ISSN 1407-7493 **DATORZINĀTNE** **2009-7493**
COMPUTER SCIENCE

INFORMATION TECHNOLOGY AND MANAGEMENT SCIENCE
INFORMĀCIJAS TEHNOLOĢIJA UN VADĪBAS ZINĀTNE

ANALYSIS OF ERP SYSTEMS IMPLEMENTATION IN THE CONSTRUCTION ENTERPRISES

ERP SISTĒMAS IEVIEŠANAS ANALĪZE BŪVNIECĪBAS UZŅĒMUMOS

Andrejs Tambovcevs, M.sc.ing., Ph.D. student, Riga Technical University, Faculty of Computer Science and Information Technology, Mezha street 1/4, LV-1048, Riga, Latvia, ata2000@inbox.lv.

Yuri Merkuryev, Dr.habil.sc.ing., professor, Riga Technical University, Faculty of Computer Science and Information Technology, Mezha street 1/4, LV-1048, Riga, Latvia, merkur@itl.rtu.lv.

Keywords: enterprise information systems, enterprise resource planning, ERP, management information system

Abstract – Effective work requires integrated systems that can share access to a common data set. Integrated workplace organizations in the construction company are requiring enterprise resource planning (ERP)-type systems that, in turn, tie together all relevant logistic, facilities, human resource, financial, and project data into a single, shared database. Unfortunately, many ERP systems make things more complex for construction business. The reality is that few ERP systems are vertically integrated for use in construction, and most of them are very complicate and ultimately difficult to implement. In addition, suppliers of ERP systems, for example iScala, SAP, Oracle and etc., must work with consultants and integrators to provide normal systems job after implementation.

The purpose of the research is to identify, investigate, analyze and systematize the factors that can influence creation and functioning of the ERP system in a company and create metodology of ERP system implementation. ERP system modules for construction enterprise were evaluated, benefits and risks of ERP system were summarized.

Introduction

In today's dynamic and unpredictable business environment, companies face the tremendous challenge of expanding markets and rising customer expectations. This compels them to lower total costs in the entire supply chain, shorten throughput times, reduce inventories, expand product choice, provide more reliable delivery dates and better customer service, improve quality, and efficiently coordinate globe demand, supply and production [7, 13]. Over the last decade, many large organizations have been shifting from developing their business application software to licensing and installing large commercial off-the-shelf software known as enterprise resource planning (ERP) systems. ERP systems are fully integrated, enterprise-wide business applications with not only a complete set of traditional modules such as accounting, human resources management, sales and distribution, and manufacturing, but they also provide extensions such as supply chain management, data warehouse, and customer relationship management. Organizations require ERP implementation for the purposes of customer-order integration, standardization of production process, reduction of inventory level and order preparation time, standardization human resources information. Today organizations operate in an economic environment where customer demands are continuously changing and increasing.

The existing literature mostly builds on the experience of developed countries. Meanwhile, in the process of information technology implementation, organizations in developing and developed countries experience different implementation issues, human resource problems, and sociopolitical considerations. In particular, ERP system implementations in developing countries experience specific conditions resulting from both national/environmental characteristics and organizational/internal factors.

Therefore, it is necessary to conduct research among ERP projects taking place in emerging economies. An example of an emerging economy is Latvia, which is classified as a developing country with an upper-middle-income economy. The difference between Latvia and the "old" members of the EU, such as Germany or France, is very big when we take into consideration such items as gross national product (GPN), work efficiency, unemployment rate, road infrastructure, etc. Hence, the examination of ERP systems adoption in Latvia should give us some insight into the specificity of ERP systems projects in emerging economies.

This paper discusses some ERP implementation issues with data collected in some Latvian construction enterprises, and studying ERP implementation, key success factors, as well as risk factors.

In this study, a literature and abstracts review is done, some construction companies in Latvia are visited and studied their production, sales, purchasing and other processes carefully. The companies producing different type of building products are selected. The companies visited have also different size such as employee numbers, revenue.

ERP Systems

EIS evolved from material requirements planning (MRP) and manufacturing resource planning (MRP II) systems. Therefore, they started as the support for a variety of transaction-based back-office functions and were then called Enterprise Resource Planning (ERP) systems [14]. However, they further evolved to include support for front-office and inter-organizational activities including supply chain management, customer resource management, and sales force automation [10]. They started to offer solutions in an attempt to seamlessly link front-office (e.g., sales, marketing, customer services) and back-office (e.g., operations, logistics, financials, human resources) applications to enhance competitive advantages [2].

There are many ERP systems currently available in the IT market, like iScala, SAP R/3, BANN, Oracle, PeopleSoft etc.

Before beginning an analysis of implementing an ERP system, we should give some common terminology. It is difficult to build a case for an ERP system if the terminology is not clearly understood by all parties involved. Key terms include the following:

Enterprise resource planning (ERP) system: Software that provides computer system integration and support to all units and functions across an organization in a single system, thus eliminating the need for individual unit databases or systems.

Hardware and infrastructure: Physical equipment, such as servers, personal computers, cabling, network and clustering switches, backup devices, storage devices, and disaster recovery devices, required for an implementation.

Software: All programs, procedures, and routines associated with a computer system. System software controls the computer's internal functioning. Application software directs the computer to execute commands that complete processes and solve problems.

Licensing fees: The cost of vendor licenses for software required for an ERP implementation. These are usually one-time fees.

Maintenance fees: The cost of vendor support tools such as mailing list servers, help desks, updated documentation, user conferences, consultant support, and application of software patches. These are typically yearly fees and tend to increase on an annual basis.

Customization: Modification of base system software (code) to meet a functional need that the baseline product cannot.

Backfill: Additional staff hired or reassigned from other departments to replace key functional and technical staff assigned to the project because of their knowledge, skills, and abilities.

Communication plan: An integrated approach using various media to keep all stakeholders informed during the ERP implementation project.

Consultants: Third-party individuals who have expertise and experience in implementing ERP systems. They are hired to assist the project team in implementing the ERP system in the most efficient and effective way in the shortest amount of time.

Enterprise resource planning software systems attempt to integrate all departments and functions across a company onto a single information system that can serve all those different departments' particular needs. Typically, a department with specialized functions and needs may have its own information system, customized to its particular procedures and duties. Nonetheless, the main effort of an ERP implementation is to combine as much functionality as possible into a single, integrated software program that runs on a single database, in order that the various departments can easily share information and communicate with each other. This approach can have a tremendous payback if companies implement the software properly.

Investment in enterprise resource planning (ERP) systems is an important strategy that enables businesses to achieve competitive advantages and provide good quality of service. An ERP system streamlines business processes by creating an enterprise-wide transaction structure that integrates the key functions of different departments within an integrated information system platform. Through the integration of these diverse systems, organizations can gain a competitive advantage in the rapidly changing digital age.

A successfully implemented ERP can link all areas of an enterprise including customer relation, manufacturing, human resource, financial management and distribution with customers and suppliers, and forming a highly integrated system with shared data. Potential benefits include drastic declines in inventory, reduction in working capital, abundant information about what customer wants and needs, along with the ability to view and manage the extended enterprise of customers, suppliers, and alliances as an integrated whole.

In the past few years, thousands of companies around the world have implemented ERP systems. The number of companies that plan to implement ERP is growing rapidly.

However, if ERP projects are not implemented properly, the results can be disastrous, since the rate at which ERP projects fail is surprisingly high, with serious consequences including failure to fulfill anticipated functions and cost/ schedule overruns [1, 2, 4]. Many companies have seen no alternative but to terminate their ERP projects during the implementation

phase once their resources have become depleted because of mismanagement.

Several streams of study have proposed foundational theories on ERP implementation. One such stream focuses on the interaction between ERP and organizations [3, 12], and makes the observation that ERP implementation is closely intertwined with complex organizational factors. Take organization's culture for example, organizational culture affects an organization's shared beliefs, ideologies, and norms that influence organizational behavior, and therefore plays a critical part in ERP implementing [6]. Besides, ERP requires high computer self-efficacy among employees because organizational changes resulted by the ERP implementation require a large-scale use of computers, which presents different learning process for different types of organizations. Therefore, different types of organization experience different organizational fitting process [10], which makes ERP implementation face both technical and social uncertainties that cannot be predefined in full, and must, of necessity, be actively managed. Another stream concentrates on risk factors in ERP implementation. Such studies point out explicit key risk factors, such as process fit and user fit, which contribute to the failure of ERP implementation if left unchecked [5, 9]. Other studies investigate risk factors in different ERP implementation phases and note that by actively managing problems that evolve over time, better ERP implementation can be achieved [8, 10].

ERP Systems Life Cycle

As well as any product, the ERP system has the life cycle. Usually product's life-cycle includes 5 stages: development, introduction, growth, maturity, and decline. Sometimes before maturity and decline saturation stage is included.

Thereof ERP system is specific product their life-cycle is specific too. ERP system life-cycle includes 6 phases: adoption decision phase, acquisition phase, implementation phase, use and maintenance phase, evolution phase, and retirement phase.

Adoption decision phase. In this phase managers examine the needs for a new ERP system. Select the general information system approach: that will best address critical business challenges and that will improve the organization strategy. This decision phase includes: definition of system requirements, its goals and benefits, an analysis of the impact adoption at a business and organizational level.

Acquisition phase. This phase consists on selection of an ERP product that: best fits the requirements of the organization and minimize the need of customization. A consulting company is also selected to help in the next phases on the ERP life-cycle especially in the implementation phase. Factors such as price, training and maintenance service are analyzed. The contractual agreement is defined. It also important to make an analysis of the return of investment (ROI) of the selected product.

Implementation phase. This phase includes: the customization of parameterization and adaptation of the ERP package to the needs of the organization. Usually this task is made with the help of consultants who provide implementation methodologies, know-how and training.

Use and maintenance phase. This phase covers the personal of time where the ERP product is selected in a way that returns benefits and minimizes disruption. During this phase, one must be aware of the aspects related to functionality, usability and adequacy to the organizational and business processes. Once a system is implemented, it must be maintained, because malfunctions have to be corrected, special optimization requests have to be met, and general systems improvements have to be made.

Evolution phase. This phase corresponds to integration of more capabilities into the ERP system; providing new benefits, such as advanced planning and scheduling, supply-chain management, customer relationship management, workflow and expanding the frontiers to external collaboration with other partners.

Retirement phase. This phase corresponds to the stage when with the appearance of new technologies or the inadequacy of the ERP system or approach to the business needs. Substitute the ERP software with other information system approach more adequate to the organizational needs of the moment.

Costs involved in ERP system life-cycle

There are tangible and intangible costs include in the ERP system life-cycle.

Tangible costs are the costs that can be measured in a direct way in monetary terms. Intangible costs are those costs that are difficult to be measured in a direct way, since they refer to vague concepts. All costs are summarized in Table 1.

Table 1

Costs involved in ERP system life-cycle

Phase	Tangible costs	Intangible costs
Adoption decision		Decision making costs
Acquisition	Consultancy Hardware Software licenses	Decision making costs Opportunity costs
Implementation	Consultancy Training Human resources System	Customization, conversion and data analysis Time dedicated by

Phase	Tangible costs	Intangible costs
	specification	staff Business process re-engineering
Use and maintenance	System reconfiguration System adaption Costs of system failure	Indirect costs of system failure Lost of competitiveness
Evolution	Costs of new applications	
Retirement		Opportunity costs Decision making costs

ERP System Planning and Implementation

ERP System Structure

The structure of ERP is composed of four levels which is shown in Figure 1:

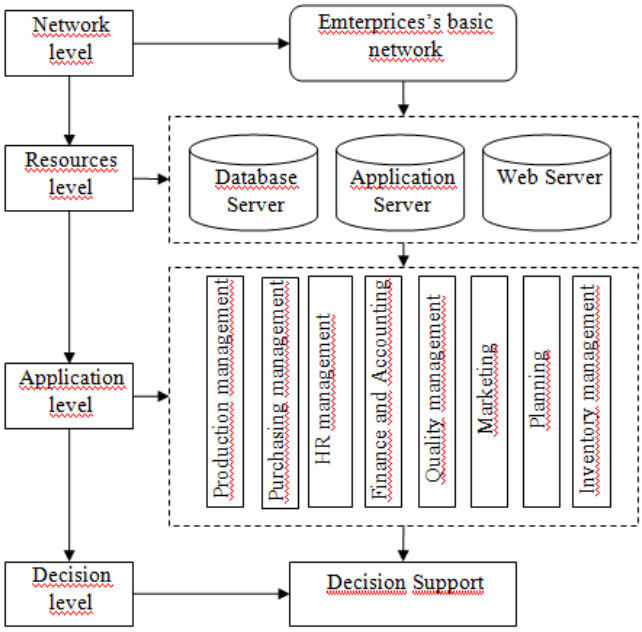

Fig. 1. ERP system structure

1. Network level: it is the infrastructure of the system which makes the information flow both internal and external enterprise flows smoothly through the network;
2. Resources level: it includes hardware, software and data needed by ERP system;
3. Application level: it contains different subsystems used by the personnel in different sections in an enterprise. Through these subsystems, management provides ERP with the data resource or obtains the required information;
4. Decision support level. Employing models and methods, management processes data or information for decision making.

ERP System Selection Process

The choice of information system, for which many options exist, must be driven by, and closely aligned with, the broader framework of competitive positioning decisions.

Every ERP system should be rooted in the business, as it often pervades the business, encompassing and changing almost every area.

We have concluded that there is no system that is best for all companies, but rather there is a process you can go through to find the right system for your company. The process starts with assembling a competent Project team, addressing business needs, exploring alternatives, developing criteria, and making informed judgments that lead to a successful system.

One of the important questions in ERP system's selection process is "Build or Buy?"

ERP systems can be categorizes by price (license fee, and implementation expenses). Usually, big businesses need big ERP applications. Big ERP systems are SAP, Oracle, People- Soft and JD Edwards and other (for more then 250,000$). Medium size businesses go for medium size ERP. The mid-range ERP applications include QAD, Microsoft's Navision, Scala etc. (from 50,000$ to 250,000$). Small business owners usually think ERP is for someone else, someone bigger. Small, shoestring ERP applications are available for even the smallest enterprise. Smaller systems include popular low cost business applications that are complete but simplified systems (over 50,000$).

Packaged applications will contain functions that will not be used by all companies because they were meant to cover the needs of many. On the other hand, they will also contain a rich set of best-practice functionalities that will have been honed by multiple users. Duplicating the breadth and depth of functionalities from leading ERP vendors will be very difficult. You should consider building a custom system only when you have a wide set of unique needs as well as the resources to materialize the system.

The large number of companies adopting a single-solution approach to their packaged application needs is a testament to the benefits of buying integration. Unified business and process models reduce training and maintenance costs, and also provide the highest level of integration of any approach available today.

Disadvantages associated with integrated solutions include the high overall cost of implementation and

long project-completion times. Large-scale implementations can take years given their scope and complexity. And, even when the initial rollout is complete, users are often faced with the task of upgrading the packages, thus creating an ongoing cycle of systems implementation. Finally, applications from single-source providers may be incompatible with the user's business process model. Some companies have adjusted their business models to fit the vendor's. More and more, however, they feel that information technology (IT) should adapt to and serve the needs of business first.

ERP System Implementation Process

The process of implementing ERP begins with planning. After planning is completed, a Project team embarks on and then moves through a number of discrete phases. After the system is up and running, there may be a post-implementation review and later a stabilization phase.

ERP implementation process can be divided into six stages: initiation, adoption, adaptation, acceptance, routinization and infusion (see Figure 2).

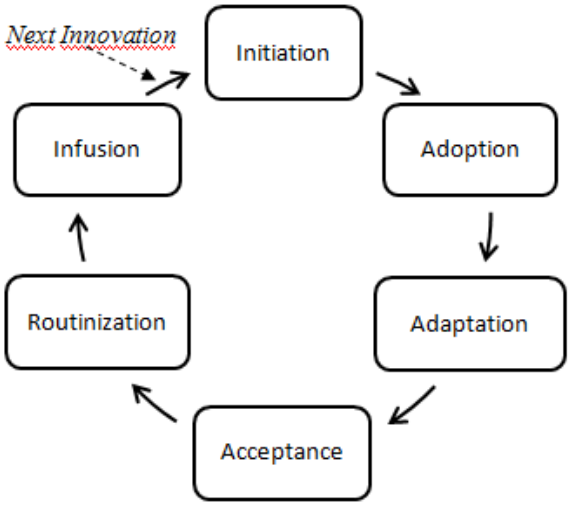

Fig. 2. ERP system implementation process

The first or the initiation is characterized by both internal and external factors that influence the organization to implement an ERP system. At this stage, the organization must carefully define why the ERP system is to be implemented and what critical business the system will address. Additionally, education is also given to the employees. They will learn some new knowledge about the development history, basic concepts, main functional modules of ERP, and the benefits of implementing an ERP.

After ERP education is finished, the implementation process enters the second stage. Organization will carry out investment decision and cost–benefit analysis related to implementing ERP and select appropriate brand or vendor.

In the adaptation stage, the organization analyses the details of the various business processes and actualizes business process re-engineering (BPR) to exploit the full potential of ERP. Once the business process is redesigned and system is customized, appropriate training is given to the end-users immediately and resistance may be observed because of the 'inertia' associated with using the previous system. This stage is considered as the most difficult of all the stages.

In the acceptance stage, the integration of various functional units is realized and continuous improvements are made to make the system easy to use and to solve various problems. The users feel comfortable with using the ERP system.

During the fifth stage, end-users accept the system completely. The ERP system usage becomes a regular day-today activity. Organizational integration and internal function coordination are realized.

At the infusion stage, the system is used to enhance the performance of the organization [11]. After years of operation, the company may need new system to cope with business and technology change, so the first stage will be repeated again.

ERP System Implementation Stakeholders

A stakeholder in any organization is any group or individual who can affect or is affected by the achievement of the organization's objectives. In an ERP outsourcing environment, two stakeholders generally participate in the implementation process: an internal project team to define the needs and an external contractor to provide a system to satisfy the requirements as depicted in Figure 3.

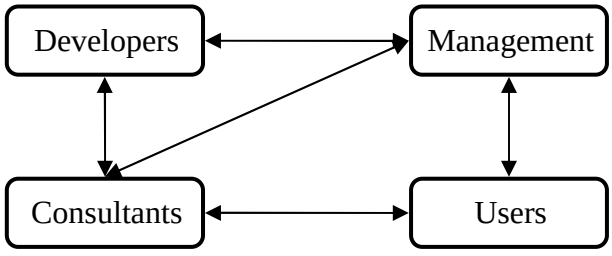

Fig. 3. ERP system implementation stakeholders

ERP implementation involves many employees and external parties — the Project manager, project team members (employees from various business units), internal IT specialists, vendors, and consultants. It also includes multiple tasks — software configuration, system integration, testing, data conversion, user training and system rollout.

In an ERP system implementation, there are usually four major parties involved the project implementation: the organization implementing the system (the implementer) with managers team inside, the organization developed the ERP system (vendor or developer), an organization aiding the implementation (the consulting company or independent consultants) and users who will use the system.

All of them have many areas of conflict. These conflict points are a potential source of problems that may seriously affect project success.

The main problematic questions for all members presented below.

1. The implementer

- How can we retain staff?
- How can we retain knowledge?
- How should we manage consultants?
- How do we determine business benefits?

2. Users

- Why do we need ERP system?
- Why do we need a process culture?
- Will I get trained for the new system?
- How can the IT people tell us what applications we need?
- Will I lose power?
- Will I lose influence?

3. Developers

- Why do we need outside help?
- I will need training.
- I will be more marketable.

4. Consultants

- We are expensive.
- We have our own way of working.

ERP System Implementation Stages

From the analysis of study, five key common features of the planning and implementation stages are identified. These are: learning from others, appointment of a process innovator, committees and Project teams, training and technical support, and changing the organizational structure and responsibilities. These are discussed below.

1. Learning from others

In the process of planning and implementation, each company took a number of steps to learn from the experience of others. They used the services of outside consultants, networked with sister companies overseas, and employed technical support staff and engineers. For example, it is possible to teach from the experience of sister company, which had implemented a similar ERP or use the services of local consultants to learn about modern management methods and to implement package solutions for their specific problems.

2. Appointment of a process innovator

Authors identified key individuals to act as process innovators of the ERP project. Typically manufacturing–sales managers, these individuals provided both technical expertise and managerial leadership throughout the planning and implementation stages. The process innovators also provided ongoing communication between management and unions as well as between management and outside suppliers–consultants. They ensured that there was sufficient consultation with the field works, and provided regular feedback on developments.

3. Committees and project teams

All companies established committees and project teams to effectively plan and implementē the ERP. Their main objective was to ensure that tasks were completed on time and within budget. Some companies set up both a cross-functional steering committee and a project team. Some companies set up an executive steering committee and an operational committee. But some companies did not establish a committee; however, their senior management had several informal discussions with the field workers.

4. Training and technical support

All companies recognized the need for ongoing training and technical support for the users of the ERP. In some companies, outside consultants were used for this purpose, while, in others, the suppliers of the ERP took on this task initially. For example, supplier of the ERP can provide considerable assistance during the planning and implementation stages. Sometimes companies provided a considerable amount of training for the ERP's users and it was demonstrated to the employees before implementation.

5. Changing the organizational structure and responsibilities

Changes to the organizational structure and responsibilities are absolutely necessary to optimize the ERP and achieve the promised benefit. Not every company made the changes necessary in this respect. With the implementation of its ERP system, companies

made a number of changes in responsibilities at headquarters, releasing staff at headquarters to focus on more strategic issues. Generally, employees and unions accepted the changes being introduced and willingly participated in meetings to provide feedback and to review progress.

Successful Factors of ERP Implementation

Based on the empirical studies of ERP implementation in Latvian building enterprises, the successful factors of implementing ERP system are as follows:

1. Senior level management support: positive commitment, enthusiastic about the project and strong support.
2. Project implementation team: teams' organization and project implementation, for example, qualified management and team members. Team members must have background and are capable. For example, they must have experiences and be able to communicate in a cross-departmental environment.
3. External consultants: knowledge and expertise on ERP project.
4. Setting goals and project scope: goals and project scope for each stage must be determined.
5. Education and training: basic education of ERP and ERP system operation training.
6. Project management: according to the project goal, determining project plan, allocating resources, and controlling cost and budget.
7. Data: data accuracy and integrity.
8. Change management: business process re-engineering (BPR).
9. Methods of implementation.
10. Evaluation: ERP project evaluation and assessing the contribution made by ERP to enterprise performance.

Risk Factors of ERP Implementation

ERP implementation is a highly risky project with a substantial amount of investment. Its success or failure is influenced by a variety of factors. All sorts of risks exist in the entire process from the software selection to final implementation. It is important to recognize such risks and set up a set of effective mechanisms for managing risks, thus to maximize the implementation success rate and improving enterprise management (Table 2).

Table 2

Risk analysis of ERP system implementation

Types of risk	Subtypes of risk
Risk of managing ideas	• Business operation is relatively independent of new technological environment; • staffs' degree of acceptance toward new technology is not high; • reluctant to change business processes.
Risk of setting goals	• Difficulties in quantifying the objectives; • deviation from the target.
Risk of software selection	• Seeking perfection of the function embedded in software; • inexpensive software with the functional problem.
Risk of temporary shutdown of business	• Negative effects of the project may affect the normal business process and disturb the continuity of the business; • Temporary business shutdown may affect operation, equipments, and environment, causing undesirable consequences.
Risk of external environment interest parties such as sharehol-ders unsatisfied	• It may cause unlawful practice due to the inconsistency with the government regulations or industry code; • fail to achieve the expected target, and making.

ERP Implementation Process in the Construction Enterprises

In introducing ERP systems, in some sense, the implementation processes determine the effect of ERP. Authors analyzed many literatures and abstracts reviews, visited and studied some Latvian construction enterprises, their ERP systems and its implementations phases. The companies producing different type of building products are selected. The companies visited have also different size such as employee numbers, revenue.As a result authors offer to include in ERP system implementation process seven phases. All of them shown in Figure 4.

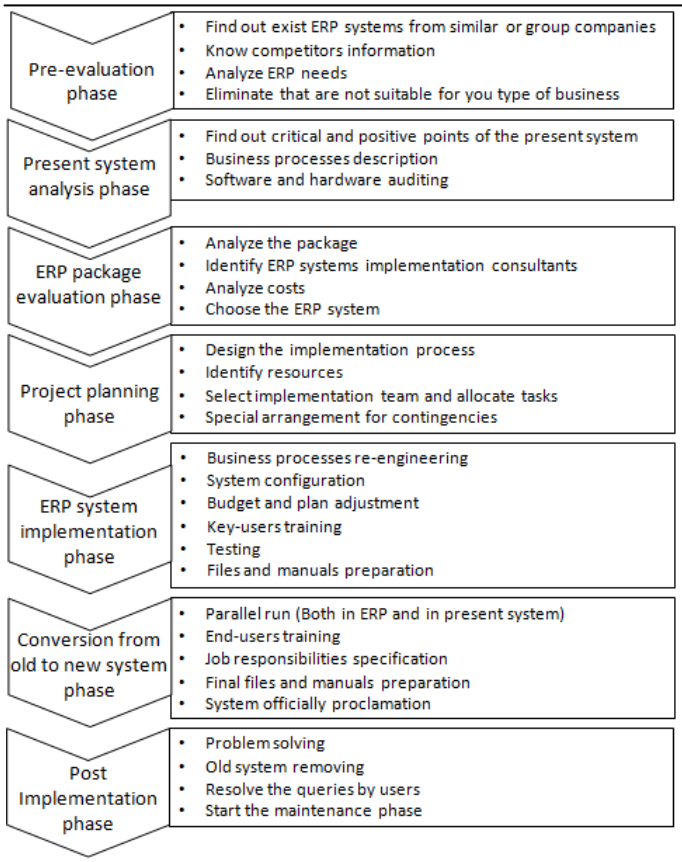

Fig. 4. ERP system implementation process in the construction enterprises

Below provided descriptions of the tasks involved with these phases.

Pre-Evaluation Phase

The pre-evaluation phase involves researching the necessity of the development of the system. In the pre-evaluation phase, first and foremost is to understand the strategic objective of the enterprise with considerations to its environment, thus to confirm the overall goal of the system and main function. The objective of the pre-evaluation phase is to address conceptual level issues including basic architecture.

Enterprise needs to identify reasons for ERP solution. It is necessary to find out exist ERP systems from similar or group companies and get know competitors information. Then necessary analyze received information and eliminate is it suitable or not for you type of business.

Also need to investigate map processes i.e. includes details like time taken, decisions to be taken and decisions point, flow of information, reports and reporting points etc. Then prepare an overall plan, alternatives for systems development and financial planning. Pre-evaluation phase is feasibility study; it will address technological feasibility, economic feasibility, organizational feasibility and social feasibility.

Selection is done on best few packages available.

Present System Analysis Phase

Find out critical and positive points of the present system. To describe all business processes we need business process documentation, job description documentation, employee roles documentations, organizational chart, actual business needs and supply-chain problems. It is necessary to audit software and hardware also to find out strengths and weaknesses of the present system. System investigation involves study team, i.e. senior management and project team members. They evaluating current business process and discussing existing problems, seeking solutions.

This analysis is process through which company can create a model where they are standing now and where they want to go. Analysis helps the company to cover the functional gap.

Demand analysis and target setting sub-item try answering the questions: “Has the enterprise reached the stage of adopting ERP? What is the problem that the enterprise needs to solve most urgently at present? Can ERP system help? What does investment return analysis and cost-benefit analysis on ERP tell? Can the enterprise support the implementation of ERP financially? Having purpose of ERP, which problems can be solved by the system? Has the preparation completed for adopting ERP including personnel?”

ERP Package Evaluation Phase

This phase based upon the recommendation from the above phases, it confirms the need for a new system. This phase will work on the evaluation of the present system, such as developing system architecture, identifying entities and determining the main techniques to be used. The focus of this stage is on conceptual design.

Package of ERP programs is selected on the basis of different parameter. It is necessary to analyze the package based on the presence (global/ local), type of market catering to, modularity, ease of implementation, cost of product, cost of implementation, post implementation support etc.

It is necessary to test and certify the package and also check the coordination with different departments. Selected package will determine the success or failure of the project. Package must be user friendly. Regular up gradation should available. Analyzing of all cost also required.

Software selection includes selection procedures, i.e. carry on a detailed analysis on the needs of the enterprise and figure out if a specific type of software can or cannot meet the enterprise's certain special needs or it requires customization. Understanding the environment of implementation. The environment here includes two aspects: The local environment of adopted country (for example financial and accounting rule and regulations, language, etc.) and the special needs of the adopted enterprises.

Implementation consultants identifying and finalizing based on the skill set, their past and present performance, installation base, industry specific experience and cost factors.

The specific models of ERP select from the angle of customization and localization.

Project Planning Phase

The project planning phase involves integrating knowledge, functions, flows and organization framework at both logical and physical layers.
This phase mainly works on the physical design and software development including algorithm design and coding. Additional considerations are given to hardware, institutional framework and staff training, etc. It is necessary to identify recourses and select project team and allocate all tasks.

Project organizing provides creation of leading, project implementation group and technical groups. Leading group made up by top managers. They build the right mix of members including the appointment of project manager and other key staff members. Project implementation group mainly in charge of a large portion of implementation tasks. In general, the project manager leads the group; other members should be made up of the leaders and key staff members of the main business segments of the enterprise. Technical group is responsible for working with the implementation group to work out new working procedures including involving personnel training. They should be able to develop new business process and operation methods through mastering ERP system; and proving that the new approach is viable. The quality of this group determines if the ERP can be implemented at each basic unit of the enterprise. Regular personnel should be assigned to the group for operation and problem-solving.

ERP System Implementation Phase

The implementation phase is to realize physical model and implement the model in practice.

This phase involves the completion of the installation and debugging, etc. Before operating ERP system, it is necessary to prepare for inputting a series of basic data that were not defined clearly before using the system. Therefore, a large amount of work is required. The data are related to products, process, inventory, etc. Related parameter setting is also needed. For instance, financial data that is required in system installation and testing.

Input of the various data is made in the system to check of functions of the software. Working groups have to be organized. They can offer decisions for those problems which often arise in system. Modeling of separate situations can be spent also.

On the basis of the readiness of personnel and basic data, system installation begins. After that key-users testing follow.

Key-users training are emphasized at this phase. Training includes senior management and ERP project team members. The main objective is to make out the basic principles and managerial thinking involved with ERP. Company trains its employee s to implement and later, run the system. Employees become self sufficient to implement the software after the vendors and consultants have left.

Customization or secondary development may follow after this. Testing is performed to find the weak link so it can be rectified before its implementation. Testing should be conducted for the entire system, and the staff in each department should participate at the same time. In this way, it is possible to have a better understanding of the relationship among all data, functions and procedures in order to locate insufficiency and propose possible solutions. After a series of testing activities, problem solutions are provided for those problems appear in the implementation process. Meanwhile, a series of corresponding regulations or procedures are prepared that are subject to further modification in the future.

At the end of implementation phase files and manuals are prepared.

Conversion from Old to New System Phase

Before old system removing it is necessary to work on both systems to check out the new system.

The work is completed, data conversation is done, databases are up and running, the configuration is completed and testing is done.

The employee who is going to use the system are identified and trained. After training weak points are found and job responsibilities are specified. Also final files and manuals are prepared.

After necessary customization is completed and before entering systems operations stage, a formal

approval by senior management is required in order to ensure the quality of systems implementation.

Conversion from old system to new completes all activities from the implementation and ends with new ERP system officially proclamation.

Post Implementation Phase

The implementation task is not over even the new system is implemented. Post implementation phase includes old system removing. Once the system is lived the old system is removed. The following steps are mainly involved with evaluation and maintenance. It is necessary to check whether the implemented system has achieved the initial objective and determine whether to make the required further improvement. Due to the change in business environment, the system should be able to accommodate new requirements and challenges.

Employees who are trained enough to handle problems those crops up time to time. The post implementation will need a different set of roles and skills than those with less integrated kind of systems. Post implementation involves minor changes to the systems, problem solving, resolve the queries by users, fine tuning of performance, provide changes for enhancement and incorporate increment changes.

Conclusions

ERP systems have a vital role in today's organizations to realize their vision and strategies. Implementations of ERP systems are one of the most difficult investment projects because of the complexity, high cost and adaptation risks. ERP projects have an abnormal number of problems, particularly related to cost, customization, and integration with existing systems as evidenced by the large number of failed projects, especially in organizations that are structurally complex and geographically dispersed [10]. Implementing ERP systems is a deep revolution in management. In order to achieve the goal, issues in the implementation process must be systematically considered.

This study presents findings about ERP system implementation for building companies in Latvia.

ERP implementation itself is a project of system engineering or practice of systems science. A thorough analysis of the systems characteristics and factors is considered a necessity as basis for the successful implementation of ERP systems.

Guidelines for successful implementation of ERP are:

- understand the enterprise's needs and culture, i.e. readiness for changes vs. capability to implement the changes, seeing the needs for changes vs. willing to accept changes;
- complete business process changes, i.e. keep in mind the need for change vs. cost of changes vs. those supported by ERP;
- communicate across organization;
- provide strong leadership;
- ensure efficient and capable project manager;
- choose a balanced team;
- train everyone;
- select a good implementation methodology;
- commitment to change.

References

1. Bingi P., Sharma M.K., Godla J.K. Critical issues affecting an ERP implementation. Information Systems Management 16 (3), 1999. 7–14 pp.
2. Chen I.J. Planning for ERP systems: analysis and future trend. Business Process Management Journal 7 (5), 2001. 374–386 pp.
3. Gattiker T.F., Goodhue D.L. Understanding the local-level costs and benefits of ERP through organizational information processing theory. Information & Management (41), 2004. 431–443pp.
4. Griffith T.L., Zammuto R.F., Aiman-Smith L. Why new technologies fail? Industrial Management 41 (3). 1999. 29–34 pp.
5. Hong K.K., Kim Y.G. The critical success factors for ERP implementation: an organizational fit perspective. Information & Management 40 (1). 2002. 25–40pp.
6. Laudon K.C., Laudon J.P. Management Information Systems: Managing the Digital Firm. Prentice-Hall, New Jersey. 2007.
7. Li L. Manufacturing capability development in a changing business environment. Industrial Management and Data Systems 100(5–6). 2000. 261–270 pp.
8. Loh T.C., Koh S.C.L. Critical elements for a successful ERP implementation in SMEs. International Journal of Production Research 42 (17). 2004. 3433–3455pp.
9. Mandal P., Gunasekaran A. Issues in implementing ERP: A case study. European Journal of Operational Research 146 (2). 2003. 274–283pp.
10. Markus M.L., Axline S., Petrie D., Tanis C. Learning from adopters' experiences with ERP: problems encountered and success achieved. Journal of Information Technology 15 (4). 2000. 245–265pp.
11. Rajagopal P. An innovation-diffusion view of implementation of enterprise resource planning (ERP) systems and development of research model. Information & Management 40. 2002. 87–114pp.

12. Somers T.M., Nelson K.G. A taxonomy of players and activities across the ERP project life cycle. Information & Management 41 (3). 2004. 257–278pp.
13. Umble E, Haft R, Umble M. Enterprise resource planning: implementation procedures and critical success factors. European Journal of Operational Research 146. 2003. 241–257 pp.
14. Volkoff O., Strong D. M., Elmes M. Understanding enterprise systems-enabled integration. European Journal of Information Systems, 14. 2005. 110–120 pp.
15. Yusuf Y., Gunasekaran A., Abthorpe M. Enterprise information systems project implementation: a case study of ERP in Rolls-Royce. International Journal of Production Economics Nr.87. 2004. 251–266 pp.

Andrejs Tambovcevs, Jurijs Merkurjevs. ERP sistēmas ieviešanas analīze būvniecības uzņēmumos

Efektīvais darbs prasa integrētās sistēmas, kuras varētu sadalīt pieeju pie kopējās datu kopas. Integrētās darba vietas organizēšana būvniecības kompānijās prasa tādu veidu uzņēmuma resursu plānošanas sistēmas, kā ERP tipa sistēmas, kas apvieno visus resursus, kuri ir saistīti ar to, t.i. loģistiku, iekārtas, cilvēku un finanšu resursus, kuri, savukārt, apvieno datus vienotā kopējā datu bāzē. Reālajā dzīvē daudzas ERP sistēmas ir vertikāli integrētās lietošanas būvniecībā un lielākā daļa no tām ir ļoti sarežģītas un ļoti grūti ieviešamas. Pie tam, ERP sistēmu, piemēram, iScala, SAP, Oracle u.c. piegādātājiem ir jāstrādā ar konsultantiem un integratoriem, lai nodrošinātu normālu sistēmas darbu pēc sistēmas ieviešanas.

Pētījuma mērķis ir identificēt, izpētīt, izanalizēt un sistematizēt faktorus, kuri var ietekmēt ERP sistēmas veidošanu un funkcionēšanu uzņēmumā. Bija novērtēts būvniecības uzņēmuma ERP sistēmas ieviešanas process un rezultātā tiek apkopoti labumi no ERP sistēmas ieviešanas un riski.

Андрей Тамбовцев, Юрий Меркурьев. Анализ внедрения ERP системы на строительных предприятиях

Эффективная работа любой компании нуждается в наличии интегрированных систем, которые функционально разделяют доступ к общему набору данных. Организация интегрированного рабочего места в строительной компании также требует системы типа систем планирования ресурсов предприятия (ERP), которые, в свою очередь, связывают все относящихся к делу ресурсы: логистические, человеческие, финансовые, различные устройства и соединяют данные в единственную, общую базу данных. К сожалению, многие ERP системы усложняют работу предприятия, связанного со строительным бизнесом, делают многие простые операции более трудоемкими.

Действительность состоит в том, что некоторые ERP системы для использования в строительстве внедрены вертикально, и большинство из них, очень сложны и в конечном счете трудно внедряемы. Почти всегда поставщики ERP систем, например, Scala, SAP, Oracle и др., должны работать с консультантами и интеграторами довольно долгое время, чтобы обеспечить нормальную работу систем после ее внедрения, что приводит к дополнительным затратам.

Цель исследования состоит в том, чтобы идентифицировать, исследовать, проанализировать и систематизировать все факторы, которые могут влиять на создание и функционирование ERP системы в компании. Был оценен процесс внедрения ERP системы на строительном предприятии, и в итоге были обобщены выгоды от внедрения ERP системы и риски.