



VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETAS

VERSLO VADYBOS FAKULTETAS

FINANSŲ INŽINERIJOS KATEDRA

Anna Marcinkevič

**VERSLO VALDymo SISTEMOS IR JŲ DIEGIMO PROJEKTŲ PARAMOS
MODELIAVIMAS**

**ENTERPRISE RESOURCE PLANNING SYSTEMS AND MODELING THE
SUPPORT OF THEIR IMPLEMENTATION PROJECTS**

Baigiamasis magistro darbas

Verslo vadybos studijų programa, valstybinis kodas 621N10004

Tarptautinio verslo specializacija

Verslo studijų kryptis

Vilnius, 2013

VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETAS

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TVIRTINU

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UŽDUOTIS**

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Vilnius

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Baigiamojo darbo tema: Verslo valdymo sistemos ir jų diegimo projektų paramos modeliavimas. Enterprise Resource Planning Systems and Modeling the Support of Their Implementation Projects.

patvirtinta 2011 m. spalio 21 d. dekanų potvarkiu Nr. 460vv

Baigiamojo darbo užbaigimo terminas 2013 m. sausio 4 d.

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**BAIGIAMOJO DARBO (PROJEKTO)
SĄŽININGUMO DEKLARACIJA**

2013 m. _____ sausio 4 _____ d.
(Data)

Patvirtinu, kad mano baigiamasis darbas tema _____
diegimo projektų paramos modeliavimas. Enterprise Resource Planning Systems and Modeling
the Support of Their Implementation Projects.
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Finansų inžinerijos katedra

ISBN ISSN
Egz. sk.
Data-.....-.....

Antrosios pakopos studijų **Verslo vadybos** programos baigiamasis darbas

Pavadinimas **Verslo valdymo sistemos ir jų diegimo projektų paramos modeliavimas**

Autorius **Anna Marcinkevič**

Vadovas **doc. dr. Rima Tamošiūnienė**

Kalba: anglų

Anotacija

Baigiamajame magistro darbe nagrinėjamos verslo valdymo sistemos (VVS), jų diegimo projektų aspektai ir problematika ir sprendžiama aktyvaus įmonių dalyvavimo šiuose projektuose bei didesnės naudos iš VVS diegimo pasiekimo problema siūlant VVS diegimo paramos modelį, pagrįstą kiekybinių ir kokybinių priemonių kombinacija.

Pirmoje dalyje analizuojama mokslinė literatūra bei įvertinamas ekspertų požiūris į verslo ir technologijų darną, analizuojama VVS komponentų įvairovė ir galimybės verslui, VVS pasirinkimo kriterijai, VVS diegimo projektų eiga, jų nauda ir problemos. Antroje dalyje atlikus svarbiausių pasaulinių VVS projektų tyrimų išvalgų analizę, aprašomi ir įvertinami VVS diegimo ekspertų ir vartotojų apklausos rezultatai, kurie padeda įvertinti esamą VVS diegimo projektų situaciją užsienyje ir Lietuvoje ir įvertinti VVS diegimo projektų paramos modelio poreikį įmonėms. Įvertinus esamų VVS diegimo modelių praktinio pritaikymo galimybes trečioje dalyje siūlomas naujas kompleksinis VVS diegimo projektų paramos modelis, kuriame sukaupta geriausia VVS diegimo praktika panaudojus užsienio literatūrą, įmonių praktiką ir Lietuvos ekspertų patirtį.

Darbą sudaro šešios dalys: įvadas, verslo valdymo sistemos ir jų diegimo projektų iššūkiai, pasaulinių ir Lietuvos verslo valdymo sistemų diegimo projektų aspektų tyrimai, verslo valdymo sistemų diegimo projektų paramos modelis, išvados ir siūlymai, literatūros sąrašas.

Darbo apimtis – 81 p. teksto be priedų, 29 iliustr., 19 lent., 63 bibliografiniai šaltiniai. Atskirai pridedami darbo priedai.

Prasminiai žodžiai

Verslo valdymo sistema (VVS), VVS diegimo modelis, VVS diegimo projektų valdymas

Vilnius Gediminas Technical University
Faculty of Business Management
Department of Finance Engineering

ISBN _____ ISSN _____
Copies No.
Date-.....-.....

Master Degree Studies **Business Management** study programme Final Thesis

Title **Enterprise Resource Planning Systems and Modeling the Support of their Implementation Projects**
Author **Anna Marcinkevič**
Academic supervisor **Assoc Prof Dr Rima Tamošiūnienė**

Thesis language:
English

Annotation

The Master's Thesis examines Enterprise Resource Planning systems (ERP), aspects and issues of their implementation projects. Problem of lack of active companies participation in ERP implementation projects is analyzed and ERP implementation benefits maximization problem is solved by proposing advanced ERP implementation support model based on the combination of quantitative and qualitative techniques.

In the first part of work scientific literature is analyzed and experts approach to business and technology alignment, ERP components variety and business opportunities, ERP selection criteria, ERP implementation projects stages, their benefits and problems are evaluated. After the insights on worldwide ERP implementation projects researches in the second part of work ERP experts and users survey is conducted. Author's survey results helped to evaluate an existing situation of ERP implementation projects worldwide and in Lithuania and to assess companies' demand for the modeling and supporting ERP projects' implementation. After the evaluation of practical adaptation possibilities of existing ERP implementation models new complex ERP implementation projects support model is proposed in the third part of the work. This model covers the best ERP systems implementation practice in foreign scientific literature and business practice as well as the experience of Lithuanian experts.

Thesis consists of six parts: introduction, ERP systems and organizational challenges of their implementation, investigation of the trends of ERP implementation projects worldwide and in Lithuania, ERP implementation project support model, conclusions and recommendations, references.

The Thesis consists of: 81 page of text without appendixes, 29 illustrations, 19 tables, 63 bibliography sources. Appendixes enclosed.

Keywords

Enterprise Resource Planning System (ERP), ERP implementation model, ERP project implementation management

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INTRODUCTION

In the fast Information Technology (IT) society of today, there have been various changes in the organization behaviour. The enterprise is forced to be able to perform well under the abundance of information and hyper competition conditions. The basis of the enterprise survival in the market and the core development factors are innovation, improving efficiency, reducing costs and increasing competitive advantage by effectively managing informational knowledge. The information has become a strategic corporate resource and encourages business to invest in IT projects.

Different measures are used to support the information and knowledge management processes and one group of them are variety of IT and information solutions such as Enterprise Resource Planning (ERP) systems. ERP systems are software packages that enable the integration of transactions oriented data and business processes throughout an organisation. ERP integrates all the enterprise processes, and thus allows to control and to optimize the business and its individual processes. ERP allows companies to operate more efficiently and move on to the next and higher quality stage. Nevertheless, whether enterprise can integrate information technology with organization, overall management, in order to advance its core competition ability, lies on the effective knowledge management during the ERP implementation process.

However, the core **problem** is that there are number of examples where enterprises, who invested in the ERP systems and informationization, fail to fully realize their original purpose. In fact, the ERP implementation projects success rate mostly depends on the level of the enterprises participation in these projects. However, the problem of enterprises involvement and active participation in the ERP implementation projects occurs.

The main reasons of lack of active enterprises involvement are weak ERP projects knowledge, passive interest in this area and transferring the responsibility for the project results to vendors and consultants. Actually, consultant's and vendor's target is to enable appropriate knowledge transfer, but enterprises have to be ready to receive this knowledge and to use it to improve ERP implementation project results.

Moreover, existing ERP implementation models are imperfect and do not fully adaptive. Therefore, enterprises ERP implementation projects should be encouraged as well as supported by improved and complex models, which would encourage enterprises involvement.

This Master thesis **goal** is to develop advanced and based on different quantitative as well as qualitative techniques support model of the ERP implementation projects, which would ensure active enterprises participation and better ERP implementation projects results.

Tasks of this paper:

- To evaluate the importance of business and IT alignment under the agility conditions;
- To introduce with ERP systems and their components;
- To unfold the opportunities, problems and other aspects of ERP projects implementation;
- To make the insights on worldwide researches of ERP implementation projects;
- To evaluate the demand for the modelling and supporting ERP projects' implementation by conducting ERP experts and users survey;
- To evaluate the effectiveness of existing ERP implementation models;
- To propose advanced support model of ERP implementation projects.

Research methods used in the Master thesis: scientific literature analysis, secondary data analysis, statistics data analysis, generalization of worldwide researches, survey, modelling.

The structure of thesis: In the Master thesis scientific literature is analyzed and experts' approach to business and technology alignment, ERP components, variety and business opportunities, ERP selection criteria, ERP implementation projects stages, their benefits and problems are evaluated. After the insights on worldwide ERP implementation projects researches ERP experts' and users' surveys are conducted. Author's surveys helped to evaluate an existing situation of ERP implementation projects in Lithuania and to assess companies' demand for the modelling and supporting ERP projects' implementation. Practical adaptation possibilities of existing ERP implementation models are evaluated and new complex ERP implementation projects' support model is proposed. This model contains the best ERP system's implementation practice in foreign scientific literature as well as the experience of Lithuanian experts.

Practical meaning of thesis: the analysis of scientific literature, worldwide researches, author's surveys and the evaluation of the existing ERP implementation models were used to develop advanced support model of ERP implementation projects, which expected to encourage more active participation of enterprises as well as provides more opportunities to make the right IT investment decision and to reach a larger benefit take-up rate of ERP implementation projects.

1. ERP SYSTEMS AND ORGANIZATIONAL CHALLENGES OF THEIR IMPLEMENTATION

Business enjoys the opportunities and benefits of ERP systems for the years and globally. ERP have been used for decades, but changes in business and IT strategies are driving implementations, new utilization of existing functionality in current systems, and re-implementations to replace aging systems.

Organizations should be prepared for the challenges of these typically large and complex projects, otherwise original purpose of implementation and high level of benefits will be missed.

1.1. Value Of Business And IT Alignment

In an environment marked by continual transformation, competitive organizations increasingly rely on the business and IT alignment based on agility. *“To survive and thrive, enterprises must capture and exploit new business and IT opportunities before competitors do”* (Mendez 2010).

“Business agility refers to the ability of an organization to rapidly adapt to change in productive and cost-effective ways through two key capabilities”: 1) timely adjustments to supporting business structures, processes, and systems and 2) effective organization and use of human resources (Allee 2010). The more agile enterprise is, the higher value and competitive advantage is. Obviously, those firms who use IT to create business agility will be the clear winners. However, alignment can only be successful if it comes from both sides (Oracle 2009). It means that IT agility enables business agility as well as business agility enables IT agility. Therefore, business and IT agility are inextricably linked.

Business and IT alignment is closely associated with attempts to improve the business value. Thus, business and IT alignment let organizations successfully deal with unpredictable, dynamic, and constantly changing internal and external environments.

In today’s business climate, where trust between business and IT in most companies has never been more fragile, possibilities to completely rethink IT have to be found, and IT have to be transformed into a strategic asset for the companies. Moreover, IT needs to become more tightly integrated with the broader business, not just aligned with it, and that means embedding IT throughout the organization (Klaus *et al.* 2000; Hinssen 2008).

However, business and IT alignment allows the company to create higher value only when there is technology, management and operational excellence (Fig. 1).

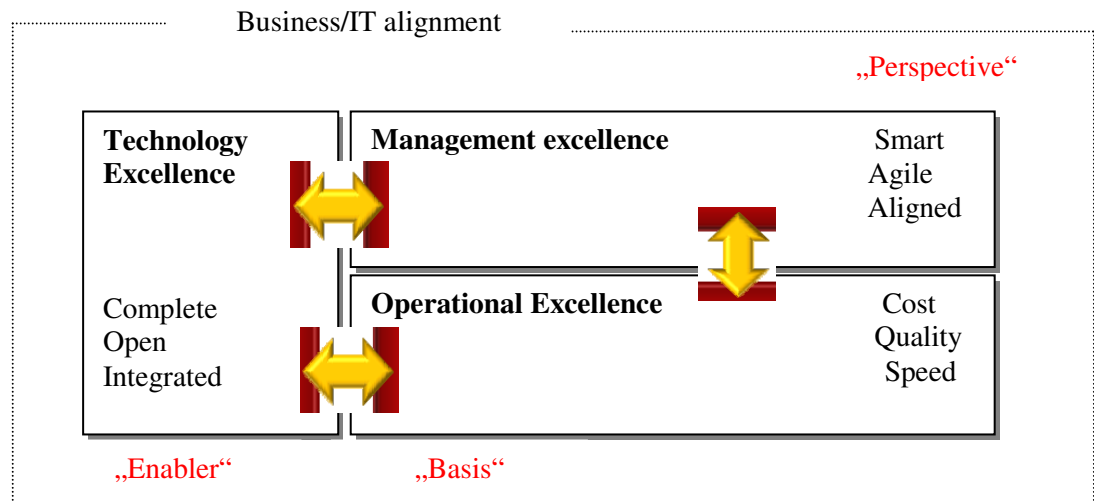


Fig. 1. Business/IT alignment (Source: Vlek 2010, Oracle 2009)

“Most people are familiar with the term operational excellence; optimizing cost, quality, and speed. It has become a prerequisite to fuel the next level of competitive differentiation - management excellence - which is characterized by three other attributes; smart, agile, and aligned” (Vlek 2010). Neither can be achieved without technology excellence; an IT strategy that focuses on being complete, open, and integrated (Vlek 2010, Oracle 2009).

In Filippo Passerini opinion¹, technology is both a commodity and a competitive advantage, not one or the other. A lot of the breakthroughs in business and business models are technology-enabled. Innovation arises from integrating what is needed and what is possible and it helps provide the agility. When enhancement of business models or processes is needed, we should innovate how to apply technology as a solution, how new technologies can make business processes and services better (Passerini 2010).

Different measures are used to support the information and management of different business processes. Among the variety of IT and information solutions ERP systems are one of the best alternative (as it is the most complex) to cope with the enterprise processes integration, control and optimization.

ERP allows companies to operate more efficiently and move on to the next and higher quality stage as well as to increase business value.

¹ President of Global Business Services and Chief Information Officer at Procter & Gamble. 2010 Chief Of The Year.

1.2. Evolution of Conception of ERP Systems

There are different approaches to ERP definition and it's volume in Lithuania and worldwide. The author noticed that the definition of ERP (Enterprise Resource Planning) is understood worldwide as the equivalent of BMS (Business Management System) in Lithuania.

Lithuanian authors describes BMS as „*all in one*“ or *computer program integrating all the business processes control and management functions. What is more, after BMS implementation there is no need to use other supportive programs. BMS usually consists of many modules, tailored to a wide range of business segments: trade companies, manufacturing companies, service industries etc. In most cases the software is flexible and allows to increase functionality by adding new modules in the future*“ (ERP-Enterprise Resource Planning, SCM-Supply Chain Management, CRM-Customer Relationship Management, EPM-Enterprise Performance Management, BI-Business Analytics etc.) (Davidavičienė, *et al.* 2009: 118-119).

According to this definition, ERP is not Business Management System, but only one module or component of it, which focuses not on the external, but internal environment, and in the most cases is suitable solution for manufacturing organizations. However, the recent worldwide tendency shows that ERP modern conception is wider as ERP extended to ERP II and ERP III (alternate future generation ERP solutions). There are three generations of enterprise applications. Thus, the difference in definitions arise due to the ERP systems development and, in author's opinion, the definition above should be equivalent to ERP definition.

The modern ERP generation systems are thought to be an outcome of 50 years of trial and error (Fig. 2).

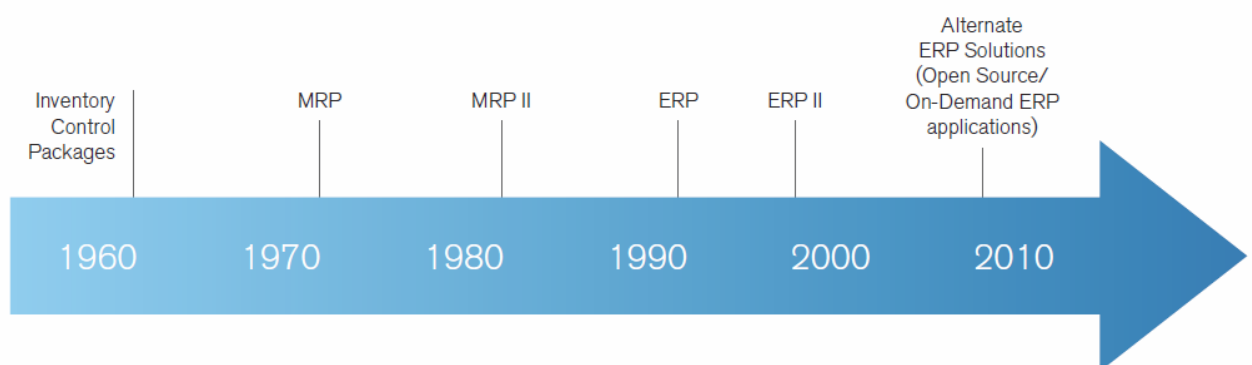


Fig. 2. ERP conception evolution

Prior to 1960s, business had to rely on the traditional ways of inventory management to ensure smooth functioning of the organization. These theories are called classical inventory management of scientific inventory control methods. Inventory Control Packages was the

combination of information technology and business processes of maintaining the appropriate level of stock in a warehouse.

In 1970s, a new technique of Material Requirements Planning, popularly known as MRP, was evolved. This was a proactive manner of inventory management. MRP utilizes software applications for scheduling production processes.

In 1980s, the need was felt to integrate the financial resource with the manufacturing activities. From this evolved an integrated manufacturing management system called Manufacturing Resource Planning (MRP II). MRP II utilizes software applications for coordinating manufacturing processes, from product planning, parts purchasing, inventory control to product distribution.

Transition from MRP II to ERP happened during 1980-90. The shortcomings of MRP II and the need to integrate new techniques led to the development of a total integrated solution called ERP, which attempts to integrate the transactions of the organization to produce the best possible plan. ERP uses multi-module application software for improving the performance of the internal business processes (Sudalaimuthu, Vadivu 2009).

Bill Wood² proposes three definitions of different generations of enterprise applications (see table 1).

Table 1. Definitions of 3 ERP generations (Source: Wood 2010)

ERP	ERP II	ERP III
ERP system integrates virtually all operational business functions and processes and automates entries to finance and reporting within the enterprise (the legal entity or entities that make up an entire company no matter where its operations are).	Through collaboration, Service Oriented Architecture, and other interface, data exchange, or interaction methods the ERP ii systems move beyond Enterprise boundaries (or a basic ERP system) and into the vendor space including the supply, design, and engineering collaboration areas.	Through collaboration, direct contact, social media, and various data streams within and outside of the enterprise ERP iii integrates marketplace fans and critics into the extended ERP and ERP ii organizations. From this integration of the customer and vendor a constructive dialog and exchange of information is created to innovate, produce, and then sell / distribute better products or services.

According to these definitions generalizations can be made about ERP:

- ERP systems focus almost exclusively on operational excellence value propositions of process efficiency and automation;

² SAP Business Process Expert.

- ERP II systems continue to enhance operational excellence and start to introduce a measure of the innovation value proposition.
- ERP III systems create a strong synergy between innovation and customer focus. Moving to the border-less enterprise, ways to bring customer input, needs, wants, and insight into the enterprise are being found (Wood 2010).

Taking all into account, Lithuanian authors who analyzes ERP systems and defines them, refer to ERP definition (prior to 2000s), but not to the ERP II or ERP III.

1.2.1. ERP Modules

ERP systems are made up of many different modules. Each of the modules in ERP module is specialized to handle specific business processes. A successful ERP system needs to be universal because the entire company uses it but it must also be modular so that individual departments within the business have their particular needs met.

For instance, Oracle³ offers the comprehensive, fully integrated portfolio of Enterprise Resource Planning (ERP) business applications in E-Business Suite. *“Each application within Oracle’s E-Business Suite is licensed separately so that organizations may choose which combination of modules that are most applicable to their organization”* (Oracle 2012). The key applications of Oracle E-Business Suite which can be also offered by other vendors are:

- Customer Relationship Management (CRM)
- Financial Management (Accounting)
- Human Resource Management System (HRMS)
- Project Management
- Supply Chain Management (SCM)
- Enterprise Performance Management (EPM)
- Business Analytics (BI)

CRM software is a large class of software programs essentially designed to help businesses manage their customer information. CRM is a means by which organizations, large and small, manage interactions with their customers and prospects. It is seen as a company-wide strategy used to learn about the company’s customers’ needs and behaviours in order to nurture and develop existing relationships and build strong new relationships. In order to do this, organizations use technology solutions to organize, automate, and synchronize their business processes around sales, marketing and customer services (Oracle 2012).

³ Leading ERP vendor.

Due to the dynamic changes, the way in which companies manages their relationships with customers also changes. Evolution of CRM is presented in Fig. 3.

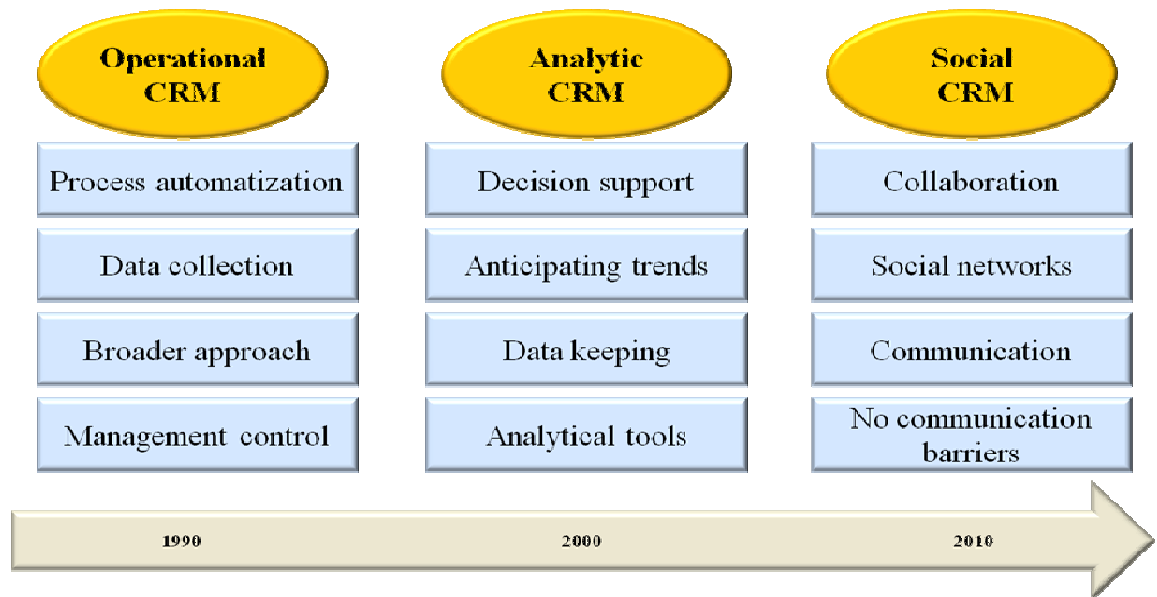


Fig. 3. CRM evolution (Source: Baliukevičius 2010)

The concept of Social CRM is slowly becoming popular. Significantly because it helps companies look at their customers as real people, not just a set of numbers that need tracking and processes. The detailed explanation of the differences between traditional CRM and Social CRM presented in Fig. 4.

Financial Management (Accounting) module can include Cash Management, Payables, Receivables, Fixed Assets, Treasury, Property Management, Financial Analyzer and other functions. Financial module can work more properly, accurately, globally and safer.

HRMS module helps companies manage the entire recruitment process and provides a real-time view of all HR activities such as recruitment, training, benefits and payroll. The HRMS can be fully integrated with other modules and can offer users an analytics package that allows for easy extraction of HR data etc. (Oracle 2012)

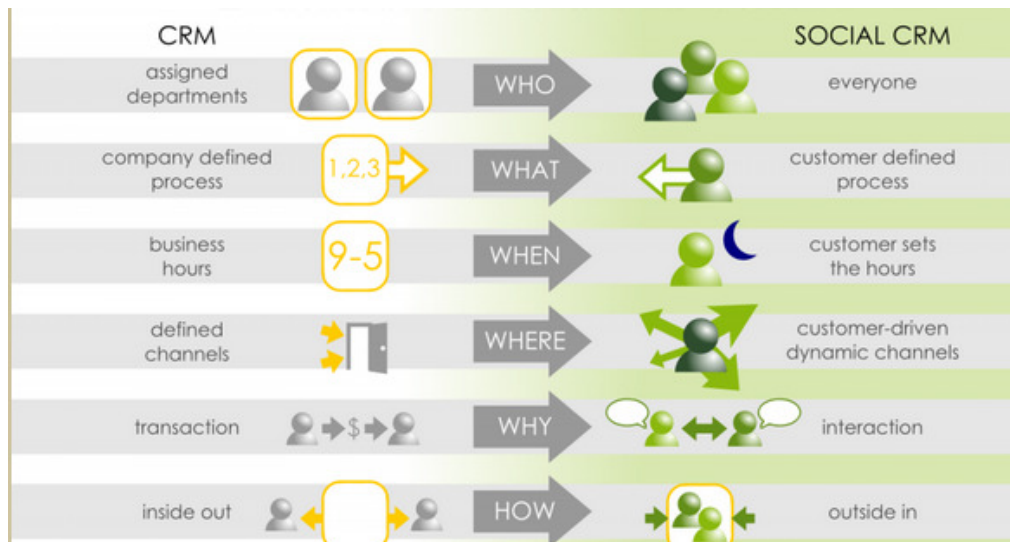


Fig. 4. Traditional CRM vs Social CRM (Source: Chess Media Group 2010)

Project Management module helps when the activities and objectives of an organization's profitability are based on projects. This module *"supports the full lifecycle of project and portfolio management. It provides a single, accurate view of all project-related activities. It allows users to select the best portfolio of initiatives, execute projects in adherence with methodologies, assign the right global resources, proactively streamline project delivery, and track profitability via accurate budgeting, forecasting, and billings/charge-backs"* (Oracle 2012).

Supply Chain Management can be described as the process of managing the movement of goods from suppliers to buyers. As defined by the council of Supply Chain Management Professionals (CSCMP) *"Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, SCM integrated supply and demand management within and across companies"*. (CSCMP 2012).

This application leads to easier and better realization of 7 rights of SCM: the right product, in the right quantity, to the right customer, at the right time, at the right place, in the right condition, at the right costs.

The goals of SCM reflects in the Supply Chain Operations Reference (SCOR®) model established by Supply Chain Council. SCM as a module of ERP is working according to the SCOR® structure (Fig. 5).



Fig. 5. The SCOR® structure (Source: Supply Chain Council 2010)

SCOR® is based on five level management processes:

1. **Plan (P).** The Plan processes describe the planning activities associated with operating a supply chain. This includes gathering customer requirements, collecting information on available resources, and balancing requirements and resources to determine planned capabilities and resource gaps.
2. **Source (S).** The Source processes describe the ordering (or scheduling) and receipt of goods and services. The Source process includes issuing purchase orders, scheduling deliveries, receiving, shipment validation and storage, and accepting supplier invoices.
3. **Make (M).** The Make processes describe the activities associated with the conversion of materials or creation of the content for services. It focuses on conversion of materials rather than production or manufacturing because Make represents all types of material conversions: assembly, chemical processing, maintenance, repair, overhaul, recycling, refurbishment, remanufacturing, and other material conversion processes. As a general guideline: these processes are recognized by the fact that one or more item numbers go in, and one or more different item numbers come out of this process.
4. **Deliver (D).** The Deliver processes describe the activities associated with the creation, maintenance, and fulfillment of customer orders. It includes the receipt, validation, and creation of customer orders; scheduling order delivery; pick, pack, and shipment; and invoicing the customer.
5. **Return (R).** The Return processes describe the activities associated with the reverse flow of goods back from the customer. The Return process includes the identification of the need for a return, the disposition decision making, the scheduling of the return, and the shipment and receipt of the returned goods (Supply Chain Council 2010).

EPM solutions are designed specifically *“to close the gap between strategy and execution by cascading corporate goals down into department-relevant metrics; ensuring accountability; enabling trusted reporting and analysis; and streamlining execution of strategy-guided and risk-aware plans”* (SAP 2012). EPM solutions offer comprehensive functionality for:

- Strategy management – Set your goals, map your strategies, and then manage performance from high-level objectives to operational metrics.
- Planning and consolidation – Increase the accuracy and effectiveness of planning, budgeting, forecasting and financial reporting processes.
- Financial consolidation – Complete your financial consolidation and reporting cycles faster – with complete confidence in your data.
- Disclosure management – Ensure a timely, accurate, and risk-free close process by managing the production, filing, and publication of financial and regulatory statements and reports.
- Notes management – Streamline the collection and management of financial notes to help improve your financial statements and reports.
- Financial information management – Leverage powerful connectivity, mapping, and loading functionality designed for business users.
- Intercompany reconciliation – Accelerate your close by enabling business units to reconcile intercompany balances and transactions directly with one another.
- Profitability and cost management – Identify the causes of underperformance, and take action to reduce costs and optimize profitability.
- Spend performance management – Maximize cost savings and reduce supplier risk by gaining continuous visibility into company-wide spending patterns.
- Supply chain performance management – Measurably improve supply chain effectiveness by focusing on actionable, operational process metrics.
- Sales and operations planning – Develop synchronized demand and supply plans that are feasible and aligned with your company's financial goals (SAP 2012)

Business Intelligence (BI) is one of the well known application for data abstraction. BI *“includes approaches to understand operational data so that intelligent decisions can be made around the business. Thus, the ability to place data into a structure that is a better representative of the way we want to look at data for decision purposes is core to Business Intelligence”* (Linthicum LLC 2011).

Other definition is more precise: *“BI refers to technologies, tools, and practices for collecting, integrating, analyzing, and presenting large volumes of information to enable better decision making”* (Dayal, et al. 2009).

Therefore, BI module based on the process of rolling up information from many physical database (modules) to one, data abstraction, visualization, what leads to better decision making.

Taking all into account, ERP software should be designed individually for the particular company according to its activity and business processes. It is the core condition for choosing appropriate modules for the particular company.

1.3. ERP Selection Criteria

ERP software selection is a strategic decision. The decision makers are responsible for all the consequences of this choice. Thus, the selection process should be fully measured and accomplished. Thus, ERP selection criteria are of strategic importance. According to these criteria the plan and fact can be compared and the level of quality of ERP implementation project can be assessed.

The most important ERP selection criteria are thought to be: functionality of software, software's ability to fit the business or functional fit, level of support from the solution provider, growth potential of software (additional modules, modifications or flexibility), vendor's reliability (vendor credentials), data security, reporting and analysis features, total cost of ownership, return on investment (ROI), implementation time, ease of implementation and use etc. (Gartner Group 2011; Kimberling, Kaas 2009; Bulotienė 2010; Oracle 2012; SAP 2012).

Although functionality is important, it is more than if the software meet business requirements. Organization should also consider architectural and technology issues to make a well-rounded decision.

Functional fit can be defined as *“the capability of the proposed software solution to satisfy the organization's business requirements and vision. Typical elements of this criterion's assessment include the preparation of business-functional requirements, the weighting of these functions and an assessment of the fit of the proposed solution in meeting the requirements”*(Gartner Group 2008).

Level of support from the solution provider is really important criterion. The technical 24x7x365 support is especially important for transnational corporations with different time zones as it influences the continuity of the ERP system and business processes. The support also means continuous improvement and filling the gaps of the system.

As the business requirements of the organization change, ERP system's growth potential is important as it should be able to add extra modules. The ERP should be flexible in order to suit the changing organizational culture and business strategy.

ERP implementation means long-term relationships with ERP vendor. Thus, the vendor's reliability or credentials are of huge importance: market share, reputation, consultants experience and qualification, financial situation etc.

An information became resource of strategic importance and the information damage or loss can lead to many negative consequences, the security is of special importance. Thus, ERP should ensure information safety and the audit possibility.

Reporting and analysis features means not only standard reports, but also implementation of manager's reporting or analysis mechanisms or tools which can be integrated to the system.

Total cost of ownership should be taken into account. ERP implementation consists of different costs and they are not limited to ERP software price. It consists of licenses and support costs, indirect consultation's costs, other hidden ERP implementation costs. ROI should also be evaluated as not only capital return, but HR, time return etc.

ERP implementation time is usually longer than expected. Thus, this should be taken into account as time waste leads to other resources waste.

Ease of implementation is not always the indicator of good ERP solution, but the importance of this criterion sometimes is important for particular companies. However, the ease of use is of crucial importance as employees training are costly and the ease of use requires less resources waste and smaller level of resistance to change.

Each ERP implementation project is unique and the criteria should be chosen according to the needs of particular company. Therefore, we cannot distinguish universal criteria. Each company should choose own ERP implementation strategy and to lean on it's own Key Performance Indicators (KPIs).

1.3. 1. AHP-Based Approach To ERP System Selection

After criteria selection company has a set of defined requirements according to which ERP vendor or software is chosen. However, the problem of reasoning why vendor A is better than vendor B, C or other is better to choose occurs. Thus, ERP system selection decision needs some tools.

Author offers comprehensive framework for selecting a suitable ERP system by using Analytic Hierarchy Process (AHP), which is quantitative decision making tool. AHP method,

directs how to determine the priority of a set of alternatives (both economic and non-economic criteria are transformed into the quantitative expression) and the relative importance of attributes in a multiple criteria decision-making problem.

Wei, Chien and Wang (2005) developed a procedure for selecting a suitable ERP system. It has seven steps, they are as follows:

Step 1. Form a project team and collect all possible information about ERP vendors and systems.

Step 2. Identify the ERP system characteristics.

Step 3. Construct a structure of objectives to develop the fundamental-objective hierarchy and means-objective network.

Step 4. Extract the attributes for evaluating ERP systems from the structure of objectives.

Step 5. Filter out unqualified vendors by asking specific questions, which are formulated according to the system requirements.

Step 6. Evaluate the ERP systems using the AHP method.

Step 7. Discuss the results and make the final decision. (Wei, Chien, Wang 2005)

AHP is one of the most widely used multi-attribute decision-making methods. „*In this method, the decision-maker (DM) performs pair-wise comparisons, and, the pair-wise comparison matrix and the eigenvector are derived to specify the weights of each parameter in the problem. The weights guide the DM in choosing the superior alternative*“ (Babak, Turan 2011).

The first step of ERP selection process is to make ERP selection criteria list and to determine which of them are very important and which of them are less important. Each criteria is assigned a number on a scale. One common scale is presented below (see Table 2). If attribute A is absolutely more important than attribute B and is rated at 9, then B must be absolutely less important than A and is valued at 1/9 etc.

After criteria selection and possible options of softwares (vendors) which meet these criteria are determined, hierarchical categorization of the ERP system selection problem is being made (decomposition of problem into hierarchy).

Table 2. Rating scale of AHP method (Source: Geoff 2004)

Intensity of importance	Definition	Explanation
1	Equal importance	Two factors contribute equally to the objective
3	Somewhat more important	Experience and judgement slightly favour one over the other.
5	Much more important	Experience and judgement strongly favour one over the other.
7	Very much more important	Experience and judgement very strongly favour one over the other. Its importance is demonstrated in practice.
9	Absolutely more important.	The evidence favouring one over the other is of the highest possible validity.
2,4,6,8	Intermediate values	When compromise is needed

Once the model of hierarchy is built, the next step is to evaluate the elements by making pair wise comparisons or the comparison matrices of decision maker for ERP software selection. The priority of all the criteria are determined. The next step is to determine the normalized weights of each ERP system (vendor A, B, Cetc.) according to the each criteria (criteria X, Y, Z etc.). The aim of this action is to prioritize ERP systems (vendors) according to each ERP selection criteria. ERP system evaluation is made by multiplying each priority of criteria by each ERP system priority according to these criteria and by summing these results (synthesis of ERP system selection evaluation). According to these evaluation, priority of ERP system A, B, C or other is the highest and it is the best solution to be selected for implementation (Geoff 2004; Babak, Turan 2011).

1.3. 2. Gartner Group ERP Magic Quadrant In ERP System Selection

Gartner Group is a well known company which offers world-class, objective insight on virtually any area of IT. It also developed the annually published ranking system of ERP vendors called the Magic Quadrant for ERP service providers which presents the landscape at particular point in time for companies considered for ERP initiatives (Fig. 6).



Fig. 6. Gartner Group ERP Magic Quadrant 2012 (Source: Gartner Group 2012)

“The Magic Quadrant is a point-in-time analysis which covers key competitors with the breadth and scale of offerings across a large array of criteria”. It is also defined as a “geographical representation of a marketplace at and for a specific time period” which intended solely as a research tool but not a specific guide to action. It is strongly emphasized that other IT services providers not evaluated in the Magic Quadrant have not to be undervalued as they may present alternatives for the companys’ business requirements. What is more, “ERP implementation projects may require a blend of business, industry, technology, program and project management skills that must align with companys’ objectives, institutional and business culture and employees”. Therefore, when considering service providers for ERP, “service providers should not be selected simply in the Leaders quadrant as all selection processes are enterprise-specific and consequently, vendors in the Challengers, Visionaries and Niche Players quadrants may prove to be more appropriate for the specific business”. (Deloitte 2009, Gartner Group 2012).

“Gartner’s Magic Quadrant research process involves primary research with direct customer references supplied by ERP service providers and each service provider’s representation of its organization. Additional insights and context are provided by the ongoing, direct discussions Gartner analysts have with enterprise buyers and service provider clients throughout the year”. All the sources of information are carefully analyzed. One of the most important measures of a service provider’s success is customer feedback. Gartner evaluates vendors on their ability to execute and their completeness of vision. Two sets of criteria are evaluated together and “the resulting analysis provides a view of how well vendor performs relative to its peers and how well it is positioned for the future” (Table 3). It should be noted that both qualitative and quantitative criteria are used in the Magic Quadrant.

Table 3. Magic Quadrant evaluation criteria (Gartner 2012)

Ability to Execute Evaluation Criteria	
<i>Evaluation Criteria</i>	<i>Weighting</i>
Product/Service	Standard
Overall Viability (Business Unit, Financial, Strategy, Organization)	Standard
Sales Execution/Pricing	Standard
Market Responsiveness and Tract Record	High
Marketing Execution	Low
Customer Experience	High
Operations	High
Completeness of Vision Evaluation Criteria	

<i>Evaluation Criteria</i>	<i>Weighting</i>
Market Understanding	High
Marketing Strategy	Low
Sales Strategy	Standard
Offering (Product) Strategy	High
Business Model	Low
Vertical/Industry Strategy	High
Innovation	High
Geographic Strategy	Standard

1.4. ERP Project Implementation Stages

ERP implementation projects are complex, high cost projects, which consist of many implementation stages. There are developed methodologies which in some extend support companies in choosing the implementation. However, these methodologies usually are very narrow and are limited to ERP implementation stages list and short description of each stage.

For instance, Panorama Consulting Group presents the ERP implementation stages as follows in Fig. 7.

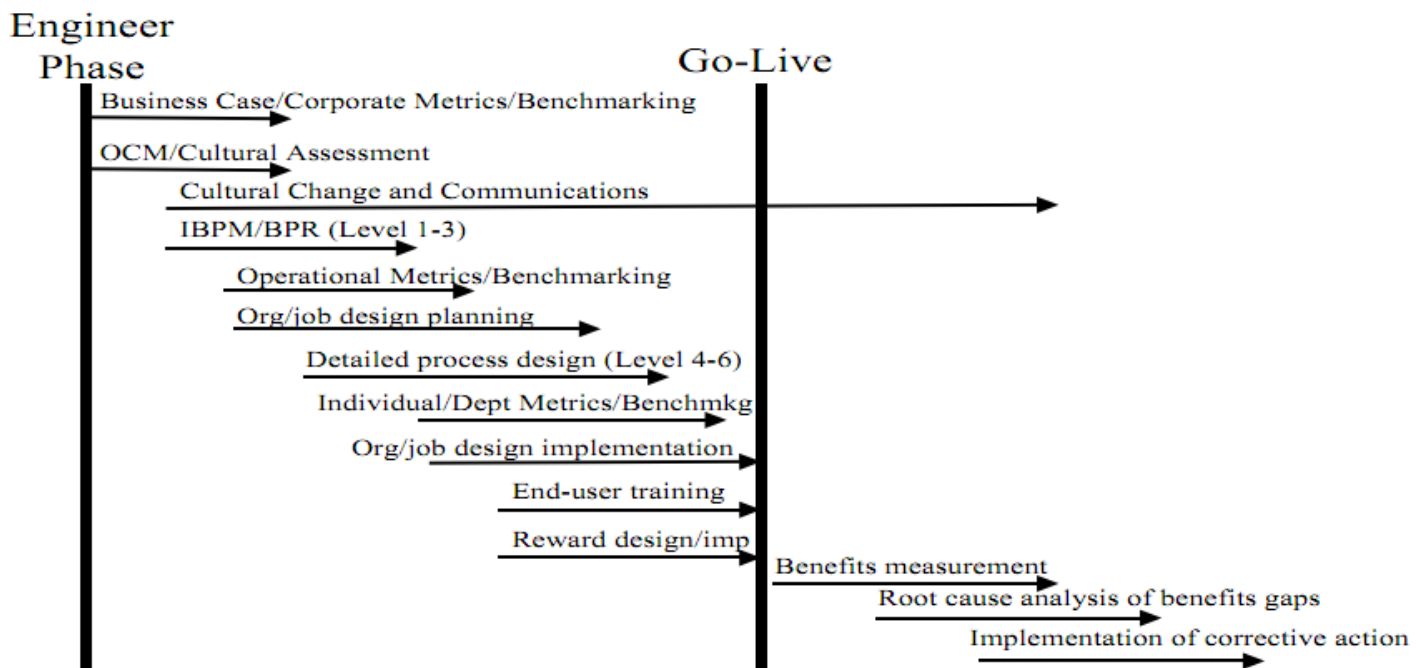


Fig. 7. ERP implementation project stages (Source: Panorama Consulting Group 2007)

Collegiate Project Services offers seven shortly described steps of ERP implementation (see Table 4).

Table 4. ERP implementation steps (Source: Collegiate Project Services 2007)

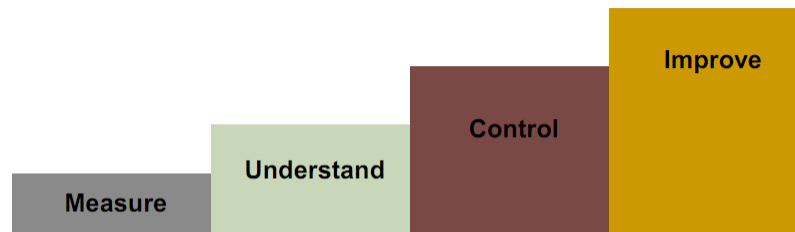
Step	Activity	Purpose
1	Strategic Plan	Provide the rationale and make the business case for the ERP project
2	Readiness Assessment	Determine institutional “preparedness” and achieve organizational understanding of the ERP process
3	Prepare for vendor selection	Document business practices and determine software requirements in preparation for vendor selection
4	Vendor Selection	Choose your technology partners, both the ERP software and the ERP implementer
5	Plan the implementation	Prepare for a successful implementation by developing a comprehensive plan
6	Implement the ERP solution	Work the implementation plan; schedule, track and control the hundreds of project tasks
7	Post implementation Assessment	Determine if objectives were met and determine the extent of functionality of the software that is being use

Annex A shows the generalization of the different authors opinions about ERP implementation stages, their sequence (flow chart). According to the flow chart in the Annex A, the decisive influence in ERP implementation should have first step – a feasibility study (also known as pre-investment phase, preparedness analysis, readiness assessment, project conception and initiation) as after that step organization decides if ERP implementation is needed. Sometimes decisions can be spontaneous and company can not fully realize the need of ERP implementation, so feasibility study is of huge importance if company wants to fully realize the purpose of ERP implementation.

According to some authors, pre-investment analysis should include:

- Existing informational structure of company;
- Existing model of business process management;
- Functional needs and the requirements for the future information system;
- Available budget;
- Evaluation of existing and needed resources;
- Time, tasks and presumable project schedule (Filemonowicz, *et al.* 2008).

However, I would complement the list mentioned above with Organizational Maturity Model (OMM). The reason of the measurement of organizational processes is reflected in James Harrington’s developed improvement process (see Fig. 8).



If you can't measure it, you can't understand it.
 If you can't understand it, you can't control it.
 If you can't control it, you can't improve it.

Fig. 8. The improvement process (Source: Harrington 1987)

OMM is five stage maturity model (see Fig. 9) and it can be a signal of the most probable benefit take-up rate from ERP system implementation. Different companies are at the different stages of maturity to implement ERP systems. Companies with different organizational maturity levels gain different benefits from ERP implementation. The higher organizational maturity level, the more benefits can be achieved by implementing ERP (Paškevičiūtė 2010). This means that, first of all, ERP implementation decision can not be spontaneous and company should answer the question: at what level of capability maturity is the organisation placed to support ERP tools?

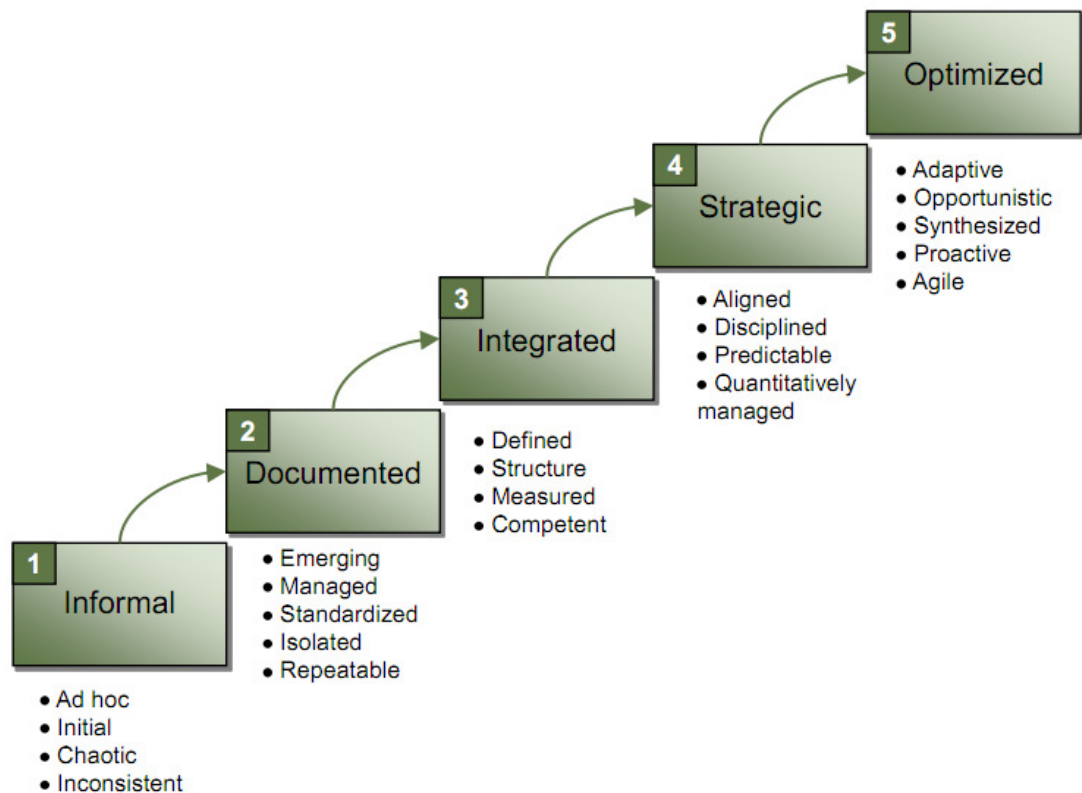


Fig. 9. Organizational Maturity Model (Source: Paškevičiūtė 2010)

In ERP implementation experts opinion, the biggest part of companies implementing ERP are the companies from the second to third organisational maturity stage and these companies make ERP implementation statistics worse just because they are not able to gain more benefits from ERP (Paškevičiūtė 2010).

Thus, after feasibility study company can proceed with other ERP implementation steps or end the process if it was discovered that ERP implementation is not the best solution.

1.5. ERP Implementation Benefits And Challenges

ERP can be defined as “all in one” (Davidavičienė et al. 2009) and as a strategic tool which helps companies gain a competitive edge. However, determining all potential benefits from an ERP implementation is a challenging task, as most benefits are not derived from the ERP system itself but from the various ways the system can be implemented and used (Eckartz et al. 2009).

As implementations of ERP systems are one of the most difficult investment projects because of the complexity, high cost and adaptation risks, there are number of studies on different ERP issues, on how ERP systems influence corporate performance. The most popular are worldwide studies of such international technology evaluation companies as Aberdeen Group, Panorama Consulting Group, Gartner Group and others.

According to the Aberdeen Group survey conducted in 2009-2010 years among over 1100 small to midsize businesses worldwide, companies which implemented ERP are able to perform better and improve the various performance indicators (Table 5).

Table 5. Sample business benefits derived from ERP (Source: Aberdeen Group 2010)

Definition of Maturity Class	Mean Class Performance
Best-in-Class: Top 20% of aggregate performance scorers	▪ 21% reduction in operating costs ▪ 19% reduction in administrative costs ▪ 17% reduction in inventory* ▪ 16% improvement in schedule compliance* ▪ 17% improvement in complete & on-time delivery
Industry Average: Middle 50% of aggregate performance scorers	▪ 14% reduction in operating costs ▪ 10% reduction in administrative costs ▪ 11% reduction in inventory* ▪ 14% improvement in schedule compliance* ▪ 14% improvement in complete & on-time delivery
Laggard: Bottom 30% of aggregate performance scorers	▪ 9% reduction in operating costs ▪ 5% reduction in administrative costs ▪ 11% reduction in inventory* ▪ 13% improvement in schedule compliance* ▪ 7% improvement in complete & on-time delivery

Data from Panorama Consulting Group ERP report 2011 (sample size is 185 companies from 57 countries which implemented ERP within the past year) indicates that although companies were forced to lower ERP projects implementation budgets, shorten durations and more tightly control their ERP projects in 2010, they also realized significantly higher business benefits and slightly shortened ERP payback periods than they did in 2009 (ERP report 2011).

Therefore, there is a real possibility that benefits of ERP implementation exceed costs and risk of the project.

Three dimensions of ERP benefits are distinguished in the literature (Eckartz *et al.* 2009):

1. Operational, managerial and strategic (cost reduction, cycle time reduction, productivity, quality and customer service improvement, revenue/profit increases, improved resource management and decision making, building cost leadership, external linkages enabling, worldwide expansion enabling, sustain competitiveness etc.).
2. Process, customer, finance, innovation, human resource satisfaction
3. IT-infrastructure and organizational (IT cost reduction, increased IT infrastructure capability, increased user-friendliness, application integration, changing work patterns and improved coordination, facilitating organizational learning, building common vision, improved internal communication etc.).

Despite the fact that ERP implementation can improve different business processes and to improve various key performance indicators, there are ERP implementation problems due to which ERP benefits decrease and companies fail to fully realize their original purpose of ERP implementation.

There are several reasons for failure of ERP implementation. Enterprises lack of the knowledge and experience of project management ERP system implementation is thought to be the major reason for project failure which causes another ERP implementation issues (Bulotienė 2010).

What is more, different companies are at the different stages of maturity to implement ERP systems.

Moreover, other most common ERP implementation project challenges are thought to be inadequate feasibility studies and organizational maturity level evaluation, change management and training issues, weak project management, inadequate ERP software (which does not meet the needs of company) selection, underlining only ERP technical possibilities, rather than the emphasis on the needs of business processes, poor top management support, long-lasting implementation, overbudget implementation (because of overexpectations), passive enterprises participation and involvement etc. (Bulotienė 2010; Paliulis 2010; Panorama Consulting Group 2011; Paškevičiūtė 2010).

As it was mentioned, experience shows that enterprises knowledge in ERP implementation field is too narrow and lack of interest in ERP implementation project aspects is noteworthy. ERP users mostly rely on ERP vendors and consulting companies consultants. However, it is worth noting that company inside information is very valuable and is helpful in every step of ERP implementation project. Each wrong step may destroy a bunch of successful previous steps independently whether it caused by lack of internal information. All that reduce return on investment and benefit take-up rate. For these reasons, author believes that active participation in ERP implementation project is essential to increase benefit take-up rate. Thus, it is not enough to rely solely on ERP vendors and consultants for high ERP implementation project results and ERP implementation model is needed to support not experienced companies.

Panorama Consulting Group offers the primary drivers of technology benefits realization or how to overcome the many obstacles to full ERP benefit achievement. Benefit realization consists of ten key proposed activities (see Fig. 10).

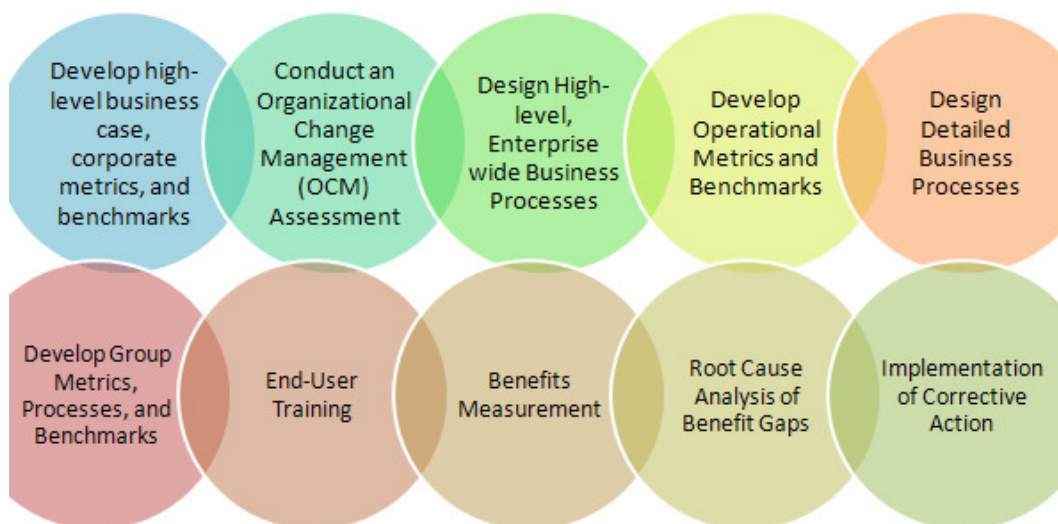


Fig. 10. ERP Benefits realization (Source: Panorama Consulting Group 2011)

Therefore, benefits realization as a comprehensive project approach that focuses on identifying, measuring and ensuring the business benefits achievable through technology is very important to make ERP implementation project successful. The value of benefits realization is reduced project risk, business and IT alignment, benefits gaps identifying and elimination, “lessons learned” evaluation, better future IT projects.

2. INVESTIGATION OF THE TRENDS OF ERP IMPLEMENTATION PROJECTS WORLDWIDE AND IN LITHUANIA

2.1. Analysis of Global ERP Implementation Practices

Enormous quantity of data that can now be experienced as overwhelming in the digitalized world (*digitization—the mass adoption of connected digital technologies and applications by consumers, enterprises, and governments* (Global Information Technology Report 2012). A recent study by the Economist estimated that humans created about 150 exabytes of information in the year 2005; in 2011, this is projected to be 1,200 exabytes. Similarly, the research firm IDC estimates that digital content is doubling every 18 months. Gartner projects that, in the future, as much as 80 percent of enterprise data will be unstructured, spanning both traditional and non-traditional sources.

Due to the abundance of information, fast globalization and technology development processes, which enable to run business globally, the world has become increasingly hyperconnected. *“We live in an environment where the Internet and its associated services are accessible and immediate, where people and businesses can communicate with each other instantly, and where machines are equally interconnected with each other”* (Global Information Technology Report 2012).

As ERP system connects the parts (different modules) into the whole and provides the opportunity to use this solution in the dispersed places of business, it is also characterized by hyperconnectivity.

ERP systems which have been created in the last age to manage and provide insights into the daily operations of a company become less effective in accessing the information company requires in a timely manner, just because there were too many data to analyze. Therefore, new improved ERP systems emerge under such changing conditions and new challenges for their implementation projects emerge.

ERP systems of new generation are more and more popular and thought to be success factor for the company. Forrester Research has detected growing interest among enterprises in ERP investment and according to their study in 2011, overall ERP market expected to grow to over \$50 billion by 2015 (\$45.5 billion in 2011).

The investment volume and theoretical benefits of ERP implementation projects, which are widely discussed and emphasized, should be based on the comprehensive examinations of real practices of implementation. Therefore, in order to be more objective, the analysis of real researches on ERP implementation practices should be made.

There are several worldwide ERP implementation reports as well as the variety of the reports for the narrower geographical region or field of business. The objectives of those reports are to analyze ERP market, evaluate the peculiarities and tendencies of ERP implementation, to assess the effectiveness of the projects, to measure the performance etc. This information can be really useful for the companies which plan to implement ERP and can be effective technique for the avoiding of the problem of ERP implementation benefits over-expectation.

Due to the reasons mentioned above, the insights on the results of the worldwide ERP implementation researches will be made by author.

2.1.1. Panorama Consulting Group ERP 2012 Report

ERP report of Panorama Consulting Group is annual independent study which examines the results from a range of organizational sizes and industries ranging from smaller companies to global, multi-billion dollar organizations. ERP report 2012 was developed by Panorama Consulting Group to investigate trends in ERP software selection, implementation and benefits realization. *“The report is a summary of the industry’s only independent research with the breadth, depth, and objectivity to make meaningful and pragmatic conclusions about ERP software initiatives”* (ERP Report 2012).

ERP 2012 report was conducted during the period from January to December 2011. The survey was open on the company’s website. It represents organizations which differ in industry, location, size, goals and needs, but all 246 participants from 64 countries (29% from North America and 71% international) have implemented ERP system within the past year.

According to Panorama research, more than six out of 10 companies (63.8-percent) implement ERP to improve business performance. Other reasons for implementation include better integration of systems across multiple locations and standardization of global business operations.

Companies assess the areas within their business that will give a competitive advantage in their market and select the appropriate modules that are thought to improve business processes and increase profitability. According to Panorama ERP Report 2012, compared to previous years’ data, the top implemented ERP modules continue to be financials, sales distribution, order processing, materials management and human resources (Fig. 11).

According to survey results, 81-percent of respondents are satisfied with their ERP software selection overall and 19-percent are unsatisfied. However, when asked to score the level of satisfaction of specific ERP functions, there was a low rating across all companies in the flexibility to change the software, the ease of reporting and user documentation provided by the vendor. Twenty-nine percent of respondents stated they experienced challenges within their ERP

implementation due to inadequate requirements definition. Therefore, it is recommended to write clear, concise requirements and understand how the vendor will support the requirements to improve overall customer satisfaction.

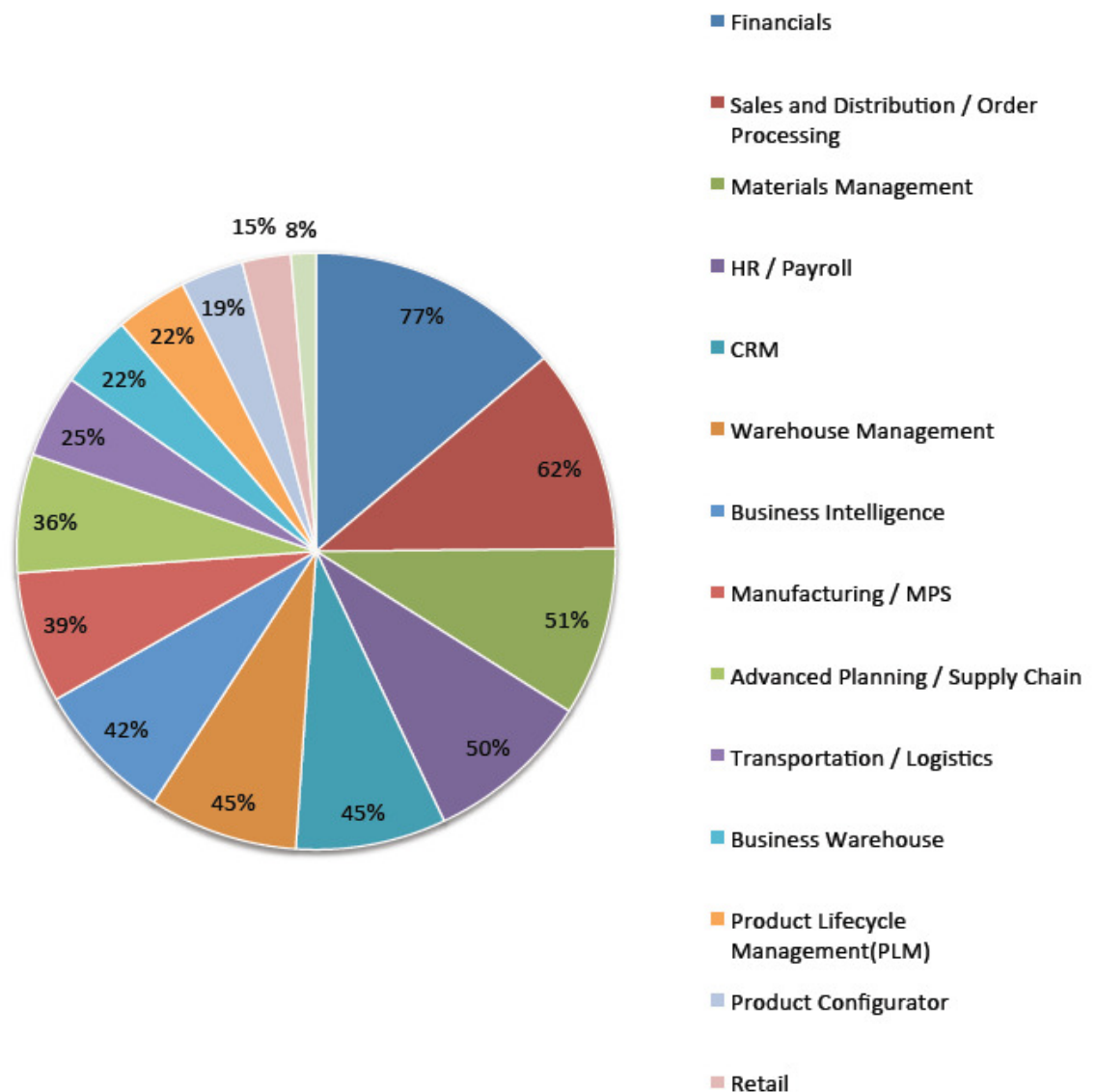


Fig. 11. Top ERP modules (Source: Panorama Consulting Group ERP Report 2012)

While the numbers still highlight the challenges and risks that most organizations face, they also show that companies are starting to do some things better than they have in the past. For example, in the Table 6, which represents the data of 2010-2012 ERP Reports, it is shown that the percentage of companies going over budget and taking longer than expected decreased compared to previous years (from 74-percent to 56-percent and from 61-percent to 54-percent). What is more, 94-percent of respondents realized some benefits, 50-percent realized greater than 50-percent of projected benefits (8-percent improvement from the findings in ERP Report 2011), and 44-percent

realized less than 50-percent of projected benefits (4-percent improvement from the findings in ERP Report 2011).

Table 6. Positive changes in ERP 2012 Report (Panorama Consulting Group ERP Report 2011, 2012)

Factor of the ERP project	2011 (ERP 2012)	2010 (ERP 2011)	2009 (ERP 2011)
Over schedule (%)	54	61	36
Over budget (%)	56	74	51
Realized 0-50% of projected benefits	44	48	67

There are different kinds of benefits realized from ERP implementation. Only 6-percent of respondents pointed they have no benefits achieved. Some of the common benefits are: improved interaction with customers and suppliers, reduced labor costs, and improved lead times (Fig. 12).

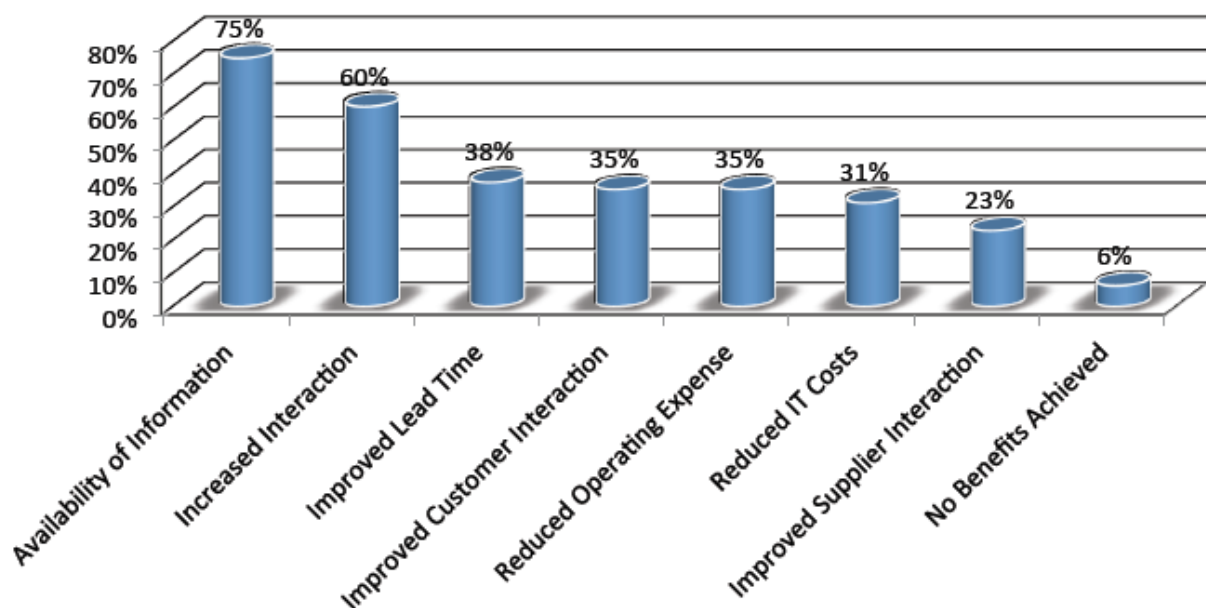


Fig. 12. Types of benefits realized (Source: Panorama Consulting Group ERP Report 2012)

The numbers show the progress in 2011 year. On the other hand, there are also bad results:

- those organizations that go over budget, it is by a significant amount (about 25-percent);
- 29-percent of respondents indicated that they have yet to realize a payback on their ERP investments;
- two out of three (63-percent) organizations indicated significant difficulties and problems in changing their business processes and organizations to accommodate their new ERP systems

(Fig. 13). Therefore, business process reengineering and change management problems are really deep and more comprehensive analysis of those aspects should be done.

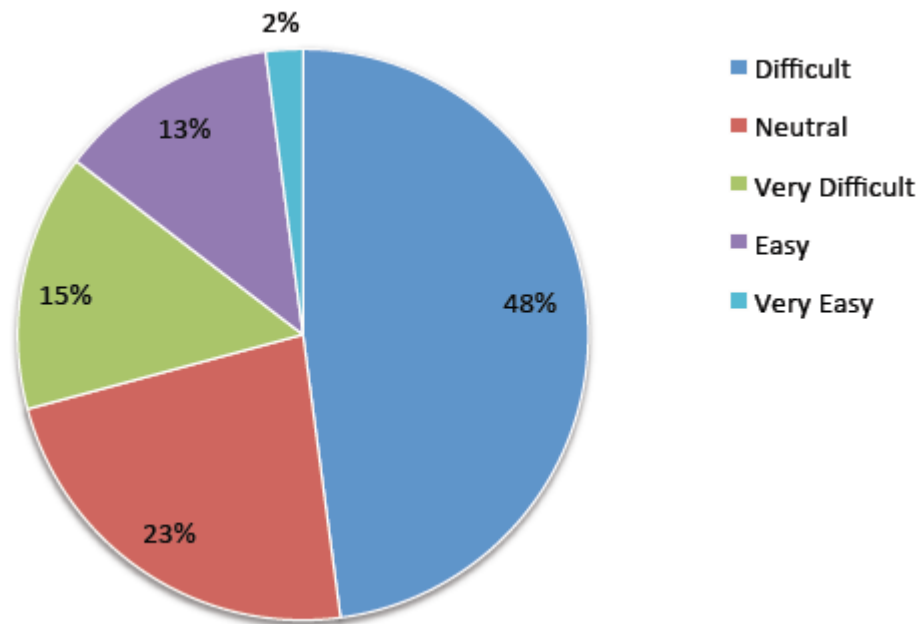


Fig. 13. Process and organizational change adjustment (Source: Panorama Consulting Group ERP Report 2012)

Numbers of ERP Report 2012 suggest that there are still significant challenges in the marketplace, but they provide a thread of optimism that more companies are figuring out how to manage their ERP initiatives more effectively.

2.1.2. Aberdeen Group 2011 ERP Benchmark Survey

Aberdeen's Group ERP Benchmark Survey is focused on manufacturing companies. It provides an in-depth and comprehensive look into process, procedure, methodologies and technologies with best practice identification and actionable recommendations.

The majority of manufacturing enterprises, almost three quarters according to Aberdeen's survey respondents, use Enterprise Resource Planning (ERP) as their main business system.

Despite the continuing arguing that ERP is complex, costly and at times inflexible, the the main success factor in ERP implementation project, according to Aberdeen Group, is a strong ERP strategy, based on a solution that is right for the particular business.

Aberdeen Group 2011 ERP Benchmark Survey *“is based on over 120 survey respondents in manufacturing, explores Best-in-Class approach to their ERP strategy and performance, looks at how an ERP Strategy is defined and why it is so important. It looks at the*

main business drivers that are shaping the way ERP is used - internally and externally - and as a result, how manufacturers are changing what they expect from ERP systems, as they are increasingly required to be less transactional and more intuitive, proactive and operational” (Aberdeen Group 2011 ERP Benchmark Survey).

Survey distinguishes the main business drivers impacting ERP strategies (Fig. 14). For large and medium companies cost and managing growth were two top. Small companies look to ERP in the similar manner, but with a higher priority on the customer experience.

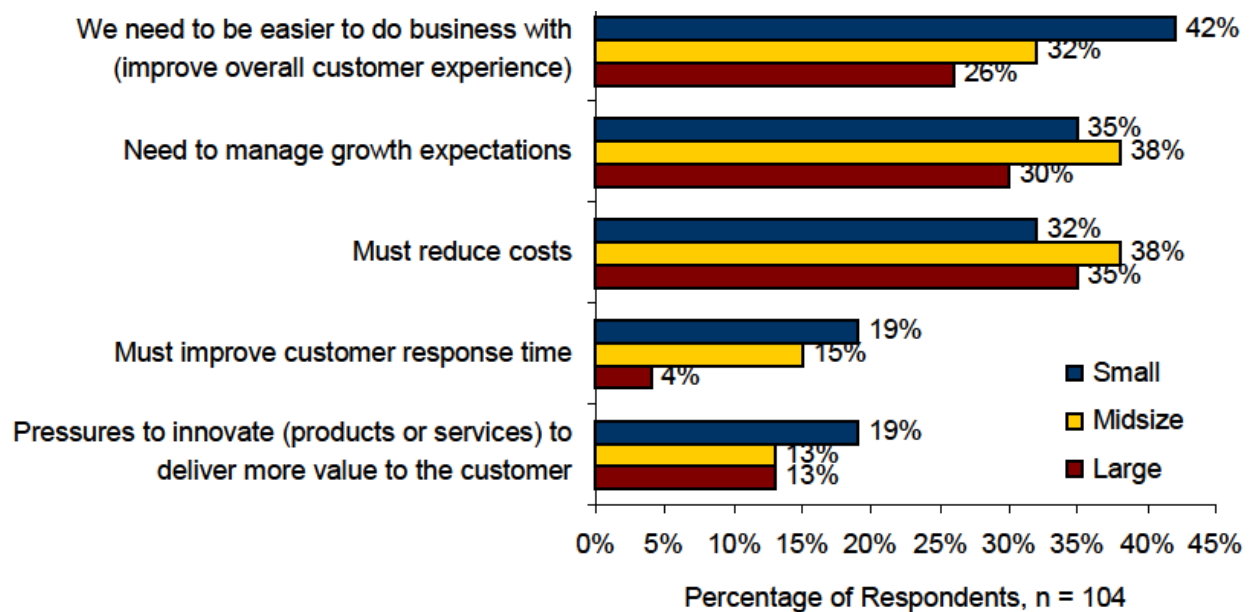


Fig. 14. Top business drivers impacting ERP strategies (Source: Aberdeen Group 2011)⁴

According to the survey, Best-in-Class companies still enjoy improved and better results, than their industry average opponents. What is more, measured business benefits derived from ERP implementations (Key Performance Indicators) in general tend to be higher in 2011 than in 2010 (Table 7, Table 8).

Table 7. Benefits derived from ERP (Aberdeen Group 2010)

Definition of Maturity Class	Mean Class Performance
Best-in-Class: Top 20% of aggregate performance scorers	17% Growth in operating margin 95% Complete and on-time shipments - Average Days Sales Outstanding (DSO): 35 - Average days to close a month: 2.8
Industry Average: Middle 50% of aggregate performance scorers	4% Growth in operating margin 91% Complete and on-time shipments - Average Days Sales Outstanding (DSO): 43 - Average days to close a month: 5.5
Laggard: Bottom 30% of aggregate performance scorers	2% Decline in operating margin 85% Complete and on-time shipments - Average Days Sales Outstanding (DSO): 63 - Average days to close a month: 8.8

⁴ Small: under \$50 million; Midsize: \$50 million to \$1 billion; Large: over \$1 billion. This is different gradation in Lithuania where small, midsize and large companies' turnover is lower.

Table 8. Benefits derived from ERP (Aberdeen Group 2011)

Definition of Maturity Class	Mean Class Performance
Best-in-Class: Top 20% of aggregate performance scorers	▪ 18% reduction in inventory levels ▪ 97% inventory accuracy ▪ 3.33 days to close a month ▪ 96% manufacturing schedule compliance ▪ 97% complete and on-time shipments
Industry Average: Middle 50% of aggregate performance scorers	▪ 11% reduction in inventory levels ▪ 95% inventory accuracy ▪ 5.98 days to close a month ▪ 89% manufacturing schedule compliance ▪ 89% complete and on-time shipments
Laggard: Bottom 30% of aggregate performance scorers	▪ 3% reduction in inventory levels ▪ 89% inventory accuracy ▪ 7.04 days to close a month ▪ 79% manufacturing schedule compliance ▪ 86% complete and on-time shipments

Aberdeen Group has also analyzed the aggregated metrics of surveyed companies to determine whether their performance ranked as Best-in-Class, Industry Average, or Laggard. Each class shared characteristics in 5 categories: Process – the ability to standardize processes and ERP implementation. Organization – executive commitment and assigned ownership for ERP implementation. Knowledge management – providing visibility in order to drive decision-making. Technology – effective use of modules and of extensions to ERP, along with providing users with immediate access to data, regardless of location. Performance management – the ability of the organization to measure its results to improve its business.

These characteristics can be used as best practices, and correlate directly with Best-in-Class performance across metrics.

As we can see in Table 9, Aberdeen’s analysis shows that significant benefits can be gained from the integrated ERP solution. In addition, Aberdeen Group summarizes quantifiable business benefits gained from the ERP implementation.

Table 9. The competitive framework of ERP (Aberdeen Group 2011)

	Best-in-Class	Average	Laggards
Process	Standardized enterprise-wide procedures for procurement, cash collection, and financial reconciliation		
	92%	75%	68%
	Sales and engineering collaborate to set proper expectations with customers		
	52%	48%	19%
	Ability to do demand planning and forecasting		
	56%	42%	35%
Organization	Cross-functional continuous improvement teams are responsible for improving operational performance		
	67%	44%	42%
	New employees are properly trained in using ERP after initial stages of implementation		
	63%	48%	33%
	ERP strategy is tied to talent plan and strategy		
	52%	29%	20%
Knowledge	Real time visibility into status of all processes from quote to cash		
	63%	47%	13%
	Ability to automatically and immediately notify decision makers when certain conditions occur		
	54%	27%	10%
	A fully integrated view of all customer information available to any sales and marketing person		
	42%	34%	3%
Technology	Event Management (Triggers & Alerts)		
	50%	36%	3%
	Ability to secure mobile device and ERP mobile applications		
	29%	19%	13%
	Integrated business applications serve as a complete and auditable system of record		
	88%	67%	36%
Performance	Measurement of accuracy of demand planning and forecasting		
	48%	25%	23%
	Ability to measure marketing influence on closed sales and pipeline		
	21%	16%	7%

Aberdeen Group summarizes that if ERP system planned to be maintained, ERP strategy should be maintained first. It is critical factor not only for ERP implementing, but for the ERP efficiency. The real practice of Best-in-Class companies shows that they maintain their ERP strategy and derive real benefits from aligning this strategy with their overall business strategy.

2.2. Analysis of Existing ERP Implementation Models and Evaluation of their Practical Application Possibilities

After the literature analysis on the ERP implementation models issue, the assumption of author that there is a lack of unified implementation methodologies that reflect the essential critical factors of success of the project was proved.

Though ERP systems are being widely implemented in many organisations, there is a lack of unified implementation methodologies that reflect the essential critical factors of success.

Despite the fact that there are plenty of created models of ERP implementation, the majority of them, in the author opinion, rather can be explained through the prism of ERP project life cycle. It means that usually those models distinguish only some general sequential steps how to implement the project without the detailed analysis or explanation of the possible tasks, qualitative and quantitative methodologies used and outcomes of each of those stages (Table 10).

Table 10. Existing ERP implementation models (Source: Vilpola 2008, Paškevičiūtė 2010, Oracle 2010, Microsoft, SAP)

Authors	ERP implementation model	General comments
Bancroft <i>et al.</i> (1998)	(1) Focus, (2) Creating As-Is picture, (3) Creating of the To-Be design, (4) Construction and testing, (5) Actual implementation	
Kuruppuarac hichi <i>et al.</i> (2002)	(1) Initiation, (2) Requirement definition, (3) Acquisition/development, (4) Implementation, (5) Termination	A model of IT projects
Markus, Tanis (2000)	(1) Project chartering, (2) The project, (3) Shakedown, (4) Onward and Upward	
Makipaa (2003)	(1) Initiative, (2) VEvaluation, (3) Selection, (4) Modification, Business Process Reengineering and Conversion of Data, (5) Training, (6) Go-Live, (7) Termination, (8) Exploitation and development	Three parallel phases in the step 4
Paškevičiūtė (2010)	(1) Feasibility study, (2) Implementation, (3) Integration, (4) Extension, (5) Data transfer (6) Training, (7) System maintenance, (8) System upgrade, (9) Audit	Lithuanian IT company's JMSYS model
Oracle (2011)	(1) Definition, (2) Operation analysis, (3) Solution design, (4) Build, (5) Transition, (6) Production	Oracle e-Business Suite Applications Implementation Methodology (AIM)
SAP (2011)	(1) Project preparation, (2) Business Blueprint, (3) Realization, (4) Final Preparation, (5) Go Live and Support, (6) Continuous change	„Accelerated SAP“ model
Microsoft (2011)	(1) Diagnostic, (2) Analysis, (3) Design, (4) Development, (5)Deployment, (6) Operation	Microsoft “Dynamics Sure Step”

Those models are too narrow and they lack of the recommendations what and in which way to to in order to improve the benefit takeup rate of the ERP implementation projects and they cannot be interpreted as support models for the companies implementing ERP.

What is more, the existing ERP implementation models usually oriented towards some particular aspects of the implementation and they are rather vendor (IT firm) oriented than client (company which implements ERP) oriented. Therefore, such models can support the implementor of technical solution, but limit the possibility for the company to participate in the project actively.

Due to the fact that author spresumes that active company's participation in ERP project should lead to the higher value and higher benefit takeup of the project, existing models should be improved and supplemented with wider company-oriented aspects. Thus, new ERP implementation model supporting the company which implements the project should be developed.

The aspects mentioned above encouraged author to make additional research on the ERP implementation success factors, ERP implementation problems, benefit takeup rate, information and resources used to implement the project, models of ERP implementation used, opinion on the development of new support model.

Due to the possibility to gather the data in a limited geographical territory, author decided to conduct the surveys of ERP implementation experts and ERP users in Lithuania. Author believes that the results of the research will be objective enough in the international context as ERP implementation experts in Lithuania work in the international companies or have the direct contacts with the global ERP implementation practices. What is more, due to the investment volume and complexity of ERP implementation, Lithuanian ERP users usually are large international companies as well.

2.3. Analysis of the Further ERP Development in the Global Market

“Many organizations are becoming increasingly global. To support these efforts, they have established multiple sites or locations—manufacturing plants, branch and regional sales offices, distribution warehouses and national, regional, and even global headquarters—that may be distributed within a country, a region, or around the world”. As organizations expand into new territories, they face a number of operational challenges to adapt to the business rules of foreign countries, to accommodate multiple languages, multiple currencies and varying local best practices. (Epicor 2009).

“ERP is a critical component of any business’ globalization strategy. ERP solutions automate the functions necessary to manage a wide range of local operations” (Epicor 2009). A

global ERP system ensures that you will be able to work as a total entity and have all the positive effects of the synergy.

Companies have a variety of strategies to select from when implementing ERP systems across their global organizations. However, they are faced with a number of complexities when implementing these systems in the geographically dispersed companies in the international environment. As ERP implementation projects for large, multi-national organizations are much different from those of smaller or less global companies, many aspects should be considered in managing global ERP implementation projects - global vs. localized business processes, big bang vs. phased implementation (practice shows that it depends on tolerance for risk, resource availability, and legacy system constraints), global vs. localized ERP support structure, language and currency, data management (not only migrating to the new system, but how it will be managed going forward) and other aspects (Kimberling 2010).

If to talk about the further development of ERP market, in June 2012 Research Vice President at Gartner explained that *“the global marketplace is still experiencing a series of conflicting and contrasting economic news reports. Spending in 2012 is anticipated to focus on industry-specific applications; upgrades to established, mission-critical software; integrating and securing established systems and infrastructure; and software as a service (SaaS) deployments representing extensions to, or replacement of, existing applications and new solutions”*.

Gartner predicts a volume of \$120.4 million for 2012, up from \$115.2 million in 2011. In the enterprise app software market, which includes such segment like business intelligence, content, communications and collaboration, customer relationship management, digital content creation, enterprise resource planning, office suites and personal productivity, project and portfolio management, and supply chain management, it is still enterprise resource planning that captures the biggest share of the segment. The potential is \$24.9 billion, followed by office suites at \$16.5 billion, business intelligence at \$13.0 billion, and customer relationship management at about \$13.0 billion as well (Gartner 2012).

Development of ERP market in the mostly cited countries as China and India is very interesting to analyze. Rising revenues for maintenance fees, new acquisitions, penetration of new industries, and emerging markets such as China or India are expected to extend development and new growth of ERP market over the coming years.

ERP market in China is the largest segment of the Chinese Enterprise Applications market. Netscribes specializing in Information Technology Industry reports prepared the ERP Market in China 2012 report. It is predicted that the Chinese ERP market *“will be boosted by increasing demand from small and medium businesses (SMBs), expansion of ERP in new industries together with the rising need for management effectiveness”* (Netscribes 2012).

Key factors driving the growth of ERP market in China mentioned in the report was wage inflation, increasing demand from SMBs, penetration of ERP in new industries, rising need for management effectiveness, rising automobile production, and opportunity from cloud computing. The report finds that wage inflation will be a catalyst for expanding ERP usage in China. ERP is increasingly gaining popularity among the SMBs that account for nearly 99% of the total Chinese enterprises. With the major enterprises entering into new industries, usage of ERP will increase to enhance their management systems. China's enterprise management software market witnesses rapid growth owing to rising need for cost-effectiveness. Growing automobile sector in China at 10% Compound Annual Growth Rate (CAGR) during 2007-20 will drive software demands for automakers. Additionally, Chinese government had invested over USD 100 mn in five cities for cloud computing advancement in 2011.

Key trends in the software market include emergence of Chinese ERP software vendors as dominant players, software localization, shift towards high-end large-scale clients, shift in ERP focus to business processes and increasing mergers & acquisitions.

Foreign ERP vendors like SAP, Oracle and others entered China attracted by significant business opportunities and taking control in the Chinese ERP market. What is more, Chinese ERP vendors are seeking growth opportunities from the growing enterprise sales revenue.

China has 2nd highest total labour cost in Emerging Asia and it was found that wage inflation will be a catalyst for expanding ERP usage in China.

It was emphasized that ERP in China is increasingly gaining popularity among the SMBs that account for 99% of the total Chinese enterprises. What is more, Chinese automobile sector growing with a CAGR 10% during 2007-20 will foster software demands for automakers.

It was concluded that ERP market in China is expected to be the fastest growing ERP market in the world (Netscribes 2012). TechNavio's analysts in September 2012 also forecasted the ERP market in China will grow at a CAGR of 15.9 percent over the 2010-2014 period.



Fig. 15. ERP market in China summary (Source: Netscribes 2012)

According to observation made by some experts in the field, ERP market in India started showing solid organic growth since 2004 as IT spending improved. The Indian ERP market experienced CAGR (compounded annual growth rate) of 25.2 during the period of 2004-2009. The report by some firm says that by 2016, India's share of the software market in revenue, or 1.5 percent of total worldwide software market revenue of \$361 billion (Precise Testing Solutions 2012).

Eresource, India's leading Web-based ERP solution company, explains that majority of Indian manufacturers are small by global standards, requiring easy-to-use ERP solutions to meet their specific process requirements, including localisation needs to address the continually evolving tax and statutory requirements. Small and medium enterprises across industry verticals and micro verticals, such as automotive, pharmaceuticals, and textiles, are leveraging ERP solutions to gain sustainable competitive advantages.

ERP Software Market in India 2011-2015 prepared by Infinity Research shows that ERP software market in India is expected to grow at a CAGR of 22.2 percent over the period 2011-2015.

Gartner's projections are more conservative but positive as it predicts India to be the world's third fastest growing enterprise software market through 2016 (market is expected to grow at a CAGR of 13.6 percent from 2009 to 2016). Despite challenging economic conditions, the

enterprise software market in India is projected to grow 13 percent in 2012, as revenues reach \$3.22 billion in 2012, according to Gartner. It is supposed that the increasing globalization of the Indian economy and rapidly growing penetration of ICT infrastructure during the past decade will lead to a growing need for modern software with the latest features and improved functionality.

In 2012, India will be the fourth largest enterprise software market in Asia/Pacific. The country is forecast to account for 11 percent of the region's total revenue of \$29.33 billion USD for Asia/Pacific this year, the equivalent to 1.15 percent of the total worldwide software of market share of \$280 billion.

By 2016, India's share of the software market in Asia/Pacific is expected to reach 12.1 percent, representing \$5.4 billion in revenue or 1.5 percent of total worldwide software market revenue of \$361 billion. In comparison to other countries in the Asia/Pacific region, such as China (with 27 percent share of regional spending in 2011), the software market in India is still relatively small and evolving (Gartner 2012).

2.4. Lithuanian ERP Market Research: ERP Experts and Users Survey

ERP market in Lithuania is usually not being investigated and not included into benchmarking or worldwide surveys, analysis etc. As the market of ERP in Lithuania is filled with foreign well-known ERP vendors like Oracle, SAP and other, the predictions and generalizations about the Lithuanian ERP market are based on the worldwide reports, analysis of the global practices or on the analysis of the foreign ERP vendors acting in Lithuania. Such data is usually fragmented and poorly adapted to Lithuanian underdeveloped ERP market.

Annual publication of Statistics Lithuania "Information Technologies in Lithuania 2012" also proves that too small attention is being paid to the questions related to ERP. This publication is limited to the narrow data about the usage of the Internet, ICT in households, enterprises and public institutions, general data about the employees of IT sector and the comparison of some indicators with the level of the EU indicators. Furthermore, IT usage in enterprises statistic is limited to some e-commerce indicators and general indicators like ICT usage, Web pages, spending in IT (Appendix B). We can see that purchase of ICT consultancy and services as well as purchase of ICT goods increased significantly in 2011. Therefore, we can presume that it can correlate with ERP market tendencies. However, ERP is mentioned in this publication only to indicate what kind of IT systems are used in companies for e-business (Appendix C). We can generalize that ERP is used rarely for that purpose in Lithuania (increased from 12.6 percent in 2011 to 23.1 percent in 2012). Those indicators are definitely lower than average worldwide indicators.

The lack of publications, analysis and data about ERP market in Lithuania increases the risk of ERP projects implemented in Lithuanian enterprises as companies have no clear view about the aspects of the implementation of those projects and their benefits and results. Therefore, the only way to know about the implementation practices is to analyse real worldwide business cases and rely on experienced vendors and consultancy companies.

Therefore, the problems of passive participation in the project implementation and how to increase the level of participation and have an impact on the result of implementation of ERP in the company usually occurs. Due to these facts, author assumes that experts of ERP implementation projects in Lithuania and users of ERP (companies which plan to implement or already have implemented) should be interviewed or surveyed. Their opinion and experience can help to develop ERP project implementation support model for Lithuanian companies.

2.4.1. Research Methodology

After the analysis of the literature and after the unfolded global ERP implementation tendencies it can be summarized that the success of the implementation depends on the variety of factors, usually implementation problems occur and the actual result is worse than planned due to the inappropriate ERP implementation project management.

The goals of this study were to determine the main success factors ERP implementation projects, to distinguish the core implementation problems and to find out the respondents view on the ERP implementation project support model which is planned to develop and which is considered to be advanced model helping to maximize project results and benefit take-up rate. It is considered that this model would help companies to evaluate possible benefits and issues of the project objectively and to take the appropriate investment decision independently (by oneself) in order to maximize the returns or to minimize the probable negative outcome.

Two groups of respondents (experts of ERP implementation projects in Lithuania and users of ERP) were interviewed using questionnaires which were placed on website www.manoapklaus.lt.

The majority of experts of ERP implementation projects were chosen from those whom author has meet on the conference „Oracle dienos 2010“ and from those who participated in the lecture of Management Information Systems program during the last year of author's Bachelor degree. The contacts of other experts were found on the websites of the companies which specialize in ERP implementation. All the experts received from author the e-mail with the link on questionnaire.

Some ERP users were found in the Internet using Google search engine, other were mentioned as clients on websites of Lithuanian ERP vendors or in the ERP experts questionnaire. Some ERP users filled questionnaire directly on website, to other respondents link were sent by e-mail.

The questionnaires of two groups of respondents are presented in the Appendix D and Appendix E. The majority of the questions are closed format questions (yes/no, multiple choice, scaled). As respondents' answers are limited to a fixed set of provided responses, all the respondents understand the question in the same way, the results are more reliable and data is easier to analyze and summarize.

Some of the questions were identical in the two questionnaires. The purpose to ask the same questions was to find out the viewpoint on the same issue of ERP implementation experts and users. It is supposed to be useful in evaluating of some aspects of ERP projects and in modeling the supportive ERP implementation model.

Study lasted from the 5th November 2012 to the 19th November 2012.

19 ERP experts and 52 ERP users received the links to questionnaire. 16 questionnaires of ERP experts (84,2 %) and 33 questionnaires of ERP users (63,5 %) were filled. The smaller activity of ERP users can be explained in this way: it is very complicated to send the questionnaire directly to the person who is responsible for ERP in the company as the majority of the companies provides only general e-mail address (administrator). Other reason: 7 ERP users refused to participate in the study due to the confidentiality of information or lack of time.

2.4.2. Analysis of Results of Research

Analysis of questionnaire of experts of ERP implementation projects in Lithuania.

In research participated experts from such companies like „Affecto Lietuva“, former „ERP“, „IT technologijos“, „Proginta“, „CID Baltic“ and from other companies which name was not published by respondents. The majority of experts are project managers and consultants (Fig. 16). The answer “other” was marked by the deputy director of the company.

Jūsų užimamos pareigos/ position held in the company

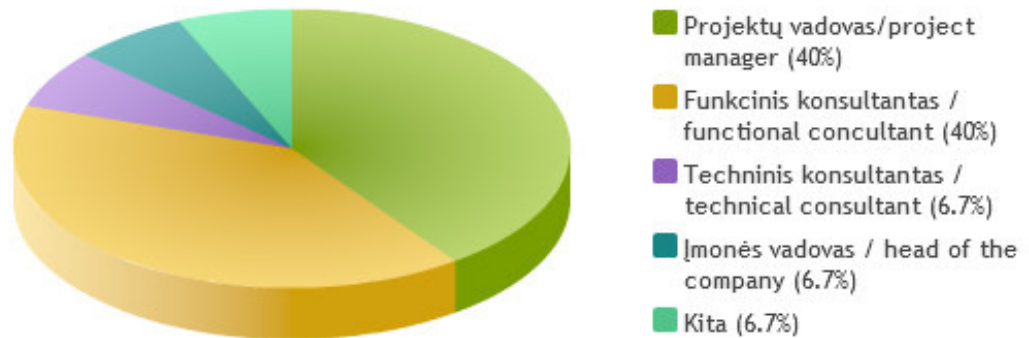


Fig. 16. Position held by the surveyed ERP experts (Source: made by author)

The majority of respondents (42,9 %) have more than 5 years experience in the field of ERP implementation projects and managed the projects which costed from tens of thousand Lt to tens of millions Lt (the biggest mentioned cost is 40 millions Lt). That means that surveyed respondents have enough experience and competence to answer the questions and to provide valuable information about large scale ERP projects and the aspects of their implementations.

Jūsų patirtis VVS diegimo projektų srityje/ Your experience in the field of ERP implementation projects

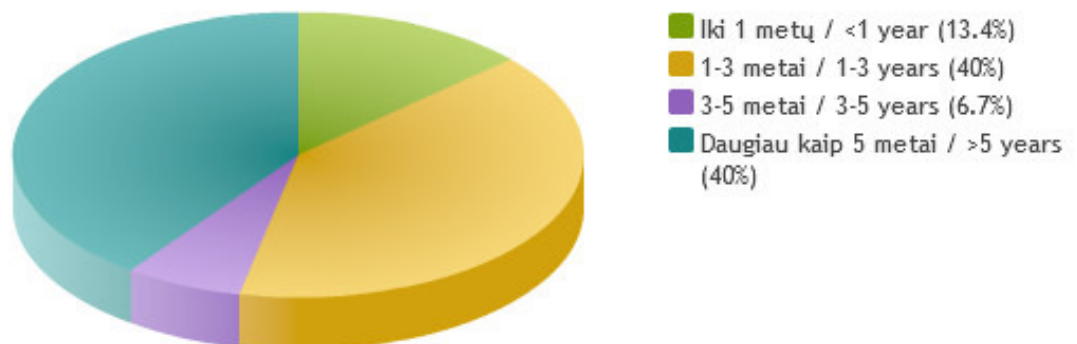


Fig. 17. Experience in ERP implementation projects of surveyed experts (Source: made by author)

According to the answers of the ERP experts, ERP projects are not always successful. 46,7 % of respondents answered that success rate is “average”, 33,4 % answered they are “often” successful, 13,4 % “very rarely” and only 6,7 % answered ERP projects are always successful. Therefore, the results about the success rate are not optimistic.

The experience of experts show that usually implementation time of ERP project in Lithuania is 1-2 years (53,4 %) or 2-3 years (20 %). This practice is similar to the global ERP implementation practice.

The rated ERP implementation success factors and their estimated average values are presented in the table below. Estimations show that, in experts opinion, the most important success factors are detailed and clear ERP implementation model (4,57), effective project management (4,50), project resources (4,50) and experience of ERP vendor (4,50).

Table 11. ERP implementation projects experts rated success factors (Source: made by author)

No.	ERP implementation project success factors	Average rating
1	Detailed and clear ERP implementation model	4,57
2	Top Management support	4,36
3	ERP implementation strategy	4,36
4	Effective project management	4,50
5	ERP project manager leadership	4,43
6	Business Process Reengineering (BPR)	3,86
7	Change Management	4,36
8	Project resources (financial, time, HR etc.)	4,50
9	Support of ERP vendor	4,29
10	Experience of ERP vendor	4,50
11	Clear ERP selection criteria	4,00
12	ERP compatibility with existing information system	3,29
13	Quality and scope of ERP users training	3,93
14	Effective communication	4,43
15	Hired consultancy firm experience	3,86

In experts opinion, that the critical risk factors in ERP implementation projects are organizational and project management risks (Fig. 18). This proves repeatedly the presumption that success of ERP projects largely depends on the companys' participation level in the project, on the ability of the company to set the clear goals and to achieve them as well as on other internal factors.

Experts were asked "how specifically developed ERP project implementation support model can influence the companies which plan ERP implementation?". The majority of the respondents (53,3 %) answered it "would be valuable not only for the companies which plan to implement ERP, but also for vendors". What is more, some experts commented that they would support the implementing of such model. The equal percentage of respondents (13,3 %) think this model "would be very valuable" or "would not be valuable at all". Respondent also commented that this model should correlate with the needs of customer (ERP user). Obviously, it is the primary goal why author decided to develop this advanced support model.

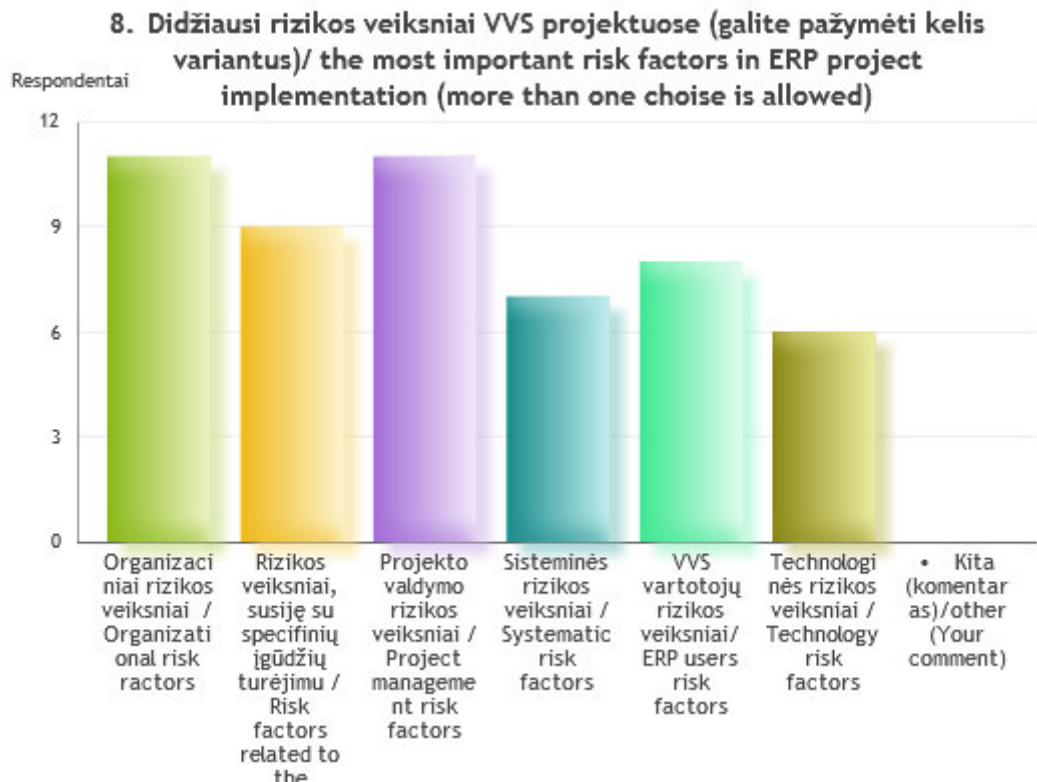


Fig. 18. Critical risk factors listed by ERP implementation experts (Source: made by author)

Therefore, the research on ERP implementation project experts views on the issues of ERP projects show that not only theoretical, but practical problem of the efficiency and benefits of the ERP implementation projects occur. The outcomes of ERP projects largely depend on the internal company's factors and lack of active participation as well as weak project management. Opinion of the experts on the benefit of new developed advanced support model on ERP implementation coincides author's opinion (useful for companies as well as for vendors) and the probability that this model would be technique which would increase benefit take-up rate and the efficiency of the ERP project is really high.

Analysis of questionnaire of ERP users in Lithuania. ERP users from different size of companies were surveyed. The majority of respondents were from large companies which employ over 200 employees (43,8 %) and from medium-sized companies which employ 50-200 employees (37,5 %). Therefore, the main ERP users are medium-sized and large companies.

The majority of respondents hold the positions of head of division/department or other – specialist, project manager, assistant, technical customer service manager (Fig. 19).

Jūsų užimamos pareigos / position held in the company

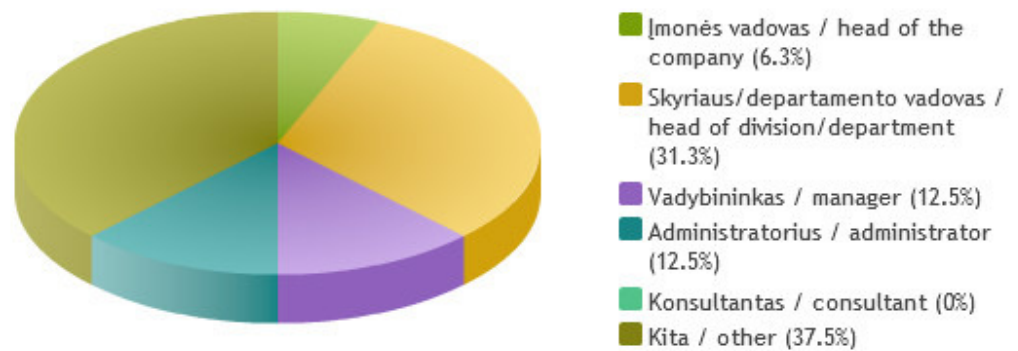


Fig. 19. ERP users by position held in the company (Source: made by author)

Two of the companies are implementing ERP and the rest of surveyed companies has already finished their ERP implementation projects.

The majority (40 % of) companies answered that the value (cost) of the project was 50-100 or 200-500 thousand Lt. Those respondents who filled “other” wrote these answers: “I do not know the exact value”, “It is confidential information”, “ERP was implemented by our Top Management in other geographical region”, “2 mln. Lt”, “over 500 thousand Lt”. Therefore, we can see that the project value is high enough as for investments in Lithuanian companies.

Kokia buvo VVS projekto vertė? / What was the value of the project?

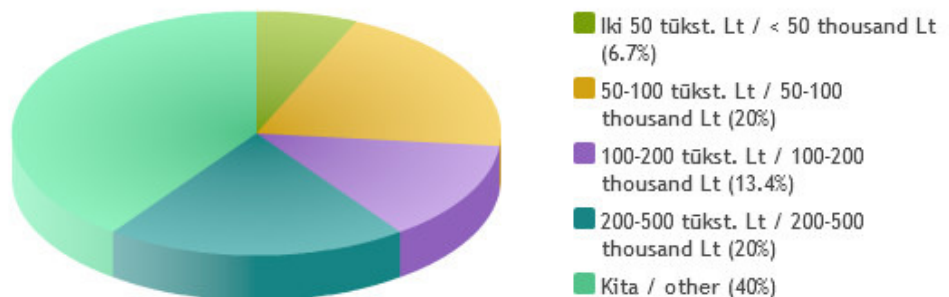


Fig. 20. ERP project value (users) (Source: made by author)

The majority of ERP users (companies) works with implemented ERP from 2 to 4 years (40 %) and from 1 yer to 2 years (33,3 %). Less than 1 year and over 4 years work equal percentage of companies – 13,3 %.

All the companies had officially appointed project manager responsible for ERP implementation. However, the results show that the participation time in the project was too small. The majority of project managers working time for ERP project was only 25-50 % and only one third of project managers worked for ERP project full time (Fig. 21).

Kiek projekto vadovo darbo laiko procentais buvo skiriama VVS įgyvendinimo projektui? / What part of the project manager's working time was for ERP project implementation management?

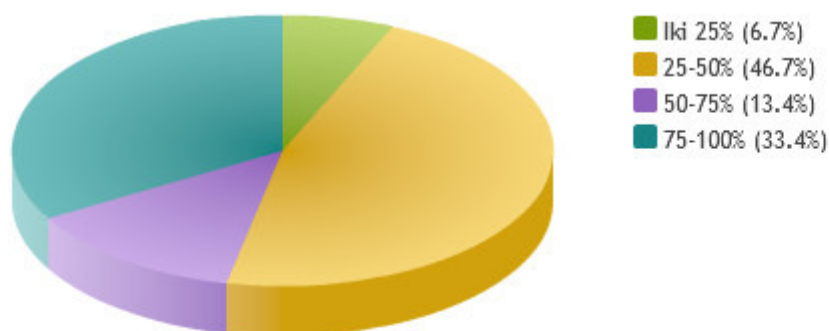


Fig. 21. ERP project manager's working time (Source: made by author)

Too small attention paid to this huge investment project was also proved in experts questionnaire. Experts also stated that weak or ineffective project management and lack of resources (in this case human resources) is one of the major problems in ERP implementation project.

Questionnaire shows that project satisfaction is not so high as 26,7 % of respondents stated ERP implementation project was not exactly successful. It should be noted that those respondents who stated that project manager worked for ERP project under 50 % of working time stated that this project was not exactly successful. Therefore, we can see the correlation between the company's activity level in ERP project and its results.

Different aspects of ERP users' satisfaction with ERP results (estimated average values of rated indicators) is presented in Table 12. As we can see, general satisfaction level is not high as neither indicator has higher than 4,17 average value (from maximum 5). What is more, some indicators as implementation time, satisfaction with vendors and implementation process (steps, model) is below 4. Therefore, these results prove the assumption that advanced ERP implementation model is needed in order to achieve higher satisfaction level.

Table 12. ERP users satisfaction level with ERP implementation project results (Source: made by author)

No.	Satisfaction with ERP implementation project factors	Average rating
1	Implementation time	3,33
2	Reached benefit level	4,08
3	ERP functionality	4,17
4	Satisfaction with vendors	3,83
5	Implementation process (steps, model)	3,83

Usually named reasons of ERP implementation are increased customer satisfaction, business development planning and faster response to customer queries (Fig. 22). It is strange that only 15 % of respondents stated that need to reduce cost is important reason to implement ERP. This result confronts with the global practice which shows that the reduction of costs is one of the most important reasons which encourages companies to implement ERP (Fig. 14). This confrontation can be understood as undervalued financial gain from ERP implementation in Lithuanian companies and understanding ERP as operational support but not the strategic investment which in long term reduces the costs and provides financial returns. This should be evaluated in planned to develop ERP implementation support model.

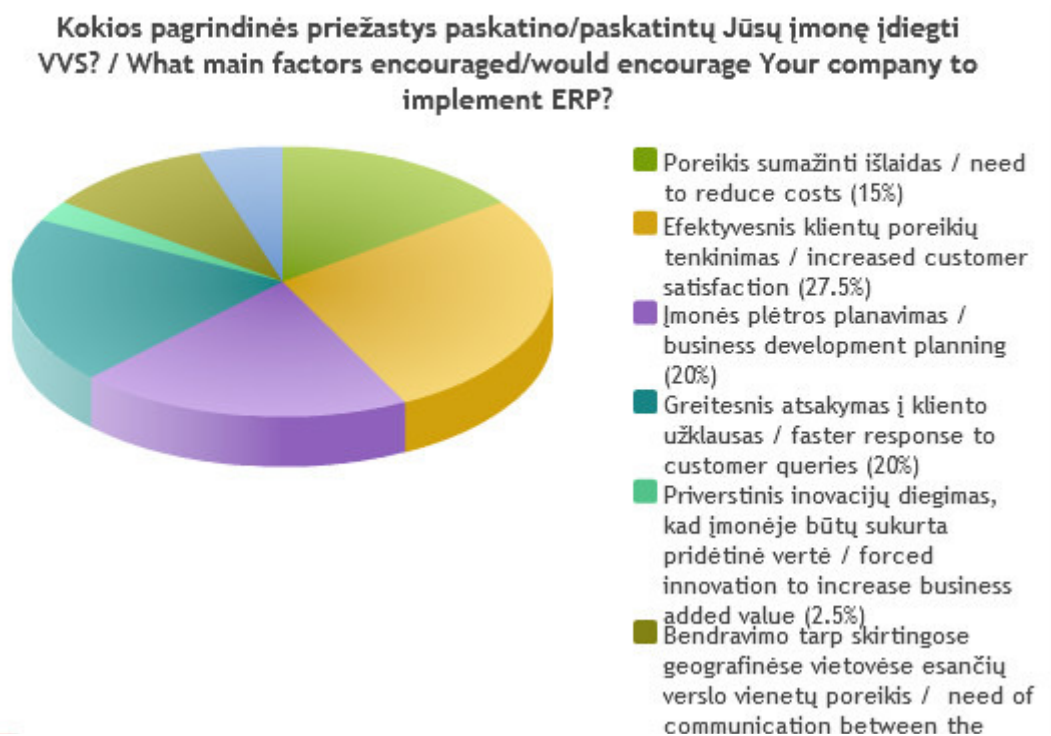


Fig. 22. What forced ERP users to implement ERP (Source: made by author)

The most usual reasons of refusal to implement ERP, in ERP users opinion, are that company is too small to implement ERP, high software and implementation services costs and that company does not know where to start and how to realize the implementation of the project. The last argument also proves the need of advanced ERP implementation support model which would encourage company to participate in the project more actively and to improve the results.

ERP users also rated the success factors of ERP implementation projects. The average ratings of experts and users are presented in the Table 13. The compared ratings of experts and users differ slightly. Three factors – detailed and clear ERP implementation model, effective project management and project resources – are the most important for two groups of response. The fourth factor according to importance differs. For ERP experts it is experience of ERP vendor and for ERP users – Top Management support. This difference is obvious as experts make bigger

emphasis on their competencies and users – on their internal aspects. In author opinion, ERP support model should concentrate on ERP users as it will be supposed to be supportive technique for them.

Table 13. ERP implementation projects experts and users rated success factors (Source: made by author)

No.	ERP implementation project success factors	Average rating (ERP experts)	Average rating (ERP users)	Average rating difference
1	Detailed and clear ERP implementation model	4,57	4,69	0,1
2	Top Management support	4,36	4,69	0,33
3	ERP implementation strategy	4,36	4,23	0,13
4	Effective project management	4,50	4,62	0,12
5	ERP project manager leadership	4,43	4,31	0,12
6	Business Process Reengineering (BPR)	3,86	4,08	0,22
7	Change Management	4,36	4,23	0,13
8	Project resources (financial, time, HR etc.)	4,50	4,38	0,12
9	Support of ERP vendor	4,29	3,92	0,37
10	Experience of ERP vendor	4,50	4,31	0,12
11	Clear ERP selection criteria	4,00	3,62	0,38
12	ERP compatibility with existing information system	3,29	3,85	0,56
13	Quality and scope of ERP users training	3,93	3,85	0,08
14	Effective communication	4,43	4,23	0,20
15	Hired consultancy firm experience	3,86	4,00	0,14

The main risk factors in ERP implementation project for both groups of respondents are organizational and project management.

In order to check if ERP support model will be useful for ERP users, the question “What source of information your company used/would use during the ERP implementation project?” was asked (Fig. 23). The majority rely on the vendors provided information (41,2 %), used global ERP implementation practice analysis (17,6 %) or specific ERP implementation model (17,6 %). Therefore, ERP users mostly rely on vendor. ERP implementation project support model can change this attitude as more aspects would depend on the company itself.

Kokiais informacijos šaltiniais Jūsų įmonė rėmėsi/remtųsi VVS diegimo projekto įgyvendinimo metu? / What source of information your company used/would use during the ERP implementation project?

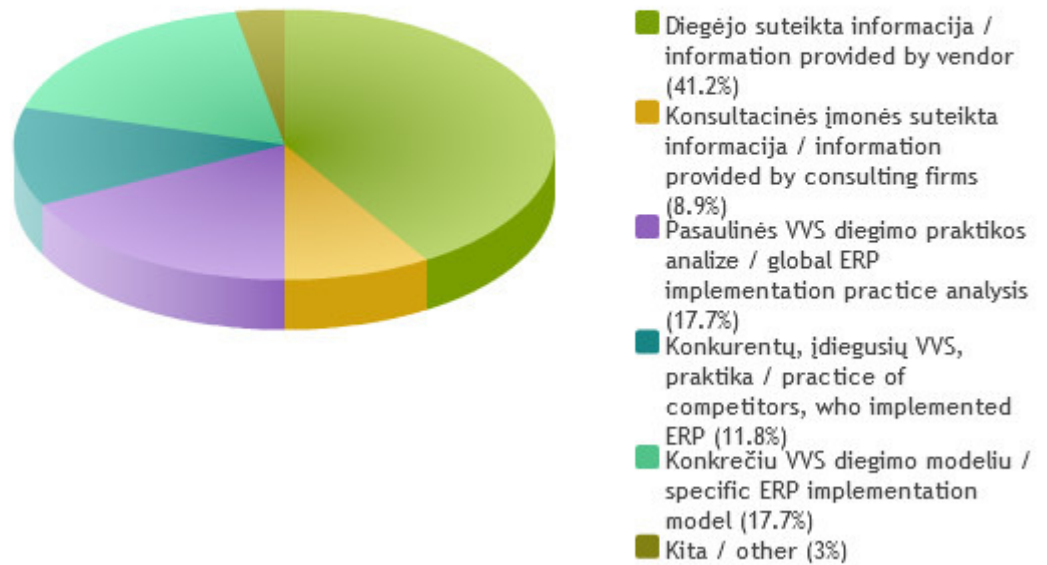


Fig. 23. Information sources used by ERP users during ERP implementation (Source: made by author)

What is more, 75,1 % of ERP users stated that developed advanced ERP implementation project support model would be very valuable or valuable for the company. This shows users interest in such support technique and proves the practical value of the model.

In summary, research proved the need and purposefulness of the developing of ERP implementation project support model which is multi-tiered support tool for companies which helps to make decision on ERP investment, to choose the right vendor, to assess project readiness, potential problems and other aspects by using qualitative and quantitative techniques.

3. ERP IMPLEMENTATION PROJECT SUPPORT MODEL

Implementing an ERP system involves a great deal of expenditure, efforts and time as well as change in some of the complex business processes. This strategic investment needs to be planned and executed without mistakes or with minimal mistakes. Each wrong implementation stage (due to the lack of information, inappropriate resource allocation, too small attention to internal implementation details and other) can reduce benefit take-up rate and return on investment. It is the main reason which encourages author to develop advanced support model which would allow not only rely on vendor or consultancy company, but participate in ERP implementation project actively. Using internal company's knowledge and resources let fit the ERP solution to the company's needs, not to the standard each vendor's client needs.

According to the results of research made by author, companies usually fail to implement ERP project successfully due to the lack of information about the aspects of implementation. As company does not know what to start from, they see the vendor or consultancy firm the best source of information in ERP implementation project. Consequently, companies passively transfer all the responsibility on vendor and consultancy firm and make minimal impact on the project result by itself.

ERP implementation project support model is multi-tiered support tool which encourages active companies' participation in the project. It helps to make appropriate decision on ERP investment, to assess project readiness, to choose the right vendor, to identify and exclude potential problems and to be aware about other aspects by using qualitative and quantitative techniques.

In authors' opinion, implemented ERP solution cannot increase value by itself. Active participation in planning, implementation stage as well as change management, BPR and other aspects of post-implementation are very important in order ERP project would be successful. Therefore, emphasis on active company's participation is made in author's ERP implementation project support model.

Both ERP experts and users in the questionnaire stated that ERP implementation project support model would be valuable not only for the company, but also for the vendor as it would increase the success rate of ERP projects. Therefore, practical significance of this model is clear.

In this part of Master Thesis ERP implementation project support model developed by the author will be presented. This model is based on the literature analysis made by author, global and authors' ERP experts' and users' researches, author's experience on this topic gained during the studies as well as the resources from IT and other conferences in which author has participated.

ERP implementation project support model proposed by author consists of four stages:

1. ERP readiness assessment stage;
2. ERP implementation planning stage;
3. ERP implementation stage;
4. ERP exploitation stage (Appendix I).

3.1. ERP Readiness Assessment Stage

As investment in ERP is characterized by high cost and complexity, the evaluation of company's needs, possibilities and ERP readiness assessment are very important. Analysis and assessment should be done by the competent person or appointed project manager. The scope of analysis and assessment can be determined by the company, but author offers analysis of business needs and business processes, to evaluate company's maturity level and to measure the level of readiness to start ERP implementation project using other possible techniques.

3.1.1. ERP Project Manager

According to the results of research made by the author, in implementation project experts and ERP user opinion, the most important success factor in ERP implementation project is effective project manager. A successful ERP implementation project has many moving parts, and those parts all need to be able to communicate with one another quickly and effectively. The project manager must communicate a number of important facts and ideas, including objectives and goals of ERP implementation, feasibility of certain goals, risks associated with the project, time and budget expectations and constraints, the way ERP will change each department's role. Therefore, project manager plays an important role and should have appropriate competencies, organizational knowledge and experience.

It was noted from the research that the less working time (<50 %) project manager dedicates for ERP implementation project management, the lower satisfaction level with the project results is. Therefore, the active participate can increase the success rate and satisfaction with the project results.

As project manager should be responsible also for all the possible pre-investment investigation and evaluations, it is important that that person would perfectly know internal business processes and procedures as well as possible consequences in terms of further ERP implementation stages, author offers to start project manager selection process from internal employees. Specialist from the company possess a lot of essential and specific information about

the company and will take the decisions which fit the company's profile and requirement. However, in order project manager would learn some specific aspects of ERP implementation project, author offers to train this person. It should be qualified trainings for ERP implementation project managers with all possible management as well as IT (or ERP solution) related aspects.

3.1.2. Analysis of Business Processes and Business Needs

Companies need to understand exactly who they are as an organization and what they want to be in the future. This includes everything from strengths to weaknesses, from core competencies to the areas which need to be improved. ERP should be aligned with overall business strategy and needs. Therefore, the current business processes and their strengths and weaknesses should be analyzed (Fig. 24).

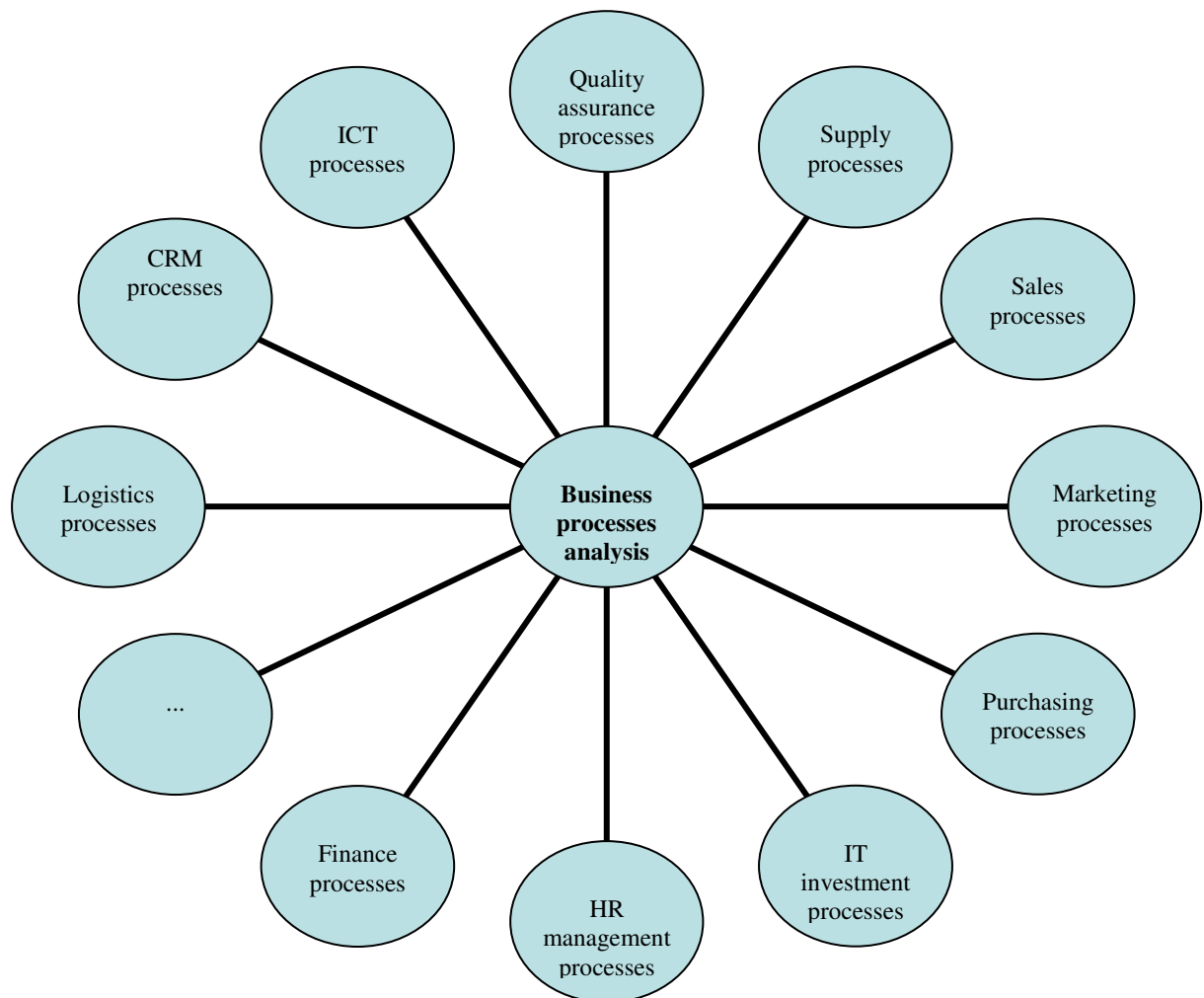


Fig. 24. Typical business processes analysis (Source: made by author)

Why company should measure the processes? According to James Harrington, well known American author, engineer, entrepreneur, and consultant in performance improvement, „measurement is the first step that leads to control and eventually to improvement. If you can't measure something, you can't understand it. If you can't understand it, you can't control it. If you can't control it, you can't improve it”.

After the analysis of business processes company should answer the question if ERP system could exclude current weaknesses and improve the processes.

The need of ERP implementation also can be identified according to the factors signalling it. Author presented some factors in the Table 14. Company can complete this list of factors and situations according their own needs.

Table 14. Signals of ERP implementation need (Source: made by author)

No.	Signals of ERP implementation need	Typical situation
1	Growth of company	• New products or services introduced • Increased number of employees as a result of the increased workload • Extension of company's activities • Increased turnover
2	Current information system	• Large amount of information and loss and error of information due to the imperfect computer programs • Information systems of departments are not integrated and information exchange is not possible or difficult • Information system administrator receives a lot of requests from the users to solve the problems • Mergers or acquisitions are not effective due to the information system integration problem • The problem of data search among different information systems
3	Supply	• The rule of “the right product, in the right place, at the right time, at the right price” usually does not work • The increase of materials and products in stocks due to the failed forecasts
4	Production/services	• Slow reaction to the changes of needs of clients • Product/services placement period is longer than expected • Faster placement with lower quality
5	Finance	• Financial analysis is difficult and time-consuming process • Difficult to present visually company's performance indicators • Human factor errors in financial calculations
6	CRM	• It is difficult to analyze and predict the needs of customers • Customer contact management is not effective • Customer satisfaction level is decreasing or is low • Customer turnover is high, the number of loyal customers

		is decreasing
7	Other	• ...

Existing business processes analysis and identification of gaps is the first and important step to determine ERP implementation need.

3.1.3. Organizational Maturity Model

Other step of companies' readiness to implement ERP is maturity assessment or measuring organizational capabilities using James Harringtons' Organizational Maturity Model (OMM).

The higher the organizational maturity level, the higher benefit take-up rate of ERP implementation (Paškevičiūtė 2010). This means that, first of all, ERP implementation decision can not be spontaneous and company should answer the question: at what level of capability maturity is the organisation placed to support ERP tools?

In ERP implementation experts opinion, the majority of companies implementing ERP are the companies from the second to third organisational maturity stage and these companies make ERP implementation statistics worse just because they are not able to gain more benefits from ERP (Paškevičiūtė 2010).

Therefore, adequate feasibility studies and organizational maturity level evaluation can rise benefit take-up rate and author offers to objectively rate company on Harringtons' scale of 1 to 5 and this score will be a roadmap for organizational improvement as well as for the evaluating the possible success from ERP implementation project (Fig. 9).

The first informal stage means that it is not understood that information management influences the quality of information, information is managed in chaotic style, many unsolved problems occur.

In documented stage the understanding that information should be managed appears and documented management practice is being started to implement.

Integrated stage means that information is being tried to define, structurize, integrate and quality measurement system exists.

Strategic stage is when information is considered to be the strategic issue, the strategic information management decisions are taken in the highest management level, estimations are made.

Optimized stage means that information ensures the competitive advantage, employees understand that information management is integral part of their responsibilities, information processes are adapted, improved and flexible.

As we can see, the Harringtons' five stage OMM is really valuable in order to predict the probable success level of ERP project.

3.1.4. ERP Implementation Project Readiness Assessment

The final ERP implementation project readiness assessment can be performed after the analysis of business needs and processes and OMM. The final questions can be asked:

1. How well existing and future business processes and ERP requirements defined, understood and documented?
2. Does the company have a formal IT strategy and formulated ERP solution architecture view?
3. Does the company have an action plan for ERP implementation failures?
4. What business aspects of the past have been successful and what failed?
5. Does a company need assistance from the third parts? How is it needed? Who should help the company?
6. Is it realistic that ERP implementation project benefits exceed the costs? It is not enough only to perform qualitative analysis, a quantitative analysis should also be performed. The author proposes to carry out a cost-benefit analysis, in order the company knew that the ERP implementation project benefits exceed the costs.

The answers should finally indicate that ERP implementation project is needed and should be started.

3.2. ERP Implementation Planning Stage

Planning is one of the most important function of project management. The success rate of the project is usually depend on the planning quality. The main ERP implementation planning aspects are:

1. Project team formation and allocation of responsibilities;
2. Preparation of project sketch;
3. Project schedule preparation;
4. Planning of the project budget;
5. Preparation of project risk management plan;
6. Preparation of communication plan;
7. Preparation of change management plan;
8. Preparation of training plan;
9. Assesment and monitoring system and corrective action plan.

3.2.1. Project Team Formation and Allocation of Responsibilities

Project team formation and allocation of responsibilities is organization of the project participants – project sponsors, project managers, project team, various functional and technical teams.

According to the authors' research results, effective project management is one of the main project success factors. Therefore, the task of choosing the right project manager as well as creating strong and motivated project team is of huge importance.

Those aspects are very important in order to ensure effective project management:

- To identify the appropriate team members;
- To identify project team members roles and their interdependence;
- Dedicated project team and project organizational structure.

As ERP is a complex system that integrates a variety of business processes to achieve better results the author suggests that the project team include representatives of a variety of areas (sales, purchasing, finance, personnel, etc.). The project team should clearly understand the company's business processes, project objectives and know the history of the company as well as to be aware of the strengths and weaknesses.

Of course, the best knowledge of the situation of the company has its employees, so the project team made up of representatives of various areas can perform this task better than others. However, this does not mean that the vendor's role here is irrelevant. There are various technological aspects, which are better done by qualified and experienced project team members who represent vendor. For these reasons, the actions of the vendor and the company's project team members should be consistent. Third part of professional consultants can also be invited to perform some specific tasks if needed.

As author's research has also shown that the second important ERP implementation project success factor is the support of Top Management, the representative of this group should also participate in the project as the member of project team.

It is important to emphasize that the project team should act not only during ERP implementation project, but also after it. The project team should ensure the effective vertical and horizontal change management in the company.

The role and responsibilities of each project team member's should be set during the team building stage. All involved in the ERP implementation project - the representatives of the top management, project manager, project team and employees – should be aware of their responsibilities. Therefore, the author proposes to prepare the roles and responsibilities matrix

according to which it is clear who and how will do particular works and tasks as well as to what extent each person is responsible. For example, the project concept plan is presented by the Top Management representative, project manager is responsible for preparing the project plan, it is prepared by the project team and reviewed by the Top Management representative and so on.

3.2.2. ERP Project Scope

Project scope can be defined as the part of project planning that involves determining and documenting a list of specific project goals (time, finance etc.), deliverables, tasks, needed resources (HR, IT, technical support, financial etc.), roles and responsibilities, deadlines, critical limits for time, budget and other indicators, possible restrictions and change control. Prepared well-defined and written scope of work in ERP implementation can mean the difference between a failed project with disastrous results, and a highly successful project with huge benefits.

3.2.3. ERP Project Schedule

Project schedule provides a basis to monitor and control project activities, helps to determine how best to allocate resources to achieve the project goals, helps to assess how time delays will impact the project and provides a basis to help to track project progress.

Project managers have a variety of tools to develop a project schedule. Author suggests Gantt Chart for this purpose. Gantt chart is a specialized bar chart used to provide a graphical overview and schedule of all tasks or to indicate the work elements and dependencies of project. It is useful tool for analyzing and planning more complex projects like ERP implementation projects. Gantt Chart helps to plan the variety of tasks that need to be completed, gives a basis for scheduling when these tasks will be carried out, allows to plan the allocation of resources needed to complete the project, and helps to work out the critical path for a project where it should be completed by a particular date.

3.2.4. Project Budget Plan

After the comprehensive analysis of needs and problems of company Top Management should calculate the losses due to the existing problems and to evaluate the results of calculation as well as to compare them to the possible benefits after ERP implementation. This assessment should help to decide on the ERP project implementation budget. For example, if it was calculated that due to the incorrectly addressed products, late delivery, delivered defective products and other reasons

company experienced 200 thousand Lt losses while after ERP implementation and improved business processes it would experience 500 thousand Lt, Top Management can decide to invest in ERP implementation about 700 thousand Lt. However, those calculations are only initial and more comprehensive budgeting analysis is required.

According to the data from worldwide as well as authors research, ERP project budget can range from tens of thousands to tens of millions. The budget depends on the size of the company as well as business processes and improvement needs related to ERP. However, it should be taken into account that such costs should be included into ERP project budget: hardware, software licenses, consulting services, employee salaries and other (Fig. 25).

According to Panorama Consulting Group ERP 2011 research companies invest more than 4 percent of their annual income in ERP implementation. However, Lithuanian ERP experts claim that the investment is limited to 2-3 percent of income. Therefore, if to consider that company's annual income is 10 million, the approximate investment in ERP can be more than 400 thousand worldwide and 200-300 thousand in Lithuania. However, it is only preliminary calculation.

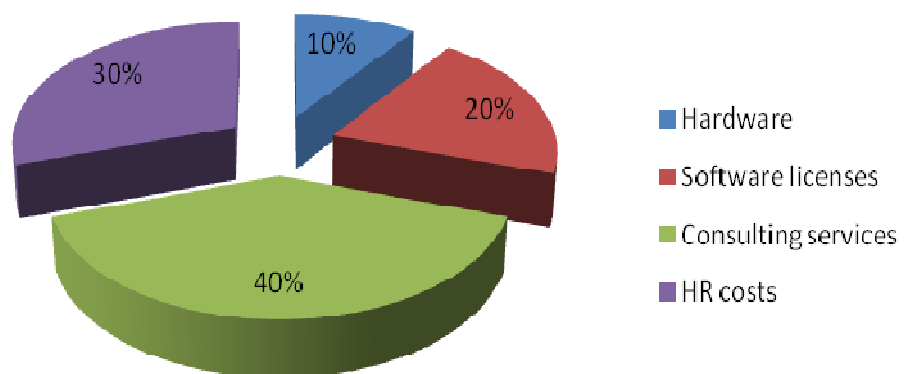


Fig. 25. Average ERP project budget distribution (Source: Paškevičiūtė 2011)

Author offers generalizations about ERP budget which are presented in the Table 15.

Table 15. ERP project implementation budget tips (Source: made by author)

No	Generalization	General comment
1	Clearly define the budget scope and communicate it to the stakeholders	Determining the costs of ERP implementation is very important as it helps to set clearer expectations and more efficiently manage and implement the project. Communicating the budget and continuing open discussions with stakeholders throughout the life of the project is essential.
2	Define the cost components of the ERP implementation	It is offered to evaluate the data in Fig. 26 as well as “hidden” or indirect costs as training and travel expenses, meeting rooms, celebration and other.
3	Identify consulting	Include all of the potential consultants in your budget:

	services costs	hardware and software installation experts, analysts, trainers, project managers (company's and from outside).
4	Do not underestimate indirect or "hidden" costs	New employees, training and travel expenses, conferences, office supplies, informal meetings, project finish celebration and other.
5	Evaluate unexpected costs	Include reserve resources in project management plan. It is normal that unexpected costs in the dynamic business environment occur.
6	Manage and control the budget	Perform regular audits of the budget in a timely manner and determine possible deviations in order the appropriate actions would be taken.

Budget should be clear, comprehensive, documented and approved by the responsible persons.

3.2.5. Project Risk Management Plan

According to the results of the author's research, ERP implementation experts and users list project management and organizational risks as the most important.

In order to minimize these risks, author offers to prepare the list of all possible risks, to rate these risks according to the importance, to prepare the action plan when those risks arise, to assign the responsible persons for the risk management. Author offers some examples of the components of risk management plan which are presented in the Annex F.

Identification of potential risk factors, evaluation of their impact on the project and possible preventive actions minimize the probability of undesirable side effects and the level of negative impact. Therefore, risk management plan is supportive tool in ERP implementation.

3.2.6. ERP Project Communication Plan

ERP Project Communication Plan should indicate the way of communication of all stakeholders (internal and external). The components of this plan is presented in Fig. 26.



Fig. 26. Major components of ERP Project Communication Plan (Source: made by author)

It is very important to identify all the stakeholders as their interests in ERP implementation are different and each group requires different information about the progress and results of the project. It is important to understand the difference of communication with project's internal stakeholders (shareholders of the company, project sponsors, project team, end users or employees etc.) and external stakeholders (clients, vendors, suppliers etc.). Effective communication let understand and meet the special needs of all stakeholders. Communication plays an important role in change management during ERP implementation and improves this process as well as the resistance to change.

3.2.7. Change Management Plan

Organizational change management is critical to the success of any ERP project. ERP typically affects an entire organization, no matter how large or small the company, is it international or local company. As a result of ERP implementation, end users or employees are usually overwhelmed with changes to their jobs (new way of working, new processes and ways of doing business, data they may not be familiar in the past etc.). People fear change and change management is a way to avoid or minimize those fears.

Change Management Plan is closely connected with Communication Plan as a lot of things should be communicated to stakeholders, especially end users or employees. These things are not limited just to training how to use the system, but extender to the communicating the reason of

implementing ERP, opportunities which can improve employees job and company's overall effectiveness.

Change management process is more complex in the international or global company due to the cultural, language, values, requirements differences. As a rule, employees in developing countries are often used to manual, time-consuming business processes and they do not want changes as they are afraid of losing their jobs.

What is more, older, more established offices, can be more resistant to change as they are certain about the rightness of their old good practices.

It is very important to estimate the level of resistance to change in the particular case in order to know how strong should be the process of Change Management and which fields are the most sensitive. Author offers Kurt Lewin's Force Field Analysis as the management technique which allows evaluate and overcome resistance to change (see Appendix G). According to the analysis, there are both driving and restraining forces that influence any change that may occur. This equilibrium can be raised or lowered by changes in the relationship between the driving and the restraining forces.

The goal of Change Management Process is higher driving forces and lower restraining forces. Those steps should be done:

1. Define change problem, compare current and desirable situation.
2. Define driving and the restraining forces (SWOT analysis or brainstorming techniques can be used in this situation).
3. Find as more as possible particular actions which can increase each driving force.
4. Find as more as possible particular actions which can decrease each restraining force.
5. This analysis helps to define and to document the sequence of the particular actions. (Janušauskienė 2010).

Force Field Analysis is a supportive tool in effective Change Management Process.

3.2.8. Training Plan

Comprehensive training is a critical requirement for all persons central to the ERP implementation process. Three levels of training should be planned: technical (managing the new hardware, database and issues specific to the technical requirements), functional area (project team members who are leading the implementation of the individual modules will receive training in the areas of business redesign and functional training) and end-users.

It is also important to evaluate the need for the technical, functional, end-users, project management, project team and project managers and other training and create a training plan

according to these needs. In author's opinion, those trainings which adapted for all, are adapted for nobody. Therefore, trainings are chosen according the needed field and group of trained persons.

3.2.9. Measuring and Monitoring System and Corrective Action Plan

Measuring and monitoring system as well as corrective action plan are essential as it is preventive action as well negative impact minimization action. Possible deviations from the plan should be foreseen and the solutions to solve problems should be identified. The measurement tools or units should be defined in order to quantify and monitor KPI's and the overall process of ERP project implementation.

3.3. ERP Project Implementation Stage

Author defines 3 aspects of EPR Project Implementation Stage:

1. Selection of ERP and vendors;
2. ERP implementation;
3. training.

3.3.1. Selection of ERP and Vendors

Author offers a sequence of actions presented in Fig. 27 in order to ease the process of selection of ERP system and vendors.

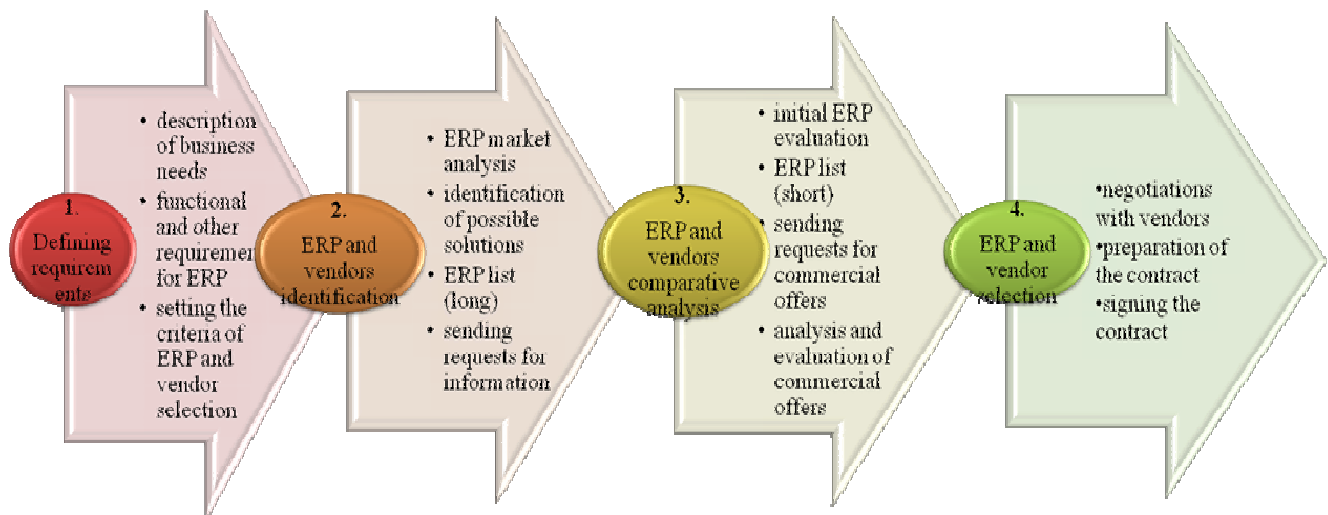


Fig. 27. ERP and vendors selection process (Source: made by author)

The extended list of requirements for ERP and vendors is presented in the Appendix H. The requirements are prioritized according to the specific business needs. Clear requirements will ease the analysis of ERP market, evaluate the analysis and evaluation of ERP and vendors.

There are many ERP vendors and ERP system selection process is not easy. It is obvious that company needs some metrics in order to choose the right ERP and its vendor. Due to this fact author offers to use quantitative technique or AHP method in order to make ERP and vendor selection process as objective and easy as possible.

Author will present comprehensive framework for selecting a suitable ERP system (vendor can be also evaluated) by using AHP or quantitative decision making tool. AHP method, directs how to determine the priority of a set of alternatives (both economic and non-economic criteria are transformed into the quantitative expression) and the relative importance of attributes in a multiple criteria decision-making problem.

AHP is one of the most widely used multi-attribute decision-making methods. In this method, the decision-maker (DM) performs pair-wise comparisons, and, the pair-wise comparison matrix and the eigenvector are derived to specify the weights of each parameter in the problem. The weights guide the DM in choosing the superior alternative.

The first step of ERP selection process is to make ERP selection criteria list and to determine which of them are very important and which of them are less important. Each criteria is assigned a number on a scale. If attribute A is absolutely more important than attribute B and is rated at 9, then B must be absolutely less important than A and is valued at $1/9$.

Author makes an assumption that selection criteria of ERP system are total cost (TC), implementation time (IT), functionality (F), user friendliness (UF) and reliability (R) and there are 3 options (A, B, C) of ERP system. Hierarchical categorization of the ERP system selection problem is shown in Figure 28.

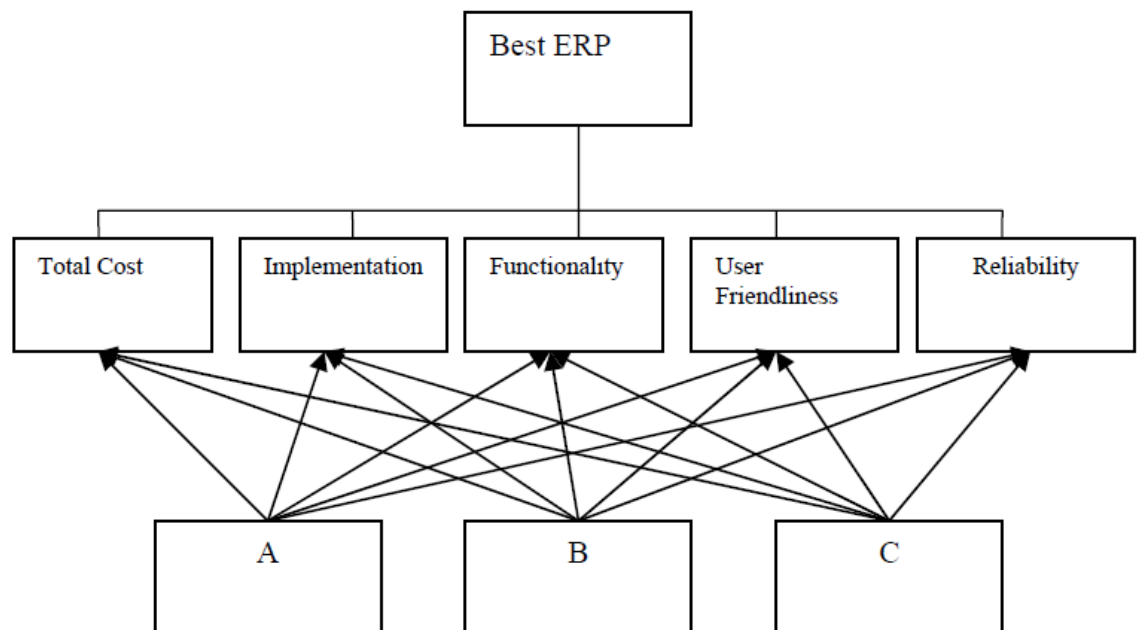


Fig. 28. Decomposition of the problem into a hierarchy

Once the model of hierarchy is built, the next step is to evaluate the elements by making pair wise comparisons or the comparison matrices of decision maker for ERP software selection (see Table 16). For example, total costs are 5 times more important than functionality of ERP etc.

Table 16. Comparison matrix of ERP selection criteria (1)

* $0,2 = 1/5$; $0,333333 = 1/3$; $0,142857 = 1/7$

	Total costs	Implementation time	Functionality	User friendliness	Reliability
Total costs	1	0,333333*	5	0,2*	3
Implementation time	3	1	7	3	5
Functionality	0,2*	0,142857*	1	0,2*	0,333333*
User friendliness	5	0,333333*	5	1	3
Reliability	0,333333*	0,2*	3	0,333333*	1
SUM	9,533333	2,009524	21	4,733333	12,33333

In order to determine the priority of all the criteria, we have to divide the number indicated in each cell by the sum of the column and then to show the sum of each row (see Table 17). For example $1 / 9,533333 = 0,104895$; $3 / 9,533333 = 0,314685$ etc.

Table 17. Comparison matrix of ERP selection criteria (2)

	TC	IT	F	UF	R	SUM
TC	0,104895	0,165877	0,238095	0,042254	0,243243	0,794364
IT	0,314685	0,49763	0,333333	0,633803	0,405405	2,184857
F	0,020979	0,07109	0,047619	0,042254	0,027027	0,208969
UF	0,524476	0,165877	0,238095	0,211268	0,243243	1,382958
R	0,034965	0,099526	0,142857	0,070423	0,081081	0,428852
	SUM_{of the last column}					5

After that we have to divide the sum of each row by the sum of the last column in Table 17. These calculations show the priority of each ERP selection criteria. Thus, the calculations are as follows:

$$W_{TC} = 0,794364 / 5 = \mathbf{0,158873}$$

$$W_{IT} = 2,184857 / 5 = \mathbf{0,436971}$$

$$W_F = 0,208969 / 5 = \mathbf{0,041794}$$

$$W_{UF} = 1,382958 / 5 = \mathbf{0,276592}$$

$$W_R = 0,428852 = \mathbf{0,08577}$$

The next step is to determine the normalized weights of each system (A, B, C) according to the each criteria (TC, IT, F, UF, R). The aim of this action is to prioritize A, B, C

systems according to each ERP selection criteria. Analogous calculations have to be made after which ERP systems priorities according to each selection criteria can be determined (see Table 18).

Table 18. Comparison matrix of ERP systems according to each selection criteria

Total costs				Total costs				Total costs				ERP priority according total costs			
A	B	C		A	B	C		A	B	C	SUM				
A	1	0,2	0,3333	A	0,1111	0,1304	0,0769	A	0,1111	0,1304	0,0769	0,3185	0,1062		
B	5	1	3	B	0,5556	0,6522	0,6923	B	0,5556	0,6522	0,6923	1,9	0,6333		
C	3	0,3333	1	C	0,3333	0,2174	0,2308	C	0,3333	0,2174	0,2308	0,7815	0,2605		
SUM	9	1,5333	4,3333					SUM of the last column				3			
Implementation time				Implementation time				Implementation time				ERP priority according implementation time			
A	B	C		A	B	C		A	B	C	SUM				
A	1	5	3	A	0,6522	0,7895	0,4286	A	0,6522	0,7895	0,4286	1,8702	0,6234		
B	0,2	1	3	B	0,1304	0,1579	0,4286	B	0,1304	0,1579	0,4286	0,7169	0,239		
C	0,3333	0,3333	1	C	0,2174	0,0526	0,1429	C	0,2174	0,0526	0,1429	0,4129	0,1376		
SUM	1,5333	6,3333	7					SUM of the last column				3			
Functionality				Functionality				Functionality				ERP priority according functionality			
A	B	C		A	B	C		A	B	C	SUM				
A	1	0,1111	0,3333	A	0,0769	0,0847	0,0526	A	0,0769	0,0847	0,0526	0,2143	0,0714		
B	9	1	5	B	0,6923	0,7627	0,7895	B	0,6923	0,7627	0,7895	2,2445	0,7482		
C	3	0,2	1	C	0,2308	0,1525	0,1579	C	0,2308	0,1525	0,1579	0,5412	0,1804		
SUM	13	1,3111	6,3333					SUM of the last column				3			
User friendliness				User friendliness				User friendliness				ERP priority according user friendliness			
A	B	C		A	B	C		A	B	C	SUM				
A	1	3	5	A	0,6522	0,6923	0,5556	A	0,6522	0,6923	0,5556	1,9	0,6333		
B	0,3333	1	3	B	0,2174	0,2308	0,3333	B	0,2174	0,2308	0,3333	0,7815	0,2605		
C	0,2	0,3333	1	C	0,1304	0,0769	0,1111	C	0,1304	0,0769	0,1111	0,3185	0,1062		
SUM	1,5333	4,3333	9					SUM of the last column				3			
Reliability				Reliability				Reliability				ERP priority according user reliability			
A	B	C		A	B	C		A	B	C	SUM				
A	1	0,1111	0,2	A	0,0667	0,0847	0,0323	A	0,0667	0,0847	0,0323	0,1837	0,0612		
B	9	1	5	B	0,6	0,7627	0,8065	B	0,6	0,7627	0,8065	2,1692	0,7231		
C	5	0,2	1	C	0,3333	0,1525	0,1613	C	0,3333	0,1525	0,1613	0,6472	0,2157		
SUM	15	1,3111	6,2					SUM of the last column				3			

After these steps all the estimations are summarized.

Table 19. Synthesis of ERP system selection evaluation

Criteria	TC	IT	F	UF	R	ERP system evaluation
Priority of criteria	0,158873	0,436971	0,041794	0,276592	0,08577	
ERP system A	0,106156	0,623406	0,071433	0,633346	0,061223	
ERP system B	0,633346	0,238967	0,748164	0,260498	0,723054	
ERP system C	0,260498	0,137627	0,180402	0,106156	0,215722	
SUM						1

ERP system evaluation is made by multiplying each priority of criteria by each ERP system priority according to these criteria and by summing these results. For example, ERP system A evaluation is $0,106156 * 0,158873 + 0,623406 * 0,436971 + 0,071433 * 0,041794 + 0,633346 * 0,276592 + 0,061223 * 0,08577 = 0,472691$ etc.

The sum of the last column is 1. It means that calculations are correct. According to these evaluation, priority of ERP system A is the highest and it is the best solution to be selected for implementation.

3.3.2. ERP Implementation

The project team has the highest responsibility level during the ERP implementation stage. ERP prototype, which should be tested by the representatives of the company. The main task of the project team during this stage is feedback process with vendors in order all the deviations would be eliminated and the implementation process would be as close to plan as possible. Corrective actions should also be implemented if needed.

These questions arise during the implementation stage: ensuring the fluent ERP and business process integration, sklandžios VVS ir verslo procesų integracijos užtikrinimas, selection of optimal information systems and customization, data consistency etc.

3.3.3. Training

All the ERP implementation stages should be completed with the final ERP users trainings. Users should know the technical and other possibilities of ERP and should have clear user manuals and wizards. What is more, the need of ERP and how it will improve the processes of users should be communicated.

Effective trainings save the costs due to the reason that as clear as possible conception is deep understanding of the opportunities provided by ERP decreases the support and additional trainings costs.

Therefore, trainings should be the strong background of the radical business process reconsideration or reengineering as the foundation of the success is not ERP as a system but people who can improve the situation using the resources which are given to them. It is very important that top management would be as an example to employees and that they would communicate those changes as it softens the adaptation process after ERP implementation.

It would be perfectly to assign the responsible person who would ensure the needed scope and quality of trainings. Trainings benefits and changes in efficiency level can be inspected by the knowledge tests, questionnaires, direct contact with the ERP users etc.

3.4. ERP Exploitation Stage

After ERP implementation author offers to audit benefit take-up rate and to improve it if needed.

ERP implementation does not end after the implementation of the ERP system and users training. Continuous process improvement (measure, understand, control, improve) is needed to achieve better than average results. The process of benefit take-up rate audit and improvement offered by author is shown in Figure 29.

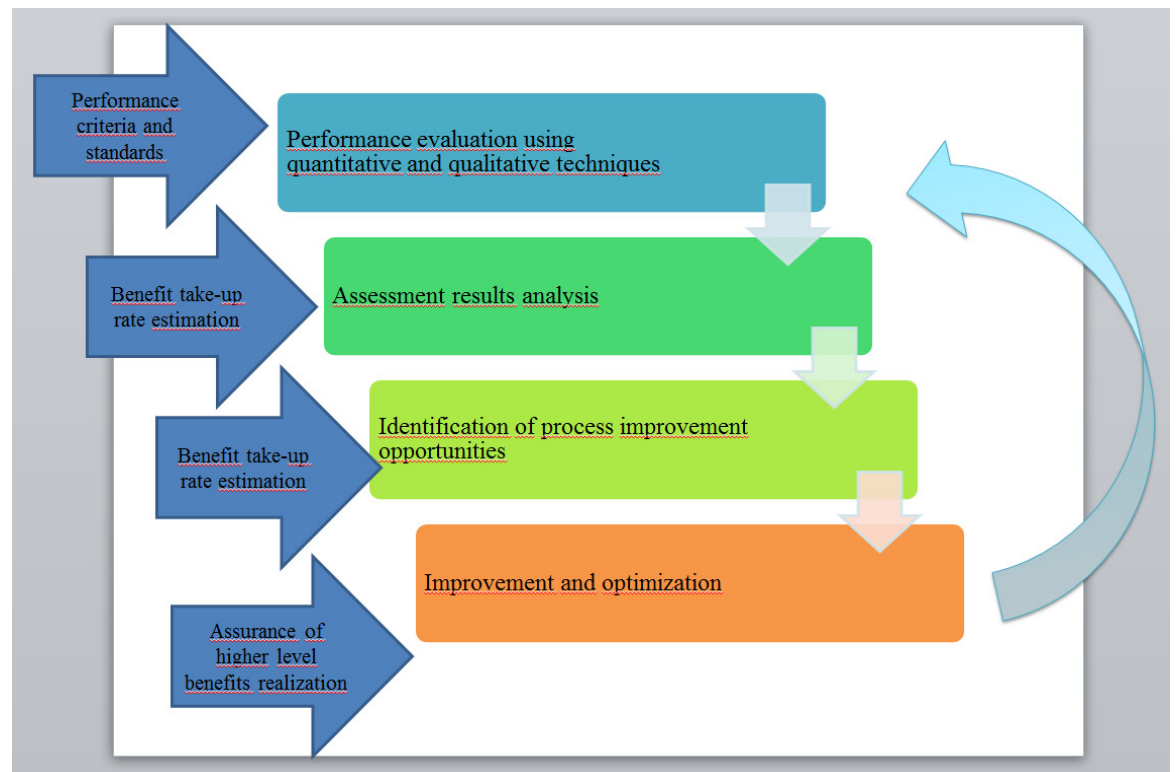


Fig. 29. ERP benefit take-up rate audit and improvement process (Source: made by author)

Therefore, the continuous control of the progress, benefit take up-rate and improvement process after ERP implementation is needed to improve the level of business processes and business results. ERP benefit take-up rate audit and improvement process increases the overall benefits of implementation project.

CONCLUSIONS AND RECOMMENDATIONS

1. Dynamic business conditions stimulate IT application in business as it is an effective way to maintain business agility and to gain a competitive advantage. Information has become a strategic corporate resource and encourages business to invest in ERP projects as ERP systems can integrate all the business processes and help to improve the effectiveness of them.
2. Organizations may choose which combination of modules that are most applicable to their organization, therefore ERP solution adapted to the business needs can integrate business processes and increase the effectiveness of the processes as well as increase business value.
Recommendation: the complexity of ERP should be evaluated as it is usually wrongly interpreted as software, but not as business management and value creation tool which depends on people and not only on the technology.
3. Unsuccessful ERP implementation is a common problem, however failure usually depends not on the limitation of the IT system, but on other aspects connected with the implementation. Therefore, evaluation of business processes, clear ERP selection criteria, concrete implementation model which is like roadmap, appropriate and active project management, effective change management and business process reengineering have huge influence on ERP benefits take-up rate.
4. Rapid growth of IT sector provides new opportunities and due to this fact organizational investment in IT technologies is fastly growing as well. The volume, tasks and aim of this investment transforms them into strategic investment. However, despite the fact that investment volume is growing, worldwide practice shows that failure rate is still high. Therefore, author's **recommendation** is to pay more attention on ERP implementation process, to investigate ERP project implementation aspects in more detail and to propose solutions or support techniques for those projects. Other author's **recommendation** is to pay more attention on the modern IT solutions and opportunities of fastly growing mobile ERP market. While mobile devices like laptops, PDAs, and tablets made it possible to work everywhere you want, now employees can use their ERP applications on their mobile devices to take advantage of business capabilities and insights. Mobility should be understood as merely an IT project, but also as a strategic business development and modern transformation investment.
5. According to worldwide ERP reports, lack of active participation in ERP project implementation is still a huge problem. It can be the important reason why ERP users are dissatisfied with implementation results. If companies save time, financial, human and other

resources and transfer all the responsibility on technical specialist from outside, they usually do not reach the planned level of benefits. Author's **recommendation** is to encourage active company's participation in the ERP implementation project and to develop different support techniques for project team.

6. According to worldwide ERP researches, the main reasons to implement ERP are cost reduction and need to improve overall customer experience and the main reasons which stop implementation is the belief that the business processes are efficient enough without ERP and lack of confidence in self management of ERP implementation projects. This means that companies usually undervalue the benefits of ERP and are afraid of the efforts to achieve higher results.

Recommendation: Deeper analysis of ERP implementation problems should be done, models based on quantitative and qualitative supportive techniques should be used. All of this would radically rethink the established wrong approach to ERP implementation projects, ERP benefits would be evaluated and higher benefit take-up rate would be achieved.

7. According to author's research, the outcomes of ERP projects largely depend on the internal company's management factors. ERP project is managerial, but not technical, thus, the main success factors are detailed and clear ERP implementation model, effective project management and project resources (financial, time, HR etc.). However, due to the lack of information and experience in ERP project implementation, companies usually transfer responsibility on vendors and technical consultants. What is more, the critical risk factors in ERP implementation projects are organizational and project management risks. Therefore, the majority of respondents (ERP users and experts) confirmed that ERP implementation support model would be very useful for companies.

Recommendation: companies should pay more attention on internal aspects and participate in ERP implementation project more actively. In this way the internal or organizational risk factors would be minimized.

8. Analysis of existing ERP implementation models has shown that existing models are not comprehensive enough, they usually covers only a certain area (usually technical), their practical adaptation is limited as they limit company's possibility to participate in ERP implementation project actively.

Recommendation: to complement existing models with descriptions, practical advices, suggestions to use appropriate quantitative and qualitative techniques in order to achieve better ERP implementation results.

9. **Recommendation:** author's proposed ERP implementation project support model solves the most common problems: it is characterized by complexity, supports organizational ERP investment decision-making and project implementation process by offering a variety of qualitative and quantitative methods, provides roadmap to concrete steps and provides the possibility to monitor ERP implementation project performance.

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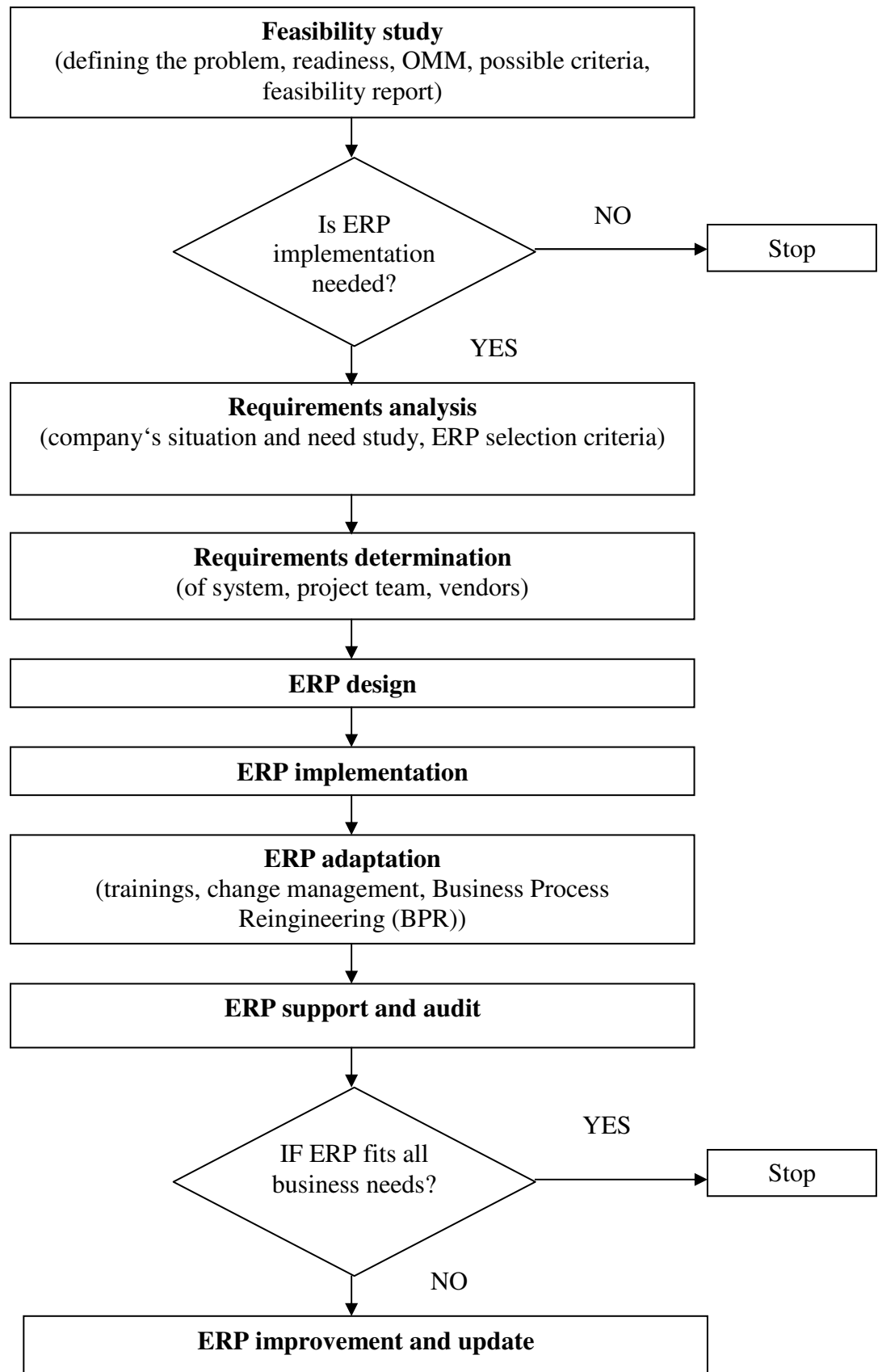
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APPENDIXES

Appendix A

ERP implementation flow chart (Made by author, on the basis of Saulis, Vasilecas 2008: 167; Paškevičiūtė 2010; Panorama Consulting Group 2011)



Appendix B

ICT expenditure and investment in Lithuanian enterprises, LTL million
(Source: Information Technology in Lithuania 2012)

	2009	2011	
	564,1	893,7	Total
	183,6	284,0	<i>Purchase of ICT goods</i>
	107,5	177,8	<i>computers and ancillary equipment</i>
	76,1	106,2	<i>communication equipment</i>
	20,2	34,7	<i>Purchase of other ICT goods (audiovisual equipment, ICT components)</i>
	123,0	125,3	<i>Purchase of software</i>
	40,9	39,5	<i>Software development</i>
	188,9	376,9	<i>Purchase of ICT consultancy and services</i>
	7,5	33,3	<i>Lease of ICT equipment</i>

Appendix C

Enterprises with ICT systems for e-business, percent (Information Technology in Lithuania 2012)

2008	2009	2010	2011	2012	
27,7	26,7	33,3	27,8	37,3	<i>Electronic exchange of information on supply chain management</i>
21,2	22,5	24,0	23,6	27,5	<i>Automatic exchange of information in the sale/purchase process</i>
50,9	49,6	63,2	69,8	60,8	<i>Automatic electronic exchange of information between enterprises</i>
5,0	5,8	11,5	12,6	23,1	<i>Enterprise resource planning (ERP)</i>
9,9	12,6	15,3	16,8	17,7	<i>Customer relationship management (CRM)</i>
24,7	23,9	68,9	72,4	72,0	<i>Secure digital signature</i>

Appendix D

Interview questions for experts of ERP implementation projects (Source: made by author)

1. Jūsų atstovaujamos įmonės pavadinimas (*atsakymas neprivalomas, rezultatai naudojami išskirtinai akademiniams tikslais*) / Name of the company You represent (*optional, the results are used solely for academic purposes*).....
2. Jūsų užimamos pareigos/position held in the company:
 - Projektų vadovas/project manager
 - Funkcinis konsultantas/functional consultant
 - Techninis konsultantas/technical consultant
 - Kita/other
3. Jūsų patirtis VVS diegimo projektų srityje/Your experience in the field of ERP implementation projects:
 - Iki 1 metų/<1 year
 - 1-3 metai/ 1-3 years
 - 3-5 metai/ 3-5 years
 - Daugiau kaip 5 metai/ >5 years
4. Ar dažnai VVS projektai būna sėkmingi/are ERP projects often successful?
 - Visada/always
 - Dažnai/often
 - Vidutiniškai/average
 - Retai/rarely
 - Labai retai/ very rarely
5. Kokia vidutiniškai būna VVS diegimo projekto kaina Lietuvoje? (*galite nurodyti kainų intervalą*) / What is the average cost of ERP implementation project in Lithuania? (*it can be price range*).....
6. Koks vidutiniškai būna VVS diegimo projekto laikotarpis Lietuvoje?/ What is the average time of ERP project implementation in Lithuania?
 - Iki 1 metų/ <1 year
 - 1-2 metai/ 1-2 years
 - 2-3 metai/ 2-3 years
 - Daugiau kaip 3 metai/ >3 years
 - Kita/other.....
7. Įvertinkite žemiau nurodytų VVS projektų sėkmės veiksnių svarbą 5 balų sistemoje, kur 5 - labai svarbus veiksnys, 1 - visai nesvarbus veiksnys/ please, rate the success factors of ERP implementation projects from 1 (unimportant) to 5 (very important).
 - Išsamus ir aiškus VVS diegimo modelis/ detailed and clear ERP implementation model
 - Aukščiausios vadovybės palaikymas/ Top Management support
 - VVS diegimo strategija/ ERP implementation strategy
 - Efektyvus projekto valdymas/ effective project management
 - VVS projekto vadovo lyderystė/ ERP project manager leadership
 - Verslo procesų reinžinerija/ Business Process Reengineering (BPR)
 - Pokyčių valdymas/ Change Management
 - Projektui skirti ištekliai (finansiniai, laiko, žmogiškieji ir kiti)/ project resources (financial, time, HR etc.)
 - VVS diegėjo parama/ support of ERP vendor
 - VVS diegėjo patirtis/ experience of ERP vendor
 - Aiškūs VVS atrankos kriterijai / clear ERP selection criteria

- VVS suderinamumas su esama informacine sistema/ ERP compatibility with existing information system
 - VVS vartotojų mokymų kokybė ir apimtis/ quality and scope of ERP users training
 - Efektyvi komunikacija / effective communication
 - Samdomos konsultacinės įmonės kompetencija / hired consultancy firm experience
8. Didžiausi rizikos veiksniai VVS projektuose (*galite pažymėti kelis variantus*)/ the most important risk factors in ERP project implementation (*more than one choice is allowed*):
- **Organizaciniai rizikos veiksniai** (įmonės tikslų nepastovumas, neįgyvendinama verslo procesų reinžinerija, neefektyvus pokyčių valdymas, neefektyvus išteklių paskirstymas) / **Organizational risk factors** (the volatility of the company's goals, ineffective business process reengineering, ineffective change management, inefficient allocation of resources)
 - **Rizikos veiksniai, susiję su specifinių įgūdžių turėjimu** (konsultacinių paslaugų, ekspertų, verslo ir technologijų konsultantų patarimų atsisakymas)/ **Risk factors related to the possession of specific skills** (consulting services, experts, undervalued advice of business and technology consultants)
 - **Projekto valdymo rizikos veiksniai** (aukščiausios vadovybės palaikymo ir paramos trūkumas, neefektyvus projekto valdymas, nepakankama projekto vadovo patirtis ar kompetencija, silpna projekto komanda) / **Project management risk factors** (lack of support from Top Management, ineffective project management, inexperienced and incompetent project manager, weak project team)
 - **Sisteminės rizikos veiksniai** (neidentifikuoti ir neįvertinti veiksniai)/ **Systematic risk factors** (unidentified and underestimated factors)
 - **VVS vartotojų rizikos veiksniai** (galutinių VVS vartotojų mokymų neefektyvumas, ilgas ir sudėtingas vartotojų adaptacijos procesas, neefektyvi komunikacija tarp padalinių)/ **ERP users risk factors** (inefficiency of ERP end-users training, lengthy and complex user adaptation process, ineffective communication between departments)
 - **Technologinės rizikos veiksniai** (susiję su VVS, kaip IT sprendimo, netobulumais)/ **Technology risk factors** (related to imperfections of ERP system as an IT solution)
 - Kita (komentarai)/other (Your comment).....
9. Kokią įtaką Lietuvos įmonėms, planuojančioms diegti VVS, turėtų specialiai sukurtas VVS projekto paramos modelis* projekto sėkmingam įgyvendinimui?/ How specifically developed ERP project implementation support model* can influence the companies which plan ERP implementation?
- *VVS projekto paramos modelis – kelių pakopų pagalbinė priemonė įmonėms, padedanti apsispręsti dėl investicinių VVS sprendimų, pasirinkti tinkamą diegėją, kokybiniais ir kiekybiniais metodais įvertinantis pasirengimą projektui, galimas problemas ir kitus VVS diegimo aspektus. Tai yra nuoseklius VVS projekto žingsnius parodanti naudos iš VVS projekto maksimizavimo priemonė./ ERP project implementation support model - multi-tiered support tool for companies which helps to make decision on ERP investment, to choose the right vendor, to assess project readiness, potential problems and other aspects by using qualitative and quantitative techniques.*
- Turėtų didelę reikšmę/would be very valuable
 - Būtų svarbus ne tik įmonėms, planuojančioms VVS diegimą, bet ir diegėjams/ would be valuable not only for the companies which plan to implement ERP, but also for vendors
 - Turėtų nedidelę reikšmę/ would be not very valuable
 - Neturėtų reikšmės VVS diegimo projektui/ would not be valuable at all
 - Kita/other.....
10. Jūsų pastabos, pasiūlymai/ Your comments and suggestions.....

Appendix E

ERP users (companies) survey (Source: made by author)

1. Jūsų įmonės darbuotojų skaičius/ number of employees in Your company:
 - Iki 20/ <20
 - 20-50/ 20-50
 - 50-100/ 50-100
 - 100-200/ 100-200
 - Daugiau kaip 200/ >200
 - Kita (tikslus skaičius)/ other (exact number)
2. Jūsų užimamos pareigos/ position held in the company
 - Įmonės vadovas/ head of the company
 - Skyriaus/departamento vadovas / head of division/department
 - Vadybininkas/ manager
 - Administratorius/ administrator
 - Konsultantas/ consultant
 - Kita/ other
3. Jūsų atstovaujamos įmonės pavadinimas (*atsakymas neprivalomas, rezultatai naudojami išskirtinai akademiniais tikslais*) / Name of the company You represent (*optional, the results are used solely for academic purposes*).....
4. Ar Jūsų įmonėje buvo įdiegta VVS?/ Do you have ERP implemented in Your company?
 - Taip/ Yes
 - Ne/ no
 - Ne, bet planuojame diegti/ No, but it is planned to implement
5. Kokia buvo VVS projekto vertė?/ What was the value of the project?
 - Iki 50 tūkst. Lt / < 50 thousand Lt
 - 50-100 tūkst. Lt / 50-100 thousand Lt
 - 100-200 tūkst. Lt / 100-200 thousand Lt
 - 200-500 tūkst. Lt / 200-500 thousand Lt
 - Kita/ other.....
6. Kiek metų dirbate su įdiegta VVS?/ How many year do you work with the implemented ERP?
 - Iki 1 metų / <1 year
 - 1-2 metai / 1-2 years
 - 2-4 metai / 2-4 years
 - Daugiau kaip 4 metus / >4 years
7. Ar VVS įgyvendinimo projektui buvo oficialiai paskirtas projekto vadovas?/ Did your ERP implementation project had officially appointed project manager?
 - Taip/ yes
 - Ne/ no
8. Kiek projekto vadovo darbo laiko procentais buvo skiriama VVS įgyvendinimo projektui?/ What part of the project manager's working time was for ERP project implementation management?
 - Iki 25% / <25%
 - 25-50% / 25-50%
 - 50-75% / 50-75%
 - 75-100% / 75-100%
9. Ar VVS diegimo projektas buvo sėkmingas? / Was ERP project implementation successful?
 - Taip / yes

- Ne visai / not exactly
 - Ne / no
10. Ar Jūs patenkinti VVS diegimo projekto įgyvendinimu? Įvertinkite pasitenkinimą VVS 5 balų sistemoje, kur 5 - labai patenkinti, 1 - visai nepatenkinti. / Are You satisfied with the ERP implementation project results? Please, rate your satisfaction level from 1 (not satisfied) to 5 (strongly satisfied).
- Diegimo trukmė/ implementation time
 - Pasiiektas naudos lygis/ reached benefits level
 - VVS funkcionalumas/ functionality of ERP
 - Pasitenkinimas diegėjais/ satisfaction with vendors
 - Diegimo eiga (žingsniai, modelis) / implementation process (steps, model)
11. Kokios pagrindinės priežastys paskatino/paskatintų Jūsų įmonę įdiegti VVS? (*galite pasirinkti kelis variantus*) / What main factors encouraged/would encourage Your company to implement ERP? (*more than one choice is allowed*)
- Poreikis sumažinti išlaidas / need to reduce costs
 - Efektyvesnis klientų poreikių tenkinimas / increased customer satisfaction
 - Įmonės plėtros planavimas / business development planning
 - Greitesnis atsakymas į kliento užklausas / faster response to customer queries
 - Priverstinis inovacijų diegimas, kad įmonėje būtų sukurta pridėtinė vertė / forced innovation to increase business added value
 - Bendravimo tarp skirtingose geografinėse vietovėse esančių verslo vienetų poreikis / need of communication between the geographically dispersed business units
 - VVS įdiegė mūsų konkurentai, todėl nusprendėme įdiegti ir mes / we decide to implement it as our competitors did it
 - Kita / other.....
12. Dėl kokių priežasčių, Jūsų nuomone, įmonės atsisako diegti VVS? (*galite pasirinkti kelis variantus*) / Why do you think some companies refuse to implement ERP? (*more than one choice is allowed*)
- Įmonės veikla yra efektyvi ir be VVS / company's activities are effective without ERP
 - Įmonė yra per maža diegti VVS / company is too small to implement ERP
 - Trukdo vidinės diegimo kliūtys / internal barriers of implementation
 - Aukšta programinės įrangos ir diegimo paslaugų kaina / high software and implementation services costs
 - VVS yra per daug sudėtinga verslo valdymo priemonė / ERP is too complex business management tool
 - Įmonė nežino nuo ko pradėti ir kaip įgyvendinti diegimo projektą / company does not know where to start and how to realize the implementation of the project
 - Kita/ other.....
13. Įvertinkite žemiau nurodytų VVS projektų sėkmės veiksnių svarbą 5 balų sistemoje, kur 5 - labai svarbus veiksnys, 1 - visai nesvarbus veiksnys/ please, rate the success factors of ERP implementation projects from 1 (unimportant) to 5 (very important).
- Išsamus ir aiškus VVS diegimo modelis/ detailed and clear ERP implementation model
 - Aukščiausios vadovybės palaikymas/ Top Management support
 - VVS diegimo strategija/ ERP implementation strategy
 - Efektyvus projekto valdymas/ effective project management
 - VVS projekto vadovo lyderystė/ ERP project manager leadership
 - Verslo procesų reinžinerija/ Business Process Reengineering (BPR)
 - Pokyčių valdymas/ Change Management

- Projektui skirti ištekliai (finansiniai, laiko, žmogiškieji ir kiti)/ project resources (financial, time, HR etc.)
 - VVS diegėjo parama/ support of ERP vendor
 - VVS diegėjo patirtis/ experience of ERP vendor
 - Aiškūs VVS atrankos kriterijai / clear ERP selection criteria
 - VVS suderinamumas su esama informacine sistema/ ERP compatibility with existing information system
 - VVS vartotojų mokymų kokybė ir apimtis/ quality and scope of ERP users training
 - Efektyvi komunikacija / effective communication
 - Samdomos konsultacinės įmonės kompetencija / hired consultancy firm experience
14. Didžiausi rizikos veiksniai VVS projektuose (*galite pažymėti kelis variantus*)/ the most important risk factors in ERP project implementation (*more than one choice is allowed*):
- **Organizaciniai rizikos veiksniai** (įmonės tikslų nepastovumas, neįgyvendinama verslo procesų reinžinerija, neefektyvus pokyčių valdymas, neefektyvus išteklių paskirstymas) / **Organizational risk factors** (the volatility of the company's goals, ineffective business process reengineering, ineffective change management, inefficient allocation of resources)
 - **Rizikos veiksniai, susiję su specifinių įgūdžių turėjimu** (konsultacinių paslaugų, ekspertų, verslo ir technologijų konsultantų patarimų atsisakymas)/ **Risk factors related to the possession of specific skills** (consulting services, experts, undervalued advice of business and technology consultants)
 - **Projekto valdymo rizikos veiksniai** (aukščiausios vadovybės palaikymo ir paramos trūkumas, neefektyvus projekto valdymas, nepakankama projekto vadovo patirtis ar kompetencija, silpna projekto komanda) / **Project management risk factors** (lack of support from Top Management, ineffective project management, inexperienced and incompetent project manager, weak project team)
 - **Sisteminės rizikos veiksniai** (neidentifikuoti ir neįvertinti veiksniai)/ **Systematic risk factors** (unidentified and underestimated factors)
 - **VVS vartotojų rizikos veiksniai** (galutinių VVS vartotojų mokymų neefektyvumas, ilgas ir sudėtingas vartotojų adaptacijos procesas, neefektyvi komunikacija tarp padalinių)/ **ERP users risk factors** (inefficiency of ERP end-users training, lengthy and complex user adaptation process, ineffective communication between departments)
 - **Technologinės rizikos veiksniai** (susiję su VVS, kaip IT sprendimo, netobulumais)/ **Technology risk factors** (related to imperfections of ERP system as an IT solution)
 - Komentarai/Your comment.....
15. Kokiais informacijos šaltiniais Jūsų įmonė rėmėsi/remtųsi VVS diegimo projekto įgyvendinimo metu? / What source of information your company used/would use during the ERP implementation project?
- Diegėjo suteikta informacija / information provided by vendor
 - Konsultacinės įmonės suteikta informacija / information provided by consulting firms
 - Pasaulinės VVS diegimo praktikos analizė / global ERP implementation practice analysis
 - Konkurentų, įdiegusių VVS, praktika / practice of competitors, who implemented ERP
 - Konkrečiu VVS diegimo modeliu / specific ERP implementation model
 - Kita/other
16. Kokią įtaką Lietuvos įmonėms, planuojančioms diegti VVS, turėtų specialiai sukurtas VVS projekto paramos modelis* projekto sėkmingam įgyvendinimui?/ How specifically developed ERP project implementation support model* can influence the companies which plan ERP implementation?

**VVS projekto paramos modelis – kelių pakopų pagalbinė priemonė įmonėms, padedanti apsispręsti dėl investicinių VVS sprendimų, pasirinkti tinkamą diegėją, kokybiniais ir kiekybiniais metodais įvertinantis pasirengimą projektui, galimas problemas ir kitus VVS diegimo aspektus. Tai yra nuoseklius VVS projekto žingsnius parodanti naudos iš VVS projekto maksimizavimo priemonė./ ERP project implementation support model - multi-tiered support tool for companies which helps to make decision on ERP investment, to choose the right vendor, to assess project readiness, potential problems and other aspects by using qualitative and quantitative techniques.*

- Turėtų didelę reikšmę/would be very valuable
- Būtų svarbus ne tik įmonėms, planuojančioms VVS diegimą, bet ir diegėjams/ would be valuable not onlo for the companies which plan to implement ERP, but also for vendors
- Turėtų nedidelę reikšmę/ would be not very valuable
- Neturėtų reikšmės VVS diegimo projektui/ would not be valuable at all
- Kita/other.....

17. Jūsų pastabos, pasiūlymai/ Your comments and suggestions.....

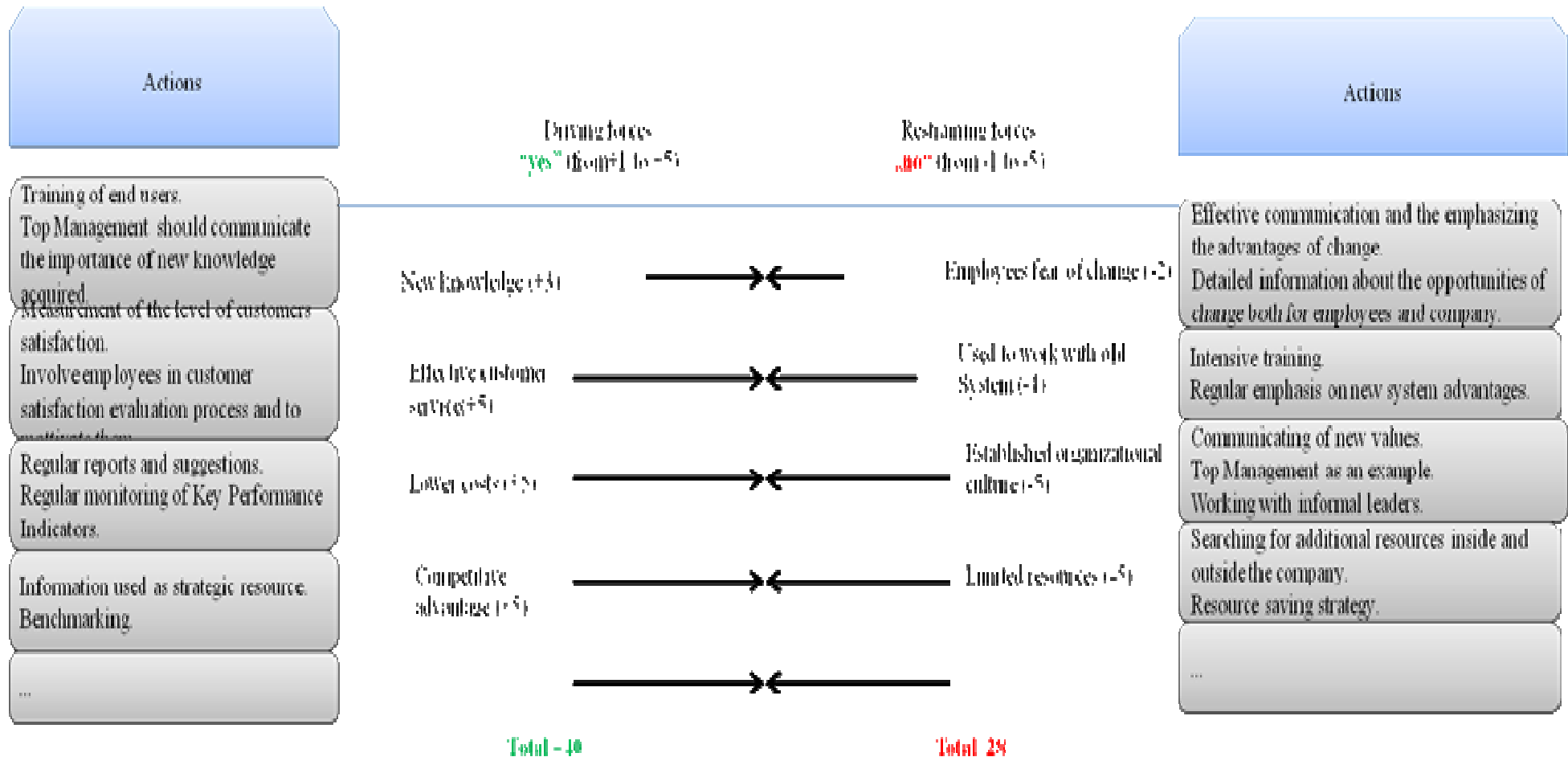
Appendix F

Example of risk management plan (Source: made by author)

Risk factor	Impact on the project goal, tasks, key performance indicators	Level of impact (from 1 to 5)	Actions	Responsible person
Inaccurate budget (undervalued/ overvalued)	Project implementation time is longer than expected due to the process of searching additional financial resources or the implementation can be disrupted and investment can be lost.	5	Budget according to the author's recommendations and reserve for unexpected expenses.	...
Weak team members	Project implementation time is longer than expected, rised expenses, lower benefit take-up rate and longer payback period.	5	Multistage selection process. Team members from reserve.	...
Inappropriate ERP system selection	ERP does not meet the real company's needs. Improvement of ERP can lead to budget increase and interrupts business processes.	5	Detailed analysis of business processes and needs. ERP Multi-Criteria selection model.	...
Project schedule deviation due to the organizational mistakes	Project implementation time is longer than expected, rised expenses due to longer implementation and possible corrective actions.	4	Gantt Chart as project schedule management tool. Management reserve in schedule. Team members are motivated for the timely implemented project.	...
Lack of modules in ERP	Lower efficiency of business processes	3	Detailed analysis of business processes and needs.	...
...	...	...	...	...

Appendix G

Example of Force Field Analysis (Source: made by author)



Appendix H

ERP and vendors selection criteria (Source: made by author)

ERP selection criteria	
1	functionality
2	integrity
3	data security and recovery possibility
4	implementation time
5	total cost of ownership and return on investment (ROI)
6	user friendliness
7	complexity of training
8	extension possibility
9	complexity of auditing
10	number of components (modules)
11	supported languages (important for international companies)
12	customization options
13	...
ERP vendors selection criteria	
	technical support
2	vendor reliability (project success rate)
3	experience in ERP project implementation
4	feedbacks of current clients
5	how long vendor is in the market
6	market share
7	financial situation of vendor
8	number of clients
9	number of satisfied clients
10	vendors employees skills and experience
11	level of support during ERP implementation
12	annual growth of vendor
13	variety of products and services
14	innovation of products and services
15	possibilities to meet future business needs of company
16	understanding the needs and requirements of client
17	ERP implementation strategy
18	conditions after implementation
19	response to client request
20	on-line services possibilities
21	...

Appendix I

ERP implementation project support model (Source: made by author)

