mediamira Science Publisher, Cluj-Napoca, 2008
4. Ani, C., **Reș M. D.**, *ERP Customization*, Annals Of The „Tiberiu Popoviciu” Seminar, vol. 6, Mediamira Science Publisher, Cluj-Napoca, 2008
5. Baskervill, R. – EDP Auditing, Georgia State University

6. Boehm, B. W. - „A Spiral Model of Software Development and Enhancement”, in IEEEC Computer, 1988
7. Booch, Rumbaugh, Jacobson - The UML Modeling Language User Guide, Addison-Wesley, 1999
8. Bouzghoub, M., Gardarin, G., Velduriez, P. - Object Technology : Concepts and Methods, International Thomson Computer Press, Boston, 1997
9. Bușe, F. (coordonator) și colectivul, „Manual de inginerie economică. Tehnologia informației în domeniul managerial”, Editura Dacia, Cluj-Napoca, 2002
10. Carmichael, A.R., Object Development Methods, SIGS Books, Ney York, 1994
11. Coad, P., Yourdon, E. - Object-Oriented Anulysis, Second Edition, Yourdon Press, Prentice HallBuilding, Englewood Cliffs, New Jersey, USA,1991
12. Coderre, D. – Articolul „Analiza ratelor – O înțelegere a tehnicii de analiză a datelor”, [www.theiia.org/itaudit](http://www.theiia.org/itaudit)
13. Cornion, J., P., Haltab, N., J., *Qui a encore peur del'informatique*, Eyrolles, Paris, 1990
14. Digital - A Guide to Use Digital Program Methodology, 1996
15. Edwards, J.M. - The Fountain Model for Object-Oriented Systems Development, in Object Magasine, 1993
16. Fotache, D., Hurbean, L. – Soluții informatice integrate pentru gestiunea afacerilor – ERP, Editura Economică, București, 2004
17. Frățilă, L., Proiectarea sistemelor informatice, Editura InfoMega, București, 2007
18. Hay David C., The Zachman framework:. An introduction, in Object Magasine, 1993
19. Henderson-Sellers, B. and Edwards, J.M.,„The Fountain Model for Object Oriented Systems Development”, in Object Magasine, 1993
20. Henderson-Sellers, - Object-Oriented Metrics - Measures of Complexity, Prentice Hall PTR, Upper Saddle River, New Jersey, USA, 1996.
21. Hoffer, J.A., George, J.F., Valacich, J.S. - Modern Systems Analysis and Design, The Benjamin / Cummings Publishing Company, Inc., Menlo Park, CA, 1996
22. Kosanke, K., ș.a., Manufacturing Enterprise Modelling with PERA and CIMOSA, Proceedings of IFAC Workshop on Manufacturing Systems: Modelling, Management and Control, Wien, 1997
23. Ilieș, L. și colectiv, Managementul firmei, Ed. Risoprint Cluj-Napoca, 2005
24. Lungu I., Sabău Gh., Bodea C., Surcel Tr., “Sisteme informatice pentru conducere”, Ed. SIAJ, 1994
25. Lupaș, M., Modul de training – GMP, Farmec, 2008
26. Martin, J. - Rapid Application Development, Macmillan Publishing Company, New York, N Y, 1991
27. Mehdi, J., Ran A., Frank van der Linden - Software Architecture for Product Families: Principles and Practice,. Addison Wesley Longman, 2000
28. Milan, Z., "The IEBM Handbook of Information Technologi In Business", Editura THOMSON LEARNING 2007
29. Militaru, Gh., „Sisteme informatice pentru management”, Editura BIC All, București, 2004
30. Munteanu, A. – Auditul sistemelor informatice contabile : cadrul general, Ed. Polirom, Iasi,2001
31. Mureșan, M., Generic Integrating Business Architecture, Revista Informatica Economică nr.2 (38)/2006
32. Nicolescu, O., Verboncu I., Fundamentele managementului organizației, Ed. Universitară, București, 2008

33. O'Brien J., Marakas G., "Management Informations Systems", Seventh Edition, Editura McGrawHill International 2006
34. Oprea, D., Analiza și proiectarea sistemelor informaționale economice, Editura Polirom, Iași, 1999
35. Oprea, D., Protecția și securitatea sistemelor informatice, Ed. Universității "Al.I.Cuza", Iași, 2004
36. Oprean, C., Kifor, C., Arhitecturi și modele generice în sistemele, Timișoara, CIM, TEHNO98, 1998
37. Oprean, C., Kifor C., Enterprise modelling with, CIMOSA, CNMU, București, 1998
38. Oprean, C., Kifor, C., Strategia de implementare a sistemelor CIM, Timișoara, TEHNO98, 1998
39. Peaucelle, J.L., La gestion de l'informatique, Les Editions d'Organisation, Paris, 1990
40. Remenyi, D., Investițiile în TI – elaborarea unui studiu de eficiență, Editura Club Europa, București, 2001
41. **Reș, M. D.**, Ghișoiu N., *Design Strategies For An Integrated Information System*, Competitiveness and European Integration, Business Information System Days, Cluj-Napoca, 2007
42. **Reș, M. D.**, *Production Optimisation By Means Of ERP*, Competitiveness and European Integration, Cluj-Napoca, Business Information System Days, 2007
43. **Reș, M. D.**, Ani C., *Criteria for selection ERP*, Proceedings of the Challenges for Analysis of the Economy, the Businesses, and Social Progress International Scientific Conference, Unidocument Kft., Szeged, 2010
44. **Reș, M. D.**, Ani C., *ERP. The standard cost in a manufacturing company*, Proceedings of the Challenges for Analysis of the Economy, the Businesses, and Social Progress International Scientific Conference, Unidocument Kft., Szeged, 2010
45. **Reș, M. D.**, Ani C., *Criteria for selection ERP*, Proceedings of the Challenges for Analysis of the Economy, the Businesses, and Social Progress International Scientific Conference, Unidocument Kft., Szeged, 2010
46. Românu, I., Vasilescu, I., Managementul investițiilor, Editura Mărgăritar, București, 1997
47. Roșca, I. & colectiv, Proiectarea sistemelor informatice financiar-contabile, Editura Didactică și Pedagogică, București, 1993
48. Royce, W. W. - Managing the Development of Large Systems, Proceeding of WESTCON, CA,USA, 1970
49. Sommerville, I. - Software Engineering, 1<sup>th</sup> Edition, Addison-Wesley, UK, 1989
50. Stanciu, V., Sisteme informatice de gestiune, Tribuna Economică București, 1999
51. Stoica, M. (coordonator), Hincu, D., Frățilă, L., & colectiv, Contract de cercetare, cod CNCSU 110/1998, Metodologia de evaluare a proiectelor de transfer de tehnologie, București, 1998
52. Tardieu, H., Rochfeld, A., Colleti, R. - La Methode Merise: Principes et Outils, 2<sup>e</sup> Edition, Editions & Organisation, Paris, 1991
53. Tatomir, Virgil, Analiza sistemelor informatice, Revista e-Week, nr. 12, 2006
54. Teodorescu, L., Ivan, I., Managementul calității software, Editura Infocrec, București, 2001
55. Tubbs, T., Customer Insights, Microsoft, 2006
56. Vătuiu, V., Vătuiu, T., „Strategii manageriale de realizare și implementare a unor sisteme informatice performante la Curtea de Conturi a României”, Editura Academica Brâncuși, Tg-Jiu, 2004



57. Velicanu, M., Lungu, I. s.a - Sisteme de baze de date – Teorie și practică, Ed. Petrion, București,2003
58. Whitmire, S.A, - Object-OrientedDesign Measurement, John Wiley & Sons, Inc., New York, 1997
59. \*\*\*, First International Workshop on Architectures for Software Systems, Mary
60. \*\*\*, IEEE 1471/ 2000, Recommended Practice for Architectural Description of Software-Intensive Systems
61. \*\*\*\* Ministerul Comunicațiilor și Tehnologiei Informațiilor, ORDIN nr. 218 din 14 iunie 2004 privind procedura de avizare a instrumentelor de plată cu acces la distanță, de tipul aplicațiilor Internet-banking, home-banking sau mobile-banking , <http://www.mcti.ro/2087.html>
62. <http://www.agenda.ro/news/news/1044/...-firmele-din-romania-incep-sa-inteleaga-rolul-consultantei-in-domeniul-informatic.html>
63. [www.ager-solutions.ro/navision.aspx](http://www.ager-solutions.ro/navision.aspx)
64. [http://anale.feaa.uaic.ro/.../44 Grama A, Fotache D - Integrarea informationala a IMM-urilor romanesti.pdf](http://anale.feaa.uaic.ro/.../44_Grama_A,_Fotache_D_-_Integrarea_informationala_a_IMM-urilor_romanesti.pdf)
65. Anantha Sayana S., The IS Audit Process, pe adresa : [http://www.isaca.org/Content/NavigationMenu/Students and Educators/IT Audit Basics/](http://www.isaca.org/Content/NavigationMenu/Students_and_Educators/IT_Audit_Basics/)
66. <http://www.bizwords.ro/stiri/economie/9485/De-la-o-tara-exportatoare-de-produse-cosmetice-Romania-a-ajuns-sa-importe-sapun-detergenti-si-pasta-de-dinti.html>
67. Boehm, B., (1995),<http://www.sei.cmu.edu/architecture/definitions.html>,2002
68. [www.charisma.ro/Charisma-ERP](http://www.charisma.ro/Charisma-ERP)
69. <http://www.citynews.ro/bistrita-nasaud/shopping-34/industria-cosmetica-romaneasca-nume-cu-care-sa-ne-mandrim-78940/>
70. CSIA, The risks, pe adresa: [http://www.cabinetoffice.gov.uk/csia/the\\_risks/index.asp](http://www.cabinetoffice.gov.uk/csia/the_risks/index.asp)
71. <http://www.theiia.org/itaudit/>
72. [www.conpirom.ro/pagina5/index.htm](http://www.conpirom.ro/pagina5/index.htm)
73. [www.ebs.ro/produse/clarvision2.htm](http://www.ebs.ro/produse/clarvision2.htm)
74. [www.gao.gov/bestpractices/bpeaguide.pdf](http://www.gao.gov/bestpractices/bpeaguide.pdf)
75. [www.help.sap.com/.../146 Scen Overview RO RO.ppt](http://www.help.sap.com/.../146_Scen_Overview_RO_RO.ppt)
76. [www.hotnews.ro/stiri-arhiva-1205294-greii-domeniului-erp-comenteaza-piata-romaneasca.htm](http://www.hotnews.ro/stiri-arhiva-1205294-greii-domeniului-erp-comenteaza-piata-romaneasca.htm)
77. [www.isaca.org/About-ISACA/History/Pages/default.aspx](http://www.isaca.org/About-ISACA/History/Pages/default.aspx)
78. [http://www.isaca.org/Content/NavigationMenu/Students and Educators/IT Audit Basics/](http://www.isaca.org/Content/NavigationMenu/Students_and_Educators/IT_Audit_Basics/)
79. <http://www.llpgroup.com/ro/index.php/solutii/fbm/microsoftdynamicsnav-navision.html>
80. [www.marketwatch.ro/.../Oracle Business Intelligence Solutii performante pentru decizii strategice/](http://www.marketwatch.ro/.../Oracle_Business_Intelligence_Solutii_performante_pentru_decizii_strategice/)
81. [www.medicultau.com/.../clasificarea-produselor-cosmetice.php](http://www.medicultau.com/.../clasificarea-produselor-cosmetice.php)
82. Nigrini, M. – Articolul „Analiza digitala – Tehnologii de analiza a datelor asistate de calculator pentru auditorii interni”, [www.theiia.org/itaudit](http://www.theiia.org/itaudit)
83. <http://octaviancoifan.blogspot.com/2010/07/inceputurile-cosmeticii-in-romania.html>
84. Ozier, W., *Risk Management*, pe adresa : <http://www.theiia.org/itaudit/index.cfm?fuseaction=forum&fid=349>
85. Perkins, A., Implementing the Zachman Framework for Enterprise Architecture - <http://www.visible.com>
86. <http://profs.info.uaic.ro/~adrianaa/uml/>
87. <http://www.sap.com/romania>

88. [www.sap.com/romania/industries/.../pdf/Platforma\\_SAP\\_NetWeaver.pdf](http://www.sap.com/romania/industries/.../pdf/Platforma_SAP_NetWeaver.pdf)
89. [www.sap.com/romania/solutions/business-suite/erp/pdf/SAP\\_ERP.pdf](http://www.sap.com/romania/solutions/business-suite/erp/pdf/SAP_ERP.pdf)
90. Schwab-Chesaru, E., „ERP România 2008”, [www.clubitc.ro](http://www.clubitc.ro)
91. Schwab-Chesaru, E., [www.marketwatch.ro/.../Isi\\_revine\\_piata\\_ERP\\_locala\\_in\\_2010](http://www.marketwatch.ro/.../Isi_revine_piata_ERP_locala_in_2010)
92. Schwab-Chesaru, E., „ERP România 2009”, [www.clubitc.ro](http://www.clubitc.ro)
93. Shaw, 1995, <http://www.sei.cmu.edu/architecture/definitions.html>
94. [www.scribube.com/stiinta/informatica/ANALIZA-SI-PROIECTAREA-SISTEMULUI-INFORMATIC-UTILIZAND-UML.PHP](http://www.scribube.com/stiinta/informatica/ANALIZA-SI-PROIECTAREA-SISTEMULUI-INFORMATIC-UTILIZAND-UML.PHP)
95. [www.seniorerp.ro/resurse/modul/seniorerp\\_beneficii\\_ale\\_implementarii\\_sistemelor\\_erp](http://www.seniorerp.ro/resurse/modul/seniorerp_beneficii_ale_implementarii_sistemelor_erp)
96. <http://www.siveco.ro>
97. [www.technology-training.co.uk/introductiontoenterprisearchitecture\\_30.php](http://www.technology-training.co.uk/introductiontoenterprisearchitecture_30.php)
98. Țînt, T, Arhitecturi de referință pentru reingineria organizațiilor, [www.armyacademy.ro/reviste/3\\_2004/r13.pdf](http://www.armyacademy.ro/reviste/3_2004/r13.pdf)
99. Weber, Ron, EDP Auditing--Conceptual Foundations and Practice, [http://www.isaca.org/Content/NavigationMenu/Students\\_and\\_Educators/IT\\_Audit\\_Basics/](http://www.isaca.org/Content/NavigationMenu/Students_and_Educators/IT_Audit_Basics/)
100. Will, O., *Risk Management*, pe adresa : <http://www.theiia.org/itaudit/index.cfm?fuseaction=forum&fid=349>