

THE INTEGRATION PROCESS OF ENTERPRISE RESOURCE PLANNING SYSTEMS

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Özet

Bilişim teknolojilerindeki son yıllarda meydana gelen büyük ilerlemeler, hem imalat hem de hizmet sektörlerinde yeni yöntem ve sistem yaklaşımların ortaya çıkışını tetiklemiştir. 1990'larda söz konusu gelişmelerle yaygınlaşan ERP (Kurumsal Kaynak Planlaması) sistemleri, bütünleşik sistem çerçevesi ile işletmelerin tüm iş süreçlerini yönetmesini mümkün kılmış ve işletmeler bugünün yüksek değişkenlik içeren küresel ekonomik ortamında rekabetçi avantajlar sağlayabilmiştir. Fakat genel olarak, bu avantajların edinimi, ERP bütünleşimi sürecinde kayıplara sebebiyet verebilmektedir. Dolayısıyla, ERP sistemini bütünleşik bir sistem olarak düşünmek gerekliliği yeni ERP bütünleşme çabalarını şekillendirmektedir. Bu çalışma, bu ihtiyaçları ortaya koymakta ve ERP sistemlerini seçim, uygulama ve uygulama sonrası safha olarak incelemektedir.

Anahtar Kelimeler: Kurumsal Kaynak Planlaması; Bütünleşme Süreci; Bilişim Sistemleri Seçimi; Uygulama Safhası, Uygulama Sonrası Safha.

Abstract

The great developments in information technology have triggered the emergence of new methods and system approaches in both manufacturing and service industries. ERP (Enterprise Resource Planning) systems, well known with these improvements in 1990s, enable the companies manage all their business process by an integrated system framework. Thus, enterprises could be gaining a competitive advantage in today's highly changeable and global economic environment. But in general, the challenge of acquisition of these vantages causes losses in ERP integration process. Hence, the necessity of considering the ERP system as an integrated system shapes the new ERP integration efforts. This study allows for these needs and reviews the ERP system which is three-tiered and consists of selection, implementation and post implementation processes.

Keywords: Enterprise Resource Planning; Integration Process; Information System Selection; Implementation Phase; Post-implementation Phase.

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Introduction

In recent years, ever-changing customer expectations and world economy have put companies under pressure to fundamentally shift their business manner. This obligation includes all levels of business functions from purchasing of raw materials to delivering the finished items to customers and supporting customer requirements along the product's life cycle. Therefore systems, which are used or planned to be integrated by the companies, now have major impact on businesses. From this point of view, a significant enterprise system called ERP (Enterprise Resource Planning) (targets/aims) purposes reengineering of companies' core competencies and thus provides a competitive advantage.

The developments of technology focusing on business process integration formed the fundamentals of ERP systems (Bendoly and Jacobs, 2003). In 1960's, the focus of the manufacturing systems was on inventory control concepts (Umble et al., 2003; Al-Mashari et al., 2003). The necessity of integrated manufacturing software led the evolution of MRP (Material Requirement Planning) systems (Al-Mashari et al., 2003). This system allows for computation of the net material requirements according to *on-hand* and *scheduled* materials by keeping priorities valid in an ever-changing manufacturing environment. A computer could be used to calculate these material requirements. MPS (Master Production Schedule) supported by BOM (Bill of Materials), which specifies the all parts of a product, was the backbone of this system (Umble et al., 2003).

The influential efforts by APICS (American Production and Inventory Control Society) resulted in increases of MRP software sales in the USA in 1989 (Akkermans et al., 2003). While the sales were increasing, the technological developments allowed MRP to couple the movements of inventory with a corresponding financial activity (Umble et al., 2003). Moreover, MRP systems had disadvantage of not considering available capacity. Additional functionalities like demand forecasting, rough-cut capacity planning, capacity requirements planning, sales planning and scheduling led to new improvements and the next logical step in manufacturing planning called MRP II (Manufacturing Resource Planning) was developed (Klaus et al., 2000; Merode, 2004).

In 1990s; the requirement of taking the entire enterprise resources into account (Umble et al., 2003), the deficiencies of MRP II in conducting

the production orders, plans, inventories and the need of integrating these functions supported the improvement of ERP concept (Al-Mashari et al., 2003). In spite of shortcomings of the manufacturing resource planning, MRP II constitutes the basics of the ERP systems and uses similar modules. Additionally, ERP also includes modules not taking part in MRP II framework such as CAD (Computer Aided Design), DRP (Distribution Resource Planning), TMS (Tool Management Systems) and PDM (Product Data Management) (Yusuf et al., 2004). ERP systems typically do not have embedded modules for technical functions like CAM (Computer Aided Manufacturing) or CAD. ERP, the integrated enterprise system, covers all functionalities such as supply chain management, maintenance and human resources planning (Mabert et al., 2003). The evolution of ERP system has taken place as displayed in Figure 1.



Figure 1. The Evolution of ERP (Rashid et al., 2002)

ERP led an innovation in manufacturing. Now, companies got a chance to increase their competitiveness using all its assets including information (Umble et al., 2003). This comprehensive system integrates isolated small systems and allows the company to carry on the computing of up-to-date resources across all plants and process of a company by applying quite a few methods, strategies and concepts that were used for many years (Jacobs and Bendoly, 2002).

This study presents the ERP integration process in a three-tiered framework: ERP package selection, implementation and post-

implementation processes. The paper is organized as follows: Section 2 reviews the attempts to define ERP, drivers, benefits and architecture of the system. Section 3 presents the package selection efforts, and section 4 deals with the implementation and the post-implementation processes. Section 5 completes the paper with conclusions and the future tendencies.

1. Enterprise Resource Planning: Conceptual Framework and Benefits

Since early 1990's, many firms around the world have shifted their information technology strategy from developing information systems *in-house* to *purchasing application software* such as ERP systems (Hong and Kim, 2002). As a result, a number of academic researches have been published and also a wide commercial sector has emerged about ERP. The ERP concept is viewed from different perspectives (Klaus et al., 2000). A number of academicians and practitioners have defined the ERP term. For example, Kumar and Hillegersberg (2000) define ERP systems as “configurable information systems packages that integrate information and information-based processes within and across functional areas in an organization”.

Some of the definitions found in the literature are presented in Table 1 below.

Table 1. ERP Definitions (Reproduced from Al-Mashari et al. 2003)

Author	Definition
Gable (1998)	Comprehensive software package solutions seek to integrate the complete range of a business processes and functions in order to present a holistic view of the business from a single information and IT architecture.
Slooten and Yap (1999)	The first approach that integrally combines business management and IT (Information Technology) concepts.
Rosemann (1999)	Customizable, standard application software, which includes integrated business solutions for the core processes of an enterprise.
Chung and Snyder (1999)	ERP could combine both business processes in the organization and IT into one integrated solution, which MRP and MRP II were not able to provide.
Klaus et al (2000)	Comprehensive, packaged software solutions seeking to integrate the complete range of a business' processes and functions in order to present a holistic view of the business from single information and IT architecture.
O'Leary (2002)	Software that can integrate across multiple functional areas by focusing on processes, rather than the individual function.
Hong and Kim (2002)	One solution to the IT industry's chronic problems of custom system design: reduced cost, rapid implementation, and high system quality.
Al-Mashari et al. (2003)	The first approach that link business management and IT concept and can be perceived a way providing traceability.
Mabert et al. (2003)	Enterprise-wide on-line interactive systems that support cross functional processes using a common database.
Jacobs and Bendoly (2003)	Integrate the smaller otherwise isolated systems (e.g. MRP, MRP II) so that real time resource accountability across all business units and facilities of a corporation could be maintained.
Umble et al. (2003)	The commercially available software packages promise seamless integration of all information flows in the company (financial and accounting, human resource, supply chain and customer information).
Yusuf et al. (2004)	Allows the corporate management of a business, and aims to integrate individual functional systems such as manufacturing, finance, procurement and distribution.

Akkermans et al. (2003) define ERP in the context of business, technical and functional perspectives:

Business perspective: ERP is the combination of business processes and IT.

Technical perspective: ERP is the last stage of an evolution stemming from 1970's MRP and 1980's MRP II.

Functional perspective: These systems support the deployment of resources including materials, labor, production capacity, and capital through the enterprise.

According to Jacobs and Bendoly (2003), a clear distinction must be made between ERP “concept” and ERP “system”. The system approach focuses on the impact of ERP on the performance of various business functions while the concept approach focuses on the process and package design to meet the system approach's objectives.

ERP provides instant access to the business critical information from chief to operator working in the line (Holsapple and Sena, 2003). It includes financial, accounting, human resources, supply chain, and customer information flows (Umble et al., 2003).

The research performed by Klaus et al. (2000) utilizing from twelve researchers working in the ERP area highlights that ERP evolution drivers can be classified into technical, managerial, and marketplace dynamics. Technical dynamics include Internet, XML and standard data formats, telecommunications and networks, advent of client-server architecture, etc. The managerial ones cover complex and larger organizations, globalization, desire to fulfill the promise of BPR, need for improved managerial decision-making, etc. Marketplace drivers are Y2K problem, strong ERP vendor marketing, growing in the number of ERP vendors and assure ongoing, increasing of buying tendencies over making because of the IT skill shortages, competitive supply chains. Table 2 summarizes some of the discussions on the ERP drivers.

Table 2. ERP Drivers

Cooke and Peterson (1998)	Holsapple and Sena (2003)	Al-Mashari et al. (2003)
<ul style="list-style-type: none"> • Standardize company processes • Integrate operations and data • Reengineer business processes • Optimize supply chain or inventory • Increase business flexibility • Increase productivity • Reduce number of employees • Support globalization strategy • Help solve the Y2K problem 	<ul style="list-style-type: none"> • Decrease the size and cost of company's informatics sector • Making data available in real time to decentralize information processing • Getting technological tools to simplify administrative functions and generate management reports • Provide a better balance among decentralization and control to avoid duplication • Changing orders and information with major clients • Provide a competitive advantage by using new technologies • Support growth via reduced internal support costs 	<p>Technological Drivers</p> <ul style="list-style-type: none"> • Y2K problem • Replacement of disparate system • Quality and visibility improvements on information • Integration of business process and systems • Replacement of legacy systems • Simplification of business acquisitions <p>Operational Drivers</p> <ul style="list-style-type: none"> • Improving business performance • Decreasing high-cost structures • Improving responsiveness to customers • Support new business strategies • Simplify business process • Globalization • Standardization

According to Somers and Nelson (2004), improving productivity, providing competitive advantage and satisfying customer demands are major benefits ERP provides or driving forces giving rise to ERP uses in companies.

High functionality is one of the main features of ERP (Klaus et al., 2000; Mabert et al., 2003). ERP systems provide functionality in three levels to manage the deployment of the resources throughout a company (Akkermans et al., 2003):

- **Transaction processing engine:** (ERP systems) Take into account the management of data across all departments.

- **Work flow management:** They give the enterprise an opportunity to control process flows across departments.
- **Decision support:** They contribute the planning efforts or approval of a customer order. (or taking, giving, contributing)

In addition to these functionalities ERP systems provide, they also promise a lot of benefits. According to Yusuf et al. (2004), ERP offers three major benefits:

- Business process automation,
- Accessing the management information on time,
- Development in supply chain by means of e-commerce and e-communication.

Other important benefits stated in literature are illustrated in the following two tables. Table 3a has the tangible benefits and table 3b has the intangible ones.

Table 3a. ERP Benefits

ERP Benefits	Authors			
	Holsapple and Sena (2003)	Al-Mashari et al. (2003)	Umble et al. (2003)	Nicolaou (2004)
<i>Tangible</i>	• Inventory reduction		<input type="checkbox"/>	
	• Improved material control	<input type="checkbox"/>		<input type="checkbox"/>
	• Improved customer service			<input type="checkbox"/> *
	• Increase of revenue and profits		<input type="checkbox"/>	<input type="checkbox"/>
	• Better visibility of future requirements			<input type="checkbox"/>
	• Elimination of redundant and contradictory data bases			<input type="checkbox"/>
	• Personnel reduction	<input type="checkbox"/>	<input type="checkbox"/>	
	• Increased productivity		<input type="checkbox"/>	<input type="checkbox"/>
	• Improvements in order management		<input type="checkbox"/>	<input type="checkbox"/>
	• More rapid closing of financial cycles		<input type="checkbox"/>	<input type="checkbox"/>
	• Cost reduction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	• Improvement of cash flow and on-time delivery performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

* Nicolaou (2004) classifies this benefit into “Intangible”.

Table 3b. ERP Benefits

ERP Benefits		Authors			
		Holsapple and Sena (2003)	Al-Mashari et al. (2003)	Umble et al. (2003)	Nicolaou (2004)
<i>Intangible</i>	• Increased visibility of corporate data		<input type="checkbox"/>		
	• New or improved business processes	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>
	• Improved responsiveness to customers	<input type="checkbox"/>	<input type="checkbox"/>		
	• Increased flexibility		<input type="checkbox"/>		
	• Y2K compliance	<input type="checkbox"/>	<input type="checkbox"/>		
	• Global sharing of information		<input type="checkbox"/>		
	• Higher morale			<input type="checkbox"/>	
	• Increased communication			<input type="checkbox"/>	
	• Higher data quality	<input type="checkbox"/>			
	• Improved system reliability	<input type="checkbox"/>			
	• Improved visibility in SCM processes		<input type="checkbox"/>		
	• Tighter integration between systems		<input type="checkbox"/>		<input type="checkbox"/>
	• Business performance improvements		<input type="checkbox"/>		
	• Building a synergy		<input type="checkbox"/>		
• Improved business performance		<input type="checkbox"/>			

ERP systems are obviously standard application softwares (Klaus et al., 2000). These systems, logically extended and integrated form of MRP II (Akkermans et al., 2003; Mabert et al., 2003), are established on a threefold client-server architecture - enabling capturing of the valuable management data (O'Leary, 2002; Yusuf et al., 2004): a relational, integrated and centralized database; all business information are entered, recorded, processed, monitored and reported (Umble et al., 2003; Holsapple and Sena, 2003; Ng and Ip, 2003), one application and an incorporated interface throughout the company.

Therefore ERP systems combine the business processes and IT concepts together in one integrated solution (Al-Mashari et al., 2003). Another technical feature of ERP software is that it provides a consistent graphical user interface along application areas (Klaus et al., 2000).

ERP supports a number of business functions. Some of these can be listed as procurement, material management, production, logistics, maintenance, sales, distribution, financial accounting, asset management, cash management, controlling, quality management and strategic planning (Klaus et al., 2000). The ERP system framework and its interaction with the external and internal environment are denoted in Figure 2.

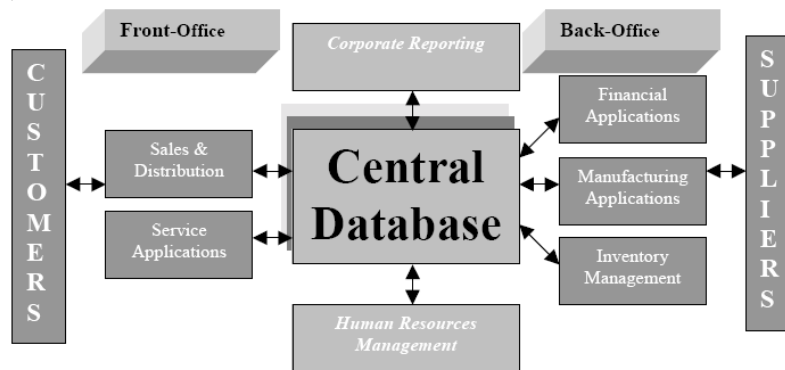


Figure 2. The framework of ERP systems (Rashid et al., 2002)

To get the benefits of these systems and stay competitive, companies have been increasingly turning to ERP systems. According to the AMR research, to establish a better control on supply chain, ERP market would grow at an annual rate of % 32 through 2003 (Umble et al., 2003). The ERP market is the largest segment of a company's applications budget (%34) and expected to remain so through 2004 (Somers and Nelson, 2004). In another research, it is predicted that the ERP marketplace would worth US\$76 billion in 2004 (Nicolaou, 2004). Yusuf et al. (2004) estimate that the businesses around the world have spent approximately \$10 billion per year on ERP systems.

However, ERP systems cost hundreds of millions of dollars to buy (Akkermans et al., 2003). To have the system running companies need to bear some other costs. According to Gartner Group's estimates, for example, companies pay much money on consultants regarding selection, configuration and implementation (Al-Mashari et al., 2003). During the late 1990s, it is estimated that one-third or one-half of the consultations with famous consulting firms have included selecting, implementing or using ERP systems in addition to consultations done after installation (O'Leary, 2002). Furthermore, additional tools as hardware may be needed during the implementation and management change. End-user training costs must be considered in cost calculation as well (Al-Mashari et al., 2003).

2. Pre-ERP: Selection Process

Today, a lot of company tend to integrate off-the-shelf solutions instead of developing systems in-house (Hong and Kim, 2002; Al-Mashari et al., 2003). As a result of these improvements, usages of ERP softwares have been increasing. The ERP vendor market has grown rapidly in 1990s. There were five big ERP software vendors (SAP, Oracle, Peoplesoft, J.D. Edwards and Baan) providing business solutions in 1998 (Yusuf et al., 2004).

A successful ERP project involves selecting an ERP software system and vendor, implementing this system, managing business process change and examining the suitability of the new system. However a wrong selection process causes some weaknesses and thus reduces the performance of the company (Wei et al., 2004).

Most ERP software reflects the management philosophy of the vendor and best practices obtained from other experiences. It means that adopting company accepts the vendor's assumptions (Umble et al., 2003). Hong and Kim (2002) also point out that the difference between adopting company's and the ERP vendor's interest on the package affects the implementation success. An ERP vendor releases package to respond the whole market needs but the company selecting an ERP package expects unique solution.

A survey on IS (Information Systems) selection states that companies believe the necessity of the fit between companies' processes and information system selected (Al-Mashari et al., 2003). Merode et al. (2004) cite structural problems related to the mismatch of ERP system structure and the organizational structure as follows:

- ERP systems assume that supply lead times do not alter with demand and flow, but in reality they do vary with utilization.
- ERP systems require fixed processes and routings, but in many organizations they are not fixed.
- These systems do not have the contingency to optimize in real time the use of capacity and thus assume infinite capacity or cause a disoptimal use of capacity.
- ERP vendors do not provide all required functions for all parts of the organization.

The fit between the business and the software selected is an important target for SMEs (small and mid size enterprises) located in Europe (Klaus et al., 2000). Hong and Kim (2002) emphasize the importance of the degree of vendor and software fit with user enterprise for small business.

A study on SMEs measuring the possible impact of strategic and operational requirements of SMEs on ERP systems project management and deployment arranges these requirements as follows (Huin, 2004):

- Low levels of organizational hierarchy,
- CEO involvement in operational decisions,
- “Blurred” departmental walls,
- Production modes in SMEs,
- Planned forecasts vs. real forecasts,
- Rate of changes in orders,
- Short lead time in manufacturing,
- High staff turnover,
- Customers' special demands.

In the literature, several ERP project or management information system selection methods have been proposed. Some of these methods can be listed as; NGT (Nominal Group Technique), AHP (Analytic Hierarchy Process), Nonlinear Programming, ANP (Analytic Network Process) and 0-1 Goal Programming. However, there is a deficiency about integrating the evaluation of objective external professional data sources and subjective internal interview data sources.

Companies have some aspects to take into account when selecting an ERP system. These include (Wei et al., 2004):

- The strategy of the system to meet the business strategy and goals,
- The ability of the system to support the business process,
- The technical requirements on which the system operates,
- The ability of the vendor to support the system implementation and maintenance,
- The methodologies of business process change and project management.

There are two distinct methods in selection process. One of these focuses on the overall business and information infrastructure and especially is used in large enterprises. The other one is used in SMEs and based on defining the particular features required in processing a specific business (Umble et al., 2003). Al-Mashari et al. (2003) indicate that the SMEs take into consideration five criteria when selecting a package: *affordability, local support level, upgrade capability of software, use of the latest technology, and the domain knowledge of suppliers.*

Umble et al. (2003) emphasize thirteen steps in the selection process:

1. Defining the visions clearly and broadcasting the approved conclusions to the entire organization to determine what a company certainly needs in such a challenging process.
2. Clarifying the software features and functions considering the company visions and processes.
3. Creating a candidate list and getting information about the package from existing users taking part in the same industry.

4. Analyzing the strengths and weaknesses of the vendors and selecting the four to six possible candidates.
5. Creating request for proposal describing the functions and features of company expectations.
6. Reviewing the proposals.
7. Selecting the final two or three candidates.
8. Requesting for a demonstration of the packages.
9. Selecting the winner package.
10. Evaluating the both tangible and intangible benefits of the selected package and make a final decision to have the package.
11. Negotiating the contract.
12. Running a pilot to facilitate the implementation.
13. Making the implementation a reality.

The package not only inexpensive, but also having the capability of supplier support, could be implemented easily, fitness to company's business and flexible enough (Umble et al., 2003).

3. Implementation and Post-Implementation Process

Certainly, the most painful, costly and time-consuming part of an ERP system adaptation is the implementation process. In a review, the two-thirds of the IT managers responsible for ERP project view these systems as the most strategic computing platform of their company (Hong and Kim, 2002). Also 65% of managers believe the existence of modest chance of implementation problems that disrupt the businesses (Umble et al., 2003).

Hong and Kim (2002) highlight the conflicting factors about adaptation, package adaptation or organizational adaptation. Because of the upgrading and maintenance difficulties, vendor companies recommend the process adaptation contrary to ERP adaptation. But the success of ERP implementation alters positive to negative as the level of adaptation (of both ERP and process) increases. Even if the ERP vendors' solutions are reviewed carefully, it is claimed that packages such as SAP

R/3 and Peoplesoft require the tailoring the adopting company's process to the package. In contrast Oracle and SQL allow the firm adapting the software to enterprise's requirements.

The most important thing adopting companies should consider is to support the improvement in business via the ERP system implementation and thus to enhance the competitiveness of the company (Umble et al., 2003; Holsapple and Sena, 2003). Klaus et al. (2000) also emphasize the importance of cooperative knowledge management links between partners in implementation processes and state that IT department should establish itself as the strategic partner of business. Adaptation between IT and end-user is a critical implementation challenge (Hong and Kim, 2002).

Packaged systems such as ERP have features as rapid implementation, reduced cost and high system quality unlike custom softwares. But ERP systems have the risks of indefiniteness in acquisition and hidden costs in implementation (Hong and Kim, 2002; Yusuf et al., 2004). So a lot of techniques have been improved to solve implementation problems. Tools for project management, guidelines, remote checks facilitate the implementation process (Klaus et al., 2000). Besides, rapid implementation technologies and programs provided by the vendors play a pivotal role during adoption and adaptation. Accelerators provided by vendors include business process modeling tools, templates for industry specific business practices, bundling of server hardware with ERP software, and combined packages of software, services and support (Somers and Nelson, 2004). Furthermore, "Big 5" ERP vendors (SAP, Oracle, Baan, J.D. Edwards and Peoplesoft) developed a knowledge base that catches the problems and allows tracing solutions (O'Leary, 2002).

In spite of the fact that ERP packages are costly softwares to buy and set up, companies tend not to do any ROI (return on investment) calculation before the implementation process. According to the Meta Group's research, the average ROI loss is \$1.5 million over a six-year period (Umble et al., 2003). Despite the existence of the implementations that reached the expected benefits, some companies (FoxMeyer Drug, Dell Computers and Hersey Food Corporation) encounter failures and difficulties during the ERP project (Davenport, 1998; Hong and Kim, 2002; Mabert et al., 2003; Yusuf et al., 2004). Hong and Kim (2002) cite

that three quarters of the ERP projects have been completed unsuccessfully.

Mabert et al. (2003) reviewed the ERP implementations according to on-time and on/under budget performance. They classify the implementation characteristics as planning efforts, implementation decisions and implementation management. These are illustrated in Table 4.

Table 4. Implementation Characteristics (Reproduced from Mabert et al., 2003)

Planning efforts	Implementation Decisions	Implementation Management
<ul style="list-style-type: none"> • Executive support and involvement in planning 	<ul style="list-style-type: none"> • Big-bang or phased-in approach 	<ul style="list-style-type: none"> • Benchmarked implementation progress
<ul style="list-style-type: none"> • Building implementation team 	<ul style="list-style-type: none"> • Amount of software Customization 	<ul style="list-style-type: none"> • Trained all users
<ul style="list-style-type: none"> • Addressed technology issues 	<ul style="list-style-type: none"> • Accelerated implementation Strategy 	<ul style="list-style-type: none"> • Kept suppliers and customers informed
<ul style="list-style-type: none"> • Clear education and training strategies 	<ul style="list-style-type: none"> • Number of modules implemented 	<ul style="list-style-type: none"> • Communicated with personnel impacted
<ul style="list-style-type: none"> • ERP steering committee 		<ul style="list-style-type: none"> • Communicated progress regularly

Outcomes of the researches on 75 company show that while modifications have affected the completion time negatively; accelerated implementation strategy, strong executive involvement throughout implementation and informing suppliers and customers decrease the implementation time. Modifications and communicating progress to the company impact budget adversely. Standish Group Research claims that 90% of the ERP implementations could have been finished/ completed over planned time and budget (Umble et al., 2003).

Factors affecting an implementation are reviewed by a number of academicians and practitioners (Al-Mashari et al., 2003; Jacobs and Bendoly, 2003; Umble et al, 2003; Somers and Nelson, 2004) in the literature. These studies point out the following factors:

Commitment of top management

Top management ensures the change of the management and the system rollout and should support the implementation from beginning of project to end (Al-Mashari et al., 2003).

Defining the visions and missions clearly

Al-Mashari et al. (2003) state “Successful visions/missions are those translated or that are/ could be translated into measurable goals and targets”. Management, vendors, users and implementation team must understand the goals of project clearly (Umble et al., 2003).

Data accuracy

Data related challenges contain finding the proper data to load into the system and converting disparate data structures into a single, consistent format (Somers and Nelson, 2004). To run the system properly, data should be entered accurately. Also old systems should not be run parallel with the new system (Umble et al., 2003).

Implementation team

The implementation team gets significant role in the earlier stages of the implementation and less important role during post installation period (Somers and Nelson, 2004). This team creates the initial and detailed plan, assigns activities, and provides the resource availability. So the team should be empowered to make rapid decision making (Umble et al, 2003).

Powerful communication between units and people impacted by new system

Lack of communication has been linked to many project failures. Effective communication influences attitude and behavior and leads to the development of trust and exchange of information (Salam and Amoako-Gyampah, 2004). Communication must include the scope, the tasks and the objectives of the project and should avoid the failures. Moreover, an information policy such as e-mail system can be built (Al-Mashari et al., 2003).

Management of business process reengineering (BPR) efforts

The BPR efforts should include analyzing the business processes and identifying the reengineering potentials (Al-Mashari et al., 2003).

Intensive training and education

To understand the full benefits of ERP, end users should use the system properly. It is estimated that 10-15% of the ERP budgets spent for education and training give the company 80% chance of success (Umble et al., 2003). Also Al-Mashari et al. (2003) emphasize that the target of training activities, enabling users to interact with the ERP system or a closely approximated prototype.

Project management

Since the combination of hardware and software and the organizational, political and human issues cause many ERP projects to be complex, huge and risky, effective project management becomes a critical process (Somers and Nelson, 2004). A number of ERP project failures causing late or over budget on project stem from wrong estimations about project cost and scheduling or changing project scope during project run (Al-Mashari et al., 2003). The project management process should include defining the objectives clearly, building work and resource plan and tracking the progresses (Umble et al., 2003). Although ERP initially brings the planning of resources required to run enterprise to mind, important one is the management of these resources effectively (Yusuf et al., 2004).

Transformation of legacy systems

Legacy systems should be defined and the probable problems encountered during implementation that were caused by old systems should be determined carefully (Al-Mashari et al., 2003). Additional costly software now is used to transfer legacy system information (Yusuf et al., 2004).

Change Management

ERP system impacts the employee's business manner and interacts. So a well-defined strategy should be improved and applied effectively throughout the implementation (Al-Mashari et al., 2003). Hong and Kim (2002) also emphasize the requirement of distinguishing the ERP

installation from a software installation effort. ERP installation should be managed by a program of wide-ranging organizational change initiatives. Resistance to the change should be considered, too.

Integration

Planning and maintaining the integration process require the excessive and ongoing expenditure of resources. Researchers indicate that companies spend 50% of the IT budgets on integration (Al-Mashari et al., 2003).

Testing of new system

Testing efforts provide validation that the system works technically and the business process configurations are practical. Also testing matches the application system and the organization's processes (Al-Mashari et al., 2003). According to the case study carried out by Yusuf et al. (2004) on Rolls-Royce, the purposes of a pilot was to clarify business principles, processes, procedures, role definitions, software, hardware and data transfers.

Multi-site and cultural adaptation

Large sized companies usually have a lot of facilities located in different sites. The challenge of implementing ERP systems in a standardized level in all locations requires the company of this kind to consider the participants from other locations. The complexity of accurately supporting the all users accessing an integrated database, locating in different sites too, must be considered in-depth (Jacobs and Bendoly, 2003). In multi-site implementation, phased-in approach is usually preferred. This enables the company to utilize the learned lessons at early sites (Umble et al., 2003).

Defining performance measurements

The measurements like profit margin, inventory turns, vendor performance, on-time deliveries should be defined carefully (Umble et al., 2003). Hong and Kim (2002) highlight success metrics covering project, early operational metrics and long-term business results. Al-Mashari et al. (2003) propose the regular auditing and benchmarking for optimization of the potential businesses to include. The other important

factor is that performance management should encompass tangible and intangible aspects.

Internal and external corporate relationships

Internal and external corporate relationships on ERP system impact the implementation and maintenance success (Jacobs and Bendoly, 2003).

Global robustness of best practices

The implementation level necessitates the integration of best practices to enhance the execution of the company as a whole (Hong and Kim, 2002; Jacobs and Bendoly, 2003; Al-Mashari et al, 2003). Klaus et al. (2000) point out the difficulties of transferring best practices built into ERP software on a global scale and claim that close cooperation between vendors and users would be a solution. Hong and Kim (2002) also indicate the disruptive effect of best practices. ERP offers a *general model* for every process/ every industry.

After the implementation, the adopting company engages in a number of activities such as post-implementation review, support and maintenance. A well-planned and executed post-implementation process contributes the organization to perform needed changes in plans and processes, decreases the implementation risks and supports the organization to realize the potential operational and strategic benefits.

The Benchmarking Partners evaluates the post-implementation activities in three stages. In the first stage, it is possible that the company encounters with a productivity decline. This decline can be overcome via redefining the jobs, establishing new procedures, adjusting the ERP software. The second stage includes skills development, structural changes, process integration and add-on technologies expanding ERP functionality. The last stage involves the introduction of applications such as SCM (Supply Chain Management), data mining, sales-force automation, CRM (Customer Relationship Management) (Nicolaou, 2004).

The training efforts should continue after implementation. Periodic user meetings help the identification of the problems (Umble et al., 2003).

Morede et. al. (2004) point out some post-implementation problems. These can be aligned as follows:

- Members of the organization are unable to upgrade the new technology.
- ERP systems are not flexible enough, therefore they necessitate major reengineering efforts.
- ERP requires that processes be described very precisely. Often the formal information is not complete, and the implementers do not know where the different types of process knowledge reside in the organization.
- Organizational memory mismatches. ERP systems require that not only organizational data but also knowledge is stored in a structural way. Memory mismatches cause underperformance of the ERP system, leading to a need for coping with, for example, further enhancing the ERP system.

Conclusions and the Future Tendencies

Large organizations across the globe have realized that in rapidly changing environments, it is impossible to create and maintain a custom designed software package that will satisfy all of their daily business needs. Realizing the requirement of user organizations, some of the leading software companies have designed Enterprise Resource Planning software, which is the latest high-end solution information technology has lent to business application.

The ERP solutions seek to streamline and integrate operation processes and information flows in the company to mix the resources of an organization, namely human, material, money and machine resources via information.

There are as many reasons for successful ERP implementations as there are for failed projects. Obviously the first of these reasons is the package selection affecting both (for) success and failure. Packages not meeting the requirements of the adopting companies are to be cited as the major reason of the unsuccessful ERP integrations.

ERP systems are complex and implementing process can be a difficult, time-consuming, and expensive project for a company. The technology is tightly integrated and requires a commitment from all divisions and often a change in the way a company does business to make it work. Moreover, there is no guarantee of the outcome. Therefore, ERP implementation decision requires a comprehensive evaluation of the factors affecting the success. Researchers have described the ERP transition with models having three to six stages (e.g. Deloitte Consulting's three stages model and Ross and Vitale's five stages model). Furthermore, some researchers arrange the IT implementation into six stages consisting of adoption, adaptation, acceptance, routinization and infusion. In this scope (what scope?), the study (which study?) purposes to take into account the process as a whole.

Performance measures must be developed and standardized to give organizations a clearer picture of the benefits derived from Enterprise Resource Planning implementation.

In the new generation of ERP, a lot of enhancements such as internet based applications, component technology using object oriented models made the implementation and customization processes quicker and faster (Ng and Ip, 2003).

Object oriented approaches in ERP system design and decision support and information analysis packages to be bolted-on now become a standard (Jacobs and Bendoly, 2003). Furthermore, Yusuf et al. (2004) emphasizes that additional information tools needed for CRM and APS (Advanced Planning and Scheduling) (Akkermans et al., 2003; Merode et al., 2004) (are) is a new trend in ERP world. (or needs some other revision) The integration of ERP with applications such as B2B, B2C, CRM or others beginning with "e-" will be the main issues in the future. (Jacobs and Bendoly, 2002).

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