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Risks in ERP Projects implementation

How communication and business processes re-engineering risks effect ERP projects

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Dissertation as partial requirement for obtaining the Master's degree in Statistics and Information Management

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RISKS IN ERP PROJECTS IMPLEMENTATION

by

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Dissertation as a partial requirement for obtaining the Master's degree in Information Management, with a specialization in Risk Analysis and Management

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ABSTRACT

Enterprise Resource Planning (ERP) systems have been regarded as one of the most important information technology developments in the past decades. While ERP systems provide the potential to bring substantial benefits, their implementations are characterized by large capital outlay, long duration, and high might be a solution to ensure the success of ERP system implementations in organizations.

The overall objective of this research is to to provide detailed analysis and impacts of business processes re-engineering and communication risks on ERP projects. At the begging, the research describes ERP systems in conjunction with the nature of Information Technology projects. Research identifies the communication and business processes re-engineering risks in ERP implementation projects and analyzes the causes. Accordingly, a conceptual research framework is presented, and the procedures and research methods are outlined. Secondly, quantitative data is provided based on twenty-one ERP projects implemented in North America. Data accompanied by based analytical statements and conclusions. Thirdly, an approach is developed based on fault tree analysis to decompose ERP systems failure and assess the relationships between ERP project failure and Communication and Business processes re-engineering risks. The principles and processes of this approach and related fault tree analysis and design methods are presented. Fourthly, certain conclusions and practical strategies are proposed.

The current research does not only contribute to the body of knowledge of information system risk management, but also can be used as an effective tool for practitioners to actively analyze, assess, and manage the risks of ERP system implementations.

KEYWORDS

Enterprise Resource Planning; Business Processes Re-engineering risk; Communication risk.

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LIST OF ABBREVIATIONS AND ACRONYMS

BPR	Business processes re-engineering
CRM	Customer relation management
DBMS	Database Management Systems
ERP	Enterprise resource planning
FTA	Fault tree analysis
ICT	Information and Communication Technologies
NIST	National Institute of Standards and Technology
SaaS	Software as a service
SCM	Supply chain management
SOA	Service orientated architecture
UAT	User acceptant test

1. INTRODUCTION

BACKGROUND

Widely regarded as one of the most important and innovative technological applications, Enterprise Resource Planning (ERP) systems have had an enormous impact on businesses and organizations around the world (Howcroft, D., Truex D. 2001). ERP represents an ideology of planning and managing the resources of an entire organization in an efficient, productive, and profitable manner, and manifested in the form of configurable information system packages (Sedera, D. 2008). ERP systems are multifunctional in scope, integrated into nature, and modular in structure (Mabert, V. A., Soni, A., Venkataramanan, M. A. 2001), can provide the potential to significantly save cost and cycle time, and increase productivity and effectiveness (Shang, S., Seddon, P. 2000).
These applications promise an integration of all the information flowing through an organization, and they fulfill this promise by integrating information and information-based processes within and across all the functional areas in an organization, and even more they can enabling the integration of information and business processes beyond the organizational boundaries.
During the last four decades, a range of technologies has been developed, such as e-commerce, software as a service (SaaS), customer relation management (CRM), supply chain management (SCM) this fact can increase the capability of ERP systems. Indeed, this application has been recognized as the most imperative information technology infrastructure of modern companies (Shah, R., Goldstein, S. M., & Ward, P. T. 2002). The adoption of ERP systems in organizations could turn out to be an efficient tool for an organization (Skibniewski, M. J., Zeng, Y. 2010). Though, on the other hand, the stake is very high. The ERP implementation projects are complex mechanisms, almost always associated with the re-engineering of business practices accompanied by a set of risks. The desire to adopt the best practices inherent in the chosen software solution or changing the software to match current business practices might turn to a failure (Panorama 2016).

1.1. PROBLEM STATEMENT

The adoption of ERP system is normally accompanied by changes in the way that an organization operates and its employees conduct their work (Adnan C., Svensson A. 2015). It also brings changes in corporate culture and the relationship of employees. Moreover, in light of the complexity of ERP system, numerous changes such as changing requirements, business processes, will be dealt with during the implementation. Sometimes the cost of changes might be more than the value which the desired changes might bring even in long term period (Goeun, S. 2013). ERP packages are not always compatible with an organization‘s needs and business processes immediately off the shelf. Thus either software modification or business process re-engineering is necessary. As software modification and customization are expensive and plagued with uncertainties, and ERP packages are normally designed with generally accepted good practices and optimized processes, restructuring the business processes is regarded by some as a favorable option (Jarrar, Y., Al-Mudimigh A., Zairi M. 2000). Business process reengineering (BPR) is a basic and fundamental rethinking and radical redesign of business processes to attain dramatic improvements in vital, contemporary initiatives of performance such as cost, quality of services and speed of delivery (Sotiris Z. 2000). Therefore, neglecting or downplaying business process reengineering is prone to risks (Aloini, D., Dulmin, R., Mininno, V. 2007; Jarrar, et al., 2000). Business reengineering involves

an overhaul of organizational structures, management systems, job descriptions, skill development, and training and of course the use of ERP itself.

Another crucial aspect of the ERP implementation projects is communication, as involving all the stockholders in the same communication cycle has a vital impact on the project´s success. Communication is often cited to be a critical success factor in ERP implementations (Curko, K., Stepanic, D., Varga M. 2012). In fact, it is critical to communicate what is happening, including the scope, objectives, and activities of the ERP project.

Usually, ERP projects are known with their high rate of failure risk. The literature provides a wide array of evidence and reference to continued project failures (Atkinson, R. 1999; Flyvbjerg, B., Bruzelius, N., Rothengatter, W. 2003; Kutsch, E., Hall, M. 2005; Kutsch, E., Maylor H., Weyer,B., Lupson, J. 2011; Mulcahy, R. M. 2003; Raz, T., Shenhar A. J., Dvir, D. 2002; Sharma, A., Sengupta, S., Gupt A. 2011; Standish Group, 2006, 2009). One significant reason is that enterprises, usually, are under high pressure with the tight schedule and limited budget. Due to this corner cutting and missteps often occurs. Taking into consideration this all organizations, before investing in ERP should realize the value that they will pay if the project does not succeed. Even if the organizational relevance and risk to failure, make ERP projects vitally important for organizations to focus on the ways to make an ERP implementation successful, several difficulties in the implementation process still might exist.

Although every organization has a differing definition of "success" and "failure," the business sector studies claim that more companies are defining their projects as failures when compared to previous years (21% in the 2015 year compared to 16% 2014 year).[1] A possible explanation for such a dramatic rate of failure of ERP projects is that the organizations (presented by the responsible managers, decision makers and other stakeholders) do not take the appropriate actions to evaluate and manage the risks involved in these projects. As a result, in recent years, about 57% of the ERP implementations took longer than expected, some of them were behind schedule significantly, and 54% of ERP implementations went over budget (Panorama 2015). As the system aims to run across each aspect of business, it might often misfit the specific conditions of the organization. Moreover, the implementation of ERP project is more complex than a traditional IT projects, as it requires business re-thinking and organization-wide change. An organization adopting ERP system has to get ready to see the organization changed, its staff disrupted, and its productivity decreased before the payoff would be realized. To avoid the disastrous consequences of implementation failure and reap the benefits of ERP systems successfully and as soon as possible, actively managing the risks in a phase of adopting and implementing the ERP has significance for organizations.

1.2. RESEARCH OBJECTIVES

In the current study, it will be discussed impacts, assessments, behaviors and possible adjustments of two risks in the ERP project´s implementation: Business processes re-engineering and communication risks. Further, ERP project failure will be defined as the failure to meet planned objectives regarding cost, time, and the stated requirements or expectations of the users on the usefulness of the ERP systems. Accordingly, the success of the projects would be described as a fit

[1] Panorama consulting ERP report February 2016

within planned timeline and budget. It will also be introduced how communication and business processes re-engineering effect projects, based on the collected data and analyzed the case.
Hence, the main purpose of the study is to provide detailed analysis and impacts of business processes re-engineering and communication risks on ERP projects; the following objectives were developed:

1. Classify the responsible of BPR risk management considering project´s success;
2. Discover weakest element of communication chain and the impact of communication risk on ERP project budget and timeline;
3. Develop a framework to measure the probability of failure of ERP projects due to Business Processes Re-engineering and communication risks.

The mentioned objectives aim to develop an approach and findings which can be utilized before ERP adoption to assess the risks of ERP projects and help the decision making of ERP adoption and selection, or during the ERP implementation process to manage and control risks and ensure successful project delivery.

1.3. SIGNIFICANCE OF THE RESEARCH

From hardware and software implementation to support services organizations spend billions of dollars on enterprise resource planning (ERP) systems. Adopting ERP makes organizations more information agile, those companies start to better process the information and integrate it into their business procedures and decision making (O'Leary D. E. 2000). And, yet, there is a little margin of error when undertaking such a significant investment. If deadlines slip or ERP does not function as intended it can quickly affect business processes, decision making and profitability of the organizations.
A possible explanation of the failure is that the organizations (presented by the responsible managers, decision makers and other stakeholders) do not take the appropriate actions to evaluate and after manage the risks involved in these projects. In general, ERP success has been seen as the degree of organizational performance resulting from the use of it (Cho J., Park I., Michel, J., W. 2011). Indeed, inadequate risk management, during the ERP adoption, implementation process and usage of the system, characterized by the lack of formal risk management planning and communication. The inability to forecast and assess risk issues, or the failure to respond to risks in a timely and proper manner, is one of the prior causes for ERP project failure (Zeng, 2010).
One of the reasons of this might be the lack of scientific-practical research on this topic that includes practical examples and up to date statistics. The discrepancy between the expected and actual results of ERP system implementations highlights a possible gap between what has been offered in theory by researchers and what is used by practitioners in real-life projects. There have already been a considerable number of existing studies addressing the risk management issues of ERP systems. However, according to an earlier literature survey (Aloini, D., Dulmin, R., Mininno, V. 2007), many of those extant studies aim to discover and analyze the critical success factors (CSFs) rather than the risk factors that lead to ERP implementation failure. Indeed, success factors not only affect the process of ERP implementation but may also influence each other (Sanjay, 2011). Also, most of the studies investigating ERP risks simply list the risk factors and suffer from a lack of systematic efforts in critically evaluating the behavior of that factors. Furthermore, in spite of the

attempts to identify various risk factors, quantitative analysis of ERP implementation risks is quite rare, making it difficult to undertake thorough risk management in practice (Severin, V., Grabski, S. A., Leech, B. L. 2001). Acknowledging the developments in the area of information system implementation, the research above provides both theoretical and practical significance. As this is, a practical issue and actionable knowledge are needed. Mainly are pointing 2 risks, which will be discussed in this study: communication and business processes re-engineering, as it has been mentioned in the previous statements ERP projects implementation mostly are being accompanied by processes re-designing, and this has a vital role on the whole project. The Communication risk is another significant element which exists in each phase of the project. Obviously, there is a need to add practical knowledge to these areas. Moreover, while there are a large number of publications addressing risk management in ERP system implementation projects, most of them are focused on identifying and qualitatively analyzing the risk factors or critical success factors for ERP projects as a whole. However, few inquire into ERP risks through the failure because these specific risks, and quantitative risk analysis has rarely been documented in extant ERP literature, although the relative importance of each factor has been studied now and again.

1.4. OUTLINE OF THE RESEARCH

The research contains five major parts. The first one is an overview chapter which provides a general picture of the study, including the purpose and objectives of the current research, it also highlights the importance of the study. The second chapter is a review of the pertinent literature associated with ERP systems. This part also identifies IT project risks and the risks and impacts of ERP systems´ implementation as a part of the latter. The literature review provides a background for identification of the research gap to be addressed and the formulation of the research questions. Chapter three outlines development of the research methodology from the research questions till the practical case study. It describes the techniques used to collect and analyze data. The research philosophy is explained, and the theoretical framework is presented in here. Next chapter, Results, and discussions, presents the statistical findings of the data, by presenting data characteristics and suitability of the sample are identified. This chapter also includes a practical case study. In the fifth chapter, the research questions are restated, and the results of the test briefly summarized. The research questions are analyzed against the findings and conclusions of the thesis are being provided. The limitations of the research are highlighted and in final chapter, recommendations for future research are proposed.

2. LITERATURE REVIEW

2.1. REVIEW OF ERP SYSTEMS

Underpinning the current study, to provide the background for the identification of the research gap and after express the research objectives a comprehensive review of the relevant literature was undertaken. This review addresses the key themes, definitions, history of evolution, debates and challenges surrounding the ERP systems, including the evaluation of the technology and the contemporary characteristics as a part of Information Technology, risk in ERP by underlining the communication and business processes re-engineering risks. Importantly, it intends to confirm the value of this empirical research as a contribution to knowledge.

The quest for improving the business activity of an organization, ameliorate processes and enhance decision-making tools, integrate all units and upgrade information flows has a long history.

Information technology advancements enabled recent development in these spheres. The progress led to the emergence of Enterprise resource planning. For contemporary organizations, ERP systems are forefront in company-wide IT solutions (Barsukova, D. 2013). ERP systems are designed to improve the flow of information throughout the enterprise, enhance the communication and decision-making systems. Also, ERP standardizes processes and data within an organization with best practices (Fergal, C., Frederic A. 2005). The company also streamlines data flow between different parts of business by creating a one-transaction system.

Wallace (2004) described ERP as an enterprise-wide set of management tools that balances demand and supply, containing the ability to link customers and suppliers into a complete supply chain, employing proven business processes for decision making, and providing high degrees of cross-functional integration among sales, marketing, manufacturing, operations, logistics, purchasing, finance, new product development and human resources, thereby enabling people to run their business with high levels of customer service and productivity, and simultaneously lower costs and inventories. In contemporary reality, ERP goals include high levels of customer service, productivity, cost reduction and financial turnover (Goeun, S. 2013). It provides the foundation for effective supply chain management. It does this by developing plans and schedules so that the right resources – manpower, materials, machinery, and money are available in the right amount at the right time. From the production based systems, ERP included wide areas, but it is also being recognized as a people-centric product: providing tools for people management, project planning, Communication, knowledge management (Guay M., Pang C., Hestermann C., Montgomery N. 2015).

The evolution of ERP systems closely followed the unprecedented development and growth of Information and Communication Technologies (ICT) driven by the advances in microelectronics, computer hardware, and software systems over the past decades (Rashid, M. A., Hossain, L., Patrick, J. D. 2002). The historical origin of ERP dates back to inventory management and control software packages that dictated system design during the 1960s. In the 1970s, the industry booming was had required new technologies involvement in the management of Production processes. Material Requirements Planning (MRP) systems were developed to automate and support decision-making processes in all aspects of production. Later there was a need for support production planning stage. A new system has been introduced to broad strata in the 1980s on the basis of MRP. As the new solution was mainly aiming to organize production, it misnamed as Manufacturing Resources Planning (MRP II). The main characteristics of the new software were

optimization of the manufacturing process and synchronizing the materials with production requirements. MRP II not only extended MRP I´s traditional focus on production processes into other business functions such as order processing, manufacturing, and distribution, but also provided automated solutions to a wider range of business processes covering engineering, finance, human resources, and project management (Rashid et al., 2002; Sammon, D., Adam, F. 2004).
ERP systems first were shown to the Public at the end of the 1980s and beginning of 1990s. The technological foundations of MRP and MRP II became a base for first ERP systems. The new systems have advantages above MRP and MRP II. Even first ERPs had been way more complex and wide. They differ from the "ancestors", not only in system requirements, but also in technical requirements, as it addresses technology aspects, such as graphical user interface, relational database, use of fourth-generation language, and computer-aided software engineering tools in development, client/server architecture, and open-systems portability (Sammon, D., Adam, F. 2004; Watson, E., Schneider, H. 1999). Besides, among inter-company business requirements which had been addressed to MRP and MRP II, ERP was covering not only traditional production planning and scheduling, but also it has focused on supplier resources, as it is based on the dynamic customer demands.
These all developments made ERP system more powerful, as they were able to:

- Apply a single set of resource planning tools across the enterprise;
- Provide real-time integration of sales, operating and financial data;
- Connect resource planning approaches to the extended supply chain of customers and suppliers.

And these advantages are serving for the primary purpose the ERP systems which is to run the business in a rapidly changing and highly competitive environment, far better than before.
Every year, with a growth of technologies and IT innovations, ERP systems are developing as well. In reality, it growled to the system which includes all the aspects of the organizations and covers each business process (Summer M. 2015).
The concept of ERP systems stands for the fact that system attempts to integrate all departments and functions across a whole organization into one single unit. The integrated computer system is based on a centralized common database which can serve all those different departments' particular needs. A common database management system (DBMS) allows every department of a company to store, update and retrieve information in a real-time. This feature enables information to be more reliable, accessible, and easily shared. Thus one of the key properties of ERP systems is that they are integrated into nature. They are also multi-functional or all-encompassing in scope, aiming to tackle a full range of business processes and activities throughout an organization including finance, accounting, sales, customer management, production, human resources, procurement, and project management. Being such complex in structure, ERP implementations projects also known as quite tricky ones, ERP implementations are different from traditional systems analysis and design projects (Davenport, T. H. 2000). Among the significant differences are the complexity of the project, impact on the organization, costs of ERP and period. As it has already been discussed, an ERP implementation will impact the entire organization, whereas a traditional project impacts often only a limited area of the business. Additionally, an ERP implementation most always requires personnel to learn new programming languages, tools and may also result in a shift in on organization's computing paradigm, from mainframe-based to network-centric. The cost of ERP projects is significantly higher than traditional projects, and failure can result in the demise of

the organization. According to Motiwalla and Thompson (2012), ERP architecture to the opposite of the other IT systems architecture is mainly defined by the vendors and not by the organizational strategy and business processes of a specific organization. In fact, each vendor-designer is trying to promote his own ERP system by claiming that its solution includes the optimal features: the best architecture, all the requisitions to ensure that business processes are correctly assimilated in its system logic. Here comes the main difference from the classic IT Software implementation and ERP system implementation. In classical software adoption, the architecture choice is made way before the software selection, in ERP system the architecture conception can only be done after choosing an ERP system to be implemented.

Furthermore, ERP systems are modular in structure and usable in any combination of modules. An organization can implement all the modules or a subset of them, it is possible to link to other support systems. Besides, ERP systems are customizable mega-packages of high complexity that require careful consideration before selection, implementation and use (Sammon & Adam, 2004).

Despite the significant benefits ERP software providers, organizations spend millions to buy the application, install it, train the staff, to maintain the software, update the system and ensure the support. Time and costs can be enormous both since ERP implementation involve a large number of stakeholders, and because the hidden costs during the ERP life cycle dramatically increase the total implementation. Therefore some companies have experienced considerable advantages while others have had to reduce their initiatives and accept minimum payoffs, or even relinquishing ERP implementation altogether (Soh, C., and Sia, S.K. 2004). Hence the main disadvantages of the ERP systems are recognized:

• Substantial investment. Implementation of ERP systems requires a substantial investment of money and internal resources and is fraught with technical and business risk (Hitt, L.M., Wu, D.J., et al. 2002). A typical ERP installation for a big production unit might have a total cost of several million dollars (and this is without taking into consideration cost of maintenance).

• Long implementation periods. ERP implementation takes a long time compared with the installation of other software applications, ranging from several months to years. A three to five year implementation period of ERP systems is fairly common in a large company (Panorama report 2016).

• Implementation difficulty and complexity. ERP implementations are also known to be unusually difficult, even when compared to other large-scale systems development projects. Part of this difficulty is due to the pervasiveness of the changes associated with ERP, the need for simultaneous process redesign of multiple functional areas within the firm, and the need to adapt processes to the capabilities of the software (Hitt, L.M., Wu, D.J., et al. 2002).

• Inflexibility and vendor dependence. Once an ERP system is established in a company, it is too difficult to change how the company works and is organized or to switch to another vendor.

• Overly hierarchical organizations ERP systems presume that information will be centrally monitored and that organizations have a well-defined hierarchical structure (Khaparde, M. V. 2012). Therefore, these systems will not match with organizations of empowerment or with employees as free agents. Additionally, re-engineering of business processes to fit the industry standard prescribed by the ERP system may lead to a loss of competitive advantage, and resistance

in sharing sensitive internal information between departments can reduce the effectiveness of the system.

To sum up the main characteristics of the ERP systems: many believe that this rapid adoption of ERP is due to the integrative nature of the system. ERP systems, coupled with rapid advances in computing technology, provide organizations with the ability to capture information from various locations and sources, and streamline the business process to increase efficiency and reduce costs. An enterprise system streamlines a company's data flows and provides management with direct access to a wealth of real-time operating information. For many companies, these benefits have translated into dramatic gains in productivity and speed.

2.2. RISKS IN IT

In business, risk plays a critical role. Almost every business decision requires executives and managers to balance risk and reward. Effectively managing the business risks is essential to an enterprise's success (Laisasikorn, K., Rampho, N. 2014). Though there is not a unique identification of a risk, it plays a vital role in decision maligning across organizations. So, we just accept that risk is everywhere, in each business and every aspect of our everyday life, and it should properly be managed.

For organizations, in general, a risk is the chance of something happening that may impact organizational and objectives. One of the most typical definitions of a risk has been given by COBIT researchers (2012). The statement identifies risk is a natural part of the business landscape, stating that risk in itself is not bad, is essential to progress, and failure is often a key part of learning. But we must learn to balance the possible negative consequences of risk against the potential benefits of its associated opportunity. Another typical definition is from National Institute of Standards and Technology, where risk has been described as a function of the likelihood of a given threat sources exercising a particular potential vulnerability, and the resulting impact of that adverse event on the organization (NIST, 2002).

To manage those risks organizations are applying risk management tools and techniques to manage a risk met while running their business. Risk management is a discipline that focuses on the identification, assessment, prevention, and treatment of risks (A Risk Management Standard by NIST, 2016). During last decades several risk standards have been proposed to classify and manage ERP related risk, among them are ones from the Project Management Institute (PMI), the National Institute of Standards and Technology (NIST), and the International Organization for Standardization (ISO).

As mentioned before, all the units of an organization are exposed to the risk and the information technologies are not an exception. In contemporary business more than ever IT plays a great role in organizing and running everyday activities of an enterprise. Ensuring that the strategic objectives of the business are not jeopardized by IT failures is a part of the business management process.

Risks associated with the information technology issues are increasingly evident on board agendas, as the impact on the business of an IT failure can have devastating consequences. The risk, however, is as much about failing to grasp an opportunity to use IT, for example, to improve competitive advantage or operating efficiency, as it is about doing something badly or incorrectly.

Though we do recognize IT risks as business risks, specifically, the business risk associated with the use, ownership, operation, involvement, influence and adoption of IT within an enterprise (IT

Governance Institute, COBIT 5, 2012). It consists of IT-related events that could potentially impact the business. It can occur with both uncertain frequency and magnitude, and it creates challenges in meeting strategic goals and objectives. The significance of an IT risk is based on the combination of impact (what effect the risk would have on the organization if it occurred) and likelihood (the probability of the risk occurring).

Although dealing with IT-related risk is not a new topic and risk taking is an everyday part of managing an enterprise, however, understanding the risks nature relating to the use of information technology is still a challenge in business reality. Most usually executives and managers of organizations do not have an idea of the full picture for the technical issues (Gino F. Pisano G. P. 2011). Technical complexity, misunderstanding of a risk can result in some significant risks being overlooked and others receiving possibly too much emphasis. Properly managing IT risks and exercising corresponding governance are therefore challenging experiences for business managers faced with the technical complexity of projects.

The scope of IT Risk involves two general categories of risk (European Journal of Operational Research, 2016):

1. Performance risk or operational risk, which identifies whether the IT group/project/imitation delivers the service levels needed and expected by the organization. Performance risk is a huge concept and includes almost all aspects of an organization. Each element connected with the use of IT and IS is a potential target. The failure of business due to the misuse of IT is a general example of exposure IT performance risk

2. Information security, it is known as a protection of data from misuse, loss or unauthorized access or change. More commonly, the categories of problems associated with information security are Confidentiality, Integrity, and Access. These can happen as a result of both malicious activities and regular day to day operations. This type of risk is related to information security in that it defines the context and definition for how data can be misused

A natural first question to pose when evaluating IT Risk is how one can measure the extent of the risk taken on by an organization given the current methods of operation. The main question is which is that “one perfect way” to manage all IT risk if such exists. It is known there is no such thing as a risk-free project, and so managers and executives are seeking for the best practices unique framework to manage IT-related risk (Liela E., Verdina G., Verdina A. 2012).

A project exists to bring about change, and with change comes uncertainty, and that means that risks have to be taken. The statement also reflects the current general idea about the main IT risk or security-related incidents, which are the most worrying threats. Indeed, these must not be underestimated, but a thorough examination of all risks by the business and its IT service providers would probably reveal a growing number of threats, such as errors, badly managed activities and poor communications, between links that exist between the customer and provider organizations themselves (IT Governance Institute, ISACA, 2012).

An increasing number of service providers and a limited supply of reliable risk-monitoring information is another challenge. Without question, effective management of these large IT projects is a new and unique challenge which requires the use of project management and control methods that have not been extensively used in the past. The sheer size of these projects requires centralized control, strict discipline and extensive monitoring of project outcomes.

The first factor of a successful management is understanding risks. There is no single accepted set of generic IT risks. In 2005, the IT Governance Institute proposed common listing of IT-related risk, which became popular mostly among organizations in North America, Asia/Pacific, and Europe. IT risk can be categorized in different ways.

- Investment or expense risk: the risk that the investment being made in IT fails to provide value for money or otherwise is excessive or wasted including consideration of the overall portfolio of IT investments.
- Access or security risk: the risk that confidential or otherwise sensitive information may be divulged or made available to those without appropriate authority. An aspect of this risk is privacy, the protection of personal data and information.
- Integrity risk: the risk that data cannot be relied on because they are unauthorized, incomplete or inaccurate.
- Relevance risk: the risk associated with not getting the right information to the right persons (processor, systems) at the right time to allow the right action to be taken.
- Availability risk: the risk of loss of service.
- Infrastructure risk: the risk that an organization does not have an information technology infrastructure and systems that can effectively support the current and future needs of the business in an efficient, cost-effective and well-controlled fashion (includes hardware, networks, software, people, and processes)
- Project ownership risk: the risk of IT projects failing to meet objectives through lack of accountability and commitment

Ultimately, though, risk taking is an essential element of business and success comes to those organizations that identify and manage risks most effectively, regular risk assessment is a key IT governance activity (National Computing Centre, ISACA 2012). However, to be effective, it should be driven by the business, which in particular should confirm the estimated impact. Interestingly, the Information Technology Governance Institute survey shows (2012) that in 80 % of organizations, IT management, rather than the business, is responsible for defining IT risk impact (business units are responsible for only 37% of the responding organizations, reflecting a lack of proper involvement in the risk assessment process by the business process owners). Executives should ensure that the business users define the business impact of an IT risk and agree and sign off on the risk position. In a critical review of risk, uncertainty and governance in IT projects emphasize the importance of considering people's fundamental epistemological assumptions about decision-maker cognition and decision-maker views on the nature of the risky or uncertain future (Sanderson, J. 2012).
Here comes a viewpoint that few texts give full consideration to the questions of how risk differs from uncertainty and which are the risks in ERP implementation projects and how they affect the business. That risks would be discussed in the next chapter.

2.3. RISK IN ERP

Enterprise Resource Planning (ERP) system introduction is a massive undertaking for an enterprise. Considering the number of an ERP implementation and the frequency of project´s failures, companies should have greater incentives to proactively identify and mitigate the various risks associated with the implementation process (according to Panorama consultation agency in 2015 21% of ERP projects implemented worldwide had a total failure).

As a result of the vast nature of the ERP implementation process, the related risks are commensurate with the complexity of the ERP system project. Risks range vary from broad to narrow and accordingly affects the outcome of the whole project (Craig, M. H. 2013). Even after project implementation some risks might still stay in there and cause issues in business processes after the go-live date when the ERP system is fully operational and available to end users.

Several research studies have investigated the ERP risks and have attempted to classify them in various ways. According to Mary Sumner (Journal of Information Technology, 2015), three main dimensions of risk in ERP implementation have been identified by, namely:

1. Organizational or project risks;
2. Business-related risks;
3. Technological risks.

The key is introducing ERP risks as a part of IT risks, though the recent studies, done by North American academic organizations (Information Technology Department of Poole College of Management at North Carolina State University, 2015), tend to present more detailed identification of the ERP risks, clearly separating them from IT. According to the latest data (2016) collected by Enterprise Risk Management Initiative and American PM Organization, based on practice of 441 organizations, the main risks met in ERP implementation projects are as follows:

- Poor project planning. Many organizations vastly underestimate the complexity and resources necessary to implement an ERP system. Therefore, they fail to accurately plan for unpredictable events that push back schedules, deliverables, and affect the quality of the project.It is exacerbated by the interdependencies associated with ERP. And one area of the ERP implementation process experiences a setback the others areas. As a result of this problem is being compounded, the project is not meeting timelines is the reason why many other risks of ERP implementation are influenced by scheduling and contingency risk. The modern project management, planning failure exists largely because of insufficient performance, measures, and practices in effective risk management part of project management employed methodology (Ganesh, L., Mehta, A. 2010). There appears to be literature offering prescriptions to Project Managers on how to plan risk in projects, rather than assess the relative effectiveness of those prescriptions (Kutsch, E., Hall, M. 2010). Thus, this is one of the high-risk areas that affect core strategic objectives. Aligning the ERP project goals with the original justification for the ERP project is one of the first steps in ensuring the success of a project. The strategic business issues to be addressed by the ERP system are usually identified when the justification for the project is developed, but they need to be reviewed and analyzed throughout the implementation to ensure that the business strategy and the project goals remain synchronized.

- Poor Project Team. A strong project team means team members who can bring the necessary experience, knowledge, dedication and a willingness to work together for the success of the project. The skills and key attributes required should first be identified, and then potential team members matched. These type of assessments are also being used to identify the desired skill gaps and weaknesses that project team has (Plant R., Willcocks L. 2007). Means that the project team feels a situation where events can occur that are outside its knowledge, and for which it cannot plan or prepare (Lenfle, S. 2011). The project team also includes managers, support is one of the most cited critical factors in ERP implementation (Soja, P. 2006). The skilled manager can drive the project to the success. Knowing about weaknesses in advance means they can be taken into account when planning the project, as re-assignments might be necessary.
- Security. As it already has been mentioned ERP systems dealing with all the processes of the organization. By introducing ERP solution into the business, project team works with the massive amount of data. Some of that data is sensitive and should never be exposed to the wrong people. Having this data in possession organization is experiencing a huge risk. Many organizations underestimate the importance of the effective planning and designing security actions to minimize costs related to redesigning.
- Project complexity. A common pitfall of management is to assume that ERP is solely an IT project. As it has been noted ERP systems are dealing with all the processes of the organization. Complex architecture and a high number of modules would result in a bigger data migration process. Data conversation and validation is a huge challenge of each ERP implementation. Also, more complex projects usually require many customizations and non-standard approaches, which is not easy to implement and support. This risk usually affects the deadline and the budget of the projects.

Besides the risks mentioned above, the same research from the University of North Carolina highlights communication and BBR risks as the most significant ones. In the current study, these two risk, as a part of the main topic, are being presented in the following two chapters.

2.4. BPR RISKS

The statement of Heraclitus claiming that in an ever-changing world, the only thing that does not change is change itself is still actual. This concurrence provokes the organizations to look for new methods and tools to become more effective, change and redesign the way of working. Business Processes Reengineering is a management theory that meets the requirements of these changes (Serban, A. L. 2015). Reengineering aims to modernize business processes and current activities that contribute to value creation in the organization, it is an important way of flexibility and social modernization.

In an era of rapidly changing technology, product/service business life cycles becoming shorter, and the concept of re-engineering is based on a new methodology, aiming to deliver continuous improvement to produce efficiently and effectively.

Despite the commonly agreed idea that BPR is important, it is also problematic and risky. In 1998 it was reported that around 30% of BPR projects were regarded as a success (Galliers, J. 1998).

According to Words Economic Research (2016), these during last 18 years this rate grew up to 40%. There are many reasons for the limited success of BPR. Many publications describe the situation before and after BPR but do not describe the path to reach the final situation (Habib M.N. 2013). Based on the literature we have highlighted several reasons:

- Management heterogeneity: BPR requires the coordination of people, processes, and technology. Top management sometimes fails to bring harmony and integration in the key components.
- Vague methodology: an adaptation of proper methodology is essential for the success of radical change process. According to Panorama Consulting organization, 46% of BPR failed organizations accepted that not the correct methodology was picked (2016)
- Cross-functional teams creating a problem: companies fail to build proper teams and fulfill the needs of cross-functional teams.
- Employee commitment: Changes might cause massive non-awareness among employees. This factor is tightly correlated with the communication risk factors.
- Focus on short-term objectives: companies expect that BPR will deliver results soon in short-term, but it is not the case. BPR is long-term process due to change enduring, and it takes much longer time than the Total Quality Management and value-chain process to provide results.
- Basic concept: companies that are following someone's footprints or best practices, without considering their organizational specifics and ignore or are not able to fulfill the prerequisites of BPR and results in failure.
- Lack of proper training: when BPR is implemented, most of the jobs and functions change. Therefore employee needs to gain the new skills, but the company pays less attention to providing training.

These all factors lay on the basis of BPR risk. The volume and number of this factors, of course, depends on how the BPR has been implemented, was it a massive case or some adjustments, was the mismatch gap between ERP system and currents business huge.

2.5. COMMUNICATION RISKS

A good communication process keeps stakeholders engaged, and project teams motivated, claims Graham Colborne, PMP, Manager of capital and projects at Barrick Australia-Pacific. Indeed, as it has already been presented managing transformation and change is one of the most difficult aspects of enterprise software implementations, but poor communication can be a root of BPR failure and rank even higher on the list of key issues that cause problems in ERP projects implementation. For these projects, communication challenges arise because new technology forces organizations to change their processes and job functions, a way of working and communicating. Another important factor is seeking communication from the right information source. Furthermore, communications and change management are a standard part of every well-run enterprise software deployment (PIM report 2013). In a complex and competitive business climate, organizations cannot afford to overlook this key element of project success and long-term profitability. Business research from Forbes (2014), shows that organizations are very aware of the

positive impact that effective communications has on projects, programs, and portfolios. However, what hasn't been clear until then is how much of an impact ineffective communications has on project outcomes and subsequent business success. PMI's 2013 Pulse of the ProfessionTM report revealed that US$135 million is at risk for every US$1 billion spent on a project. The same research claims that engaging upper management in the ERP implementation process is essential for risk mitigation. That is because management can more adequately identify, assess, and monitor risks. As management works with the ERP project team, project risk assessments are better aligned with ERP implementation milestones and therefore more effective as to gauging project progress.

Panorama consulting firm states that communications are often cited as a critical success factor in ERP implementations. In fact, according to the research done in 2015 by the same consulting agency, ineffective communications are often among the top contributors to ERP failures.

According to the American Project Manager´s Association only in North America, around 30% of ERP projects failure is a fault of poor communication. The same Association´s research completed in 2015 claims that every second Project Manager considers communication as a crucial factor.

Nowadays organizations are recognizing the value that a structured and explicit focus on effectively managing the risks can bring to the organization richer insights about opportunities and challenges on the horizon. Many of them are strengthening management's and the board's processes to identify, assess, manage, and monitor risks most likely would impact the organization's strategic success positively.

3. METHODOLOGY

3.1. INTRODUCTION

This chapter presents the research design and methodology established to address the research questions. As the literature review identified, the research would be based on the empirical investigation of the ERP project´s risks, mainly business processes re-engineering and communication risks would be discussed.
The research design process is outlined, followed by the research logic and practical examples. Following this, frameworks are developed to operationalize the key research variables: responsible for risk management in ERP implementation projects, communication chain elements, impacts of BPR and communication risks on Project´s budget and timeline. The data collection process is outlined and is described accordingly. With the variables already identified, the questionnaire design is then discussed and developed.

3.2. RESEARCH DESIGN

The research is being presented as a multistep process, where each step is a sequel to the previous one. The process has a step by step development tendency. The adopted research design process for this study is presented below:

- Identify research problem;
- Determine research propose;
- Develop theoretical framework;
- Establish research methodology;
- Apply methodology.

The research problem and purpose of the research already have been presented and supported in the previous chapters. It has been shown that there is a need to add a body of knowledge in ERP system implementation and risk management literature. It is therefore concluded that empirical research on the management of communication and business processes reengineering risks in ERP projects is considered a valuable contribution to knowledge.
These key processes comprised in the above-presented model are yet to be discussed:

- Theoretical framework and research logic;
- Research methodology;
- Application of methodology.

The theoretical framework underpinning this study has been discussed in the literature review, through propositions that recent developments in the area of information system implementation, both theoretical and practical actionable knowledge are needed (Kornkaew, A. 2012).
The logic of the research is abductive as this was determined to be the most appropriate approach to bring more insights in such a study in the context of risk, ERP systems, Business processes, as the researcher could also not conclusively rely on the initial premise being correct. A major weakness in deductive reasoning is the reliance on the initial premise being correct (Shuttleworth, M. 2012).

The abductive reasoning has been used to accomplish the case study. This form of logical inference was used to observe practical data with the application of the theory which accounts for the observation.

While selecting the research methodology, the main drive was to satisfy research objectives and seek answers to the raised questions. For the current study, as the main research methodology, analytical survey analysis with the combination of the case study has been applied. It has been considered that practical insights from the industry representatives would be valuable for the research. The method of gathering information was the questionnaire. The qualitative approach of it stresses the subjective aspects of ERP project´s implementation.

The main objective of the current study is to analyze the impact of BPR and communications risks on ERP projects with the intention to establish analytical data for an integrated risk management methodology to mitigate miscommunications and BPR. Besides, the practical goal of the current study is to develop a framework to measure BPR and Communication risks´ influence on ERP project´s failure. In order to accomplish the practical goal, the author intended to present quantitative measurements via a case study. The case is based on an implemented project, and the study attempts to model the risk relationship of ERP system components using fault tree analysis (FTA).

Researcher herself has practical experience in implementation of ERP projects. It has been decided to gather data from her peers working at enterprise applications provider organization UNIT4[2].

The qualitative elements that assist in providing further insights into the interpretation of the results include exploring the risk management approaches considered by research to be prescribed industry risk management standards and seeking perspectives from participants (project team members) regarding ERP projects and risk management. The purpose of this qualitative insight is to augment the quantitative data. After gathering data, it has been filtered and grouped. Each piece of grouped data addresses a specific research objective. Each set of the answers have been observed, and conclusions have been made accordingly, which are presented in Chapter 5.

3.3. QUESTIONNAIRE DESIGN

Survey questions were carefully designed with the main goal to gather data supporting the current research objectives to identify the impacts communication and BPR risks, provide detailed analysis on BPR that factors and events and finally identify controls used to mitigate studied risks. Taking into the consideration the specifications of the research topic, industry and targeted source of information, the main highlight was given to attaining a good response rate. A variety of techniques were used to achieve this. A webinar has been organized before delivering the questionnaire. During that open discussion, the author presented the topic and main objectives of the current study. There was also a note of the survey responses' importance. As the author personally knows the target audience, she had several discussions and meeting with the responders, providing more details on this research´s objectives and the importance of the topic. A well-written cover letter, succinct questions with simple and direct language and an offer to send a copy of the executive summary of the research findings were also taken care of. Confidentiality was very clearly stated, no names of customer organizations or questioner participants were mandatory to provide.

[2] http://www.unit4.com/

The questionnaire (see Appendix 1) contains four parts. Each of them targets to receive the specific piece of information, overall it has twenty-one questions.

- The first part of the questioner is a general, aiming to the information regarding the responder (the role in the project) and the project itself, this part provides a general information on key research defined in research methodology, which is project complexity, the sector of business EEP has been implemented and Project´s budget and timeline. With the regards of the main objective to this thesis, the author tries to find out if, in different ERP project are showing similar behavior.

- The second part of the survey is addressing to general information about risk management in the project. It seeks the answers on who is making the decisions regarding risk management and who was responsible for implementing it, among suggested variants, are ERP provider, Customer, internal project manager or another institution, which was suggested to be defined by the responder. The author is also asking to list the three main risk identified in the project. The answers to this question would describe the attitude of project's team members to the top risks.

- The third part of the questioner is about the first of the discussed risks: Business processes re-engineering. The answers provide information on which part of the organization's processes was covered by the ERP, did the implementation change during the project compared to the plan if the customer needed to re-design any of the current business processes. After, there is two open-ended question, seeking to the answers regarding Business processes re-engineering risk, describing the actions to manage those and if there were accurate.

- The last fourth part of the questioner and all about communication risks. Was it defined as a risk in the project plan and if so how. The open-ended questions are asking to describe actions which were taken to manage this risk and also the impact of it on the project. Responders also have been asked to point the weakest point of the communication chain.

Answers to these would provide insights on what is the general approach to managing those risks if they differ from one project to another and also what has been done in the case of a successful project which has been missed in others (if in among answers would be such).

3.4. Data Collection Process

The targeted source of the data was ERP project team. Members participating in different aspects and phases of the project implementation. The answers to the survey were provided by the senior project managers responsible for planning and implementing enterprise-wide/ERP systems, projects sponsors, and other key members.
The questionnaire has been provided via an on-line application. Participants got an electronic mail with the explicit cover letter inviting to participate in the survey. The invite has been sent over one hundred professionals working at the ERP application provider organization. Within all the invited were project managers, implementation consultants, customer relationship managers, quality

control specialists and support team members. The on-line survey was active over one month. Because the completion of the survey was voluntary, there is some potential for bias if that choosing to provide a response differ significantly from those who did not respond. The study's results may be limited to the extent that such bias exists. Furthermore, there is a high concentration of respondents representing different areas of ERP project´s implementation. Care was taken to minimize bias in the attempt to attain as representative a sample as possible. During this period researcher received 36 answers. However, a number were incomplete and following data validation the final sample size is 21 (N = 21). The significant part of the responses (64%) the author received during first three days after distributing the questioner. All the answers were regarding Projects implemented in North America (Canada and the USA) as the responders are based in North American subsidiary of the ERP provider organization. The geographical limitation of the data also limits the conclusions. Data is based on the personal experience of each participant. The questions regarding the effect of each risk on projects are based on project evaluation documentation, created by ERP provider and confirmed by Customer.

3.5. THEORETICAL FOUNDATION OF THE CASE STUDY

Based on the objectives the current research with the aim to deliver detailed analysis on business processes re-engineering and communication risks influence on ERP project´s, it has been decided to model a case study. The study attempts to model the risk relationship of ERP system components during the implementation process using fault tree analysis (FTA).

Originally developed in 1962 at Bell Laboratories and introduced in military and aerospace, over the decades (Stamatelatos, M. et al., 2002). It is a detailed deductive analysis that requires considerable system information and can also be a valuable design or diagnostic tool. The developed approach aims to help better understand how ERP system implementation fails and find out how BPR and communication risk factors are affecting the failure of the projects. Indeed, ERP implementation project is so complex and subject to so many dependencies and uncertainties that it is very difficult to establish a quantifiable relationship between each risk factor and the ultimate project outcome (Saumyendu, G., Skibniewski, M. J. 2010). An approach is proposed and developed using fault tree analysis to analyze ERP implementation failures both qualitatively and quantitatively. As mentioned FTA is a formal deductive procedure for determining combinations of component failures. It is a logical and diagrammatic method to depict the relationships between component states and the system state (Tanaka, H., Fan, L. T., Lai, F. S., Toguchi, K. 1983). In other words, the failure of a system, which is usually called a top event, can be considered as a result of component failures or faults that contribute to the system failure. When the top event is the failure of a project, other events (communication flow and business processes reengineering in this research) would be the failures or faults. Those events in the bottom of the constructed fault tree diagrams are called basic events. Each level of the tree lists the lower level events that are necessary to cause the event in the above level of the individual probabilities for all basic events are known, the probability of the top event can be calculated accordingly. However, it is often difficult or infeasible to know the exact probabilities of all basic events. Fault trees are depicted as a Boolean expression to demonstrate the combination of identified basic events sufficient to cause the undesired top event. It is assumed that the top event and all basic events are binary, that is, true of false (Bedford, T., Cooke, R. 2001). In the current study, it would be considered that each risk factor would impact the success of

individual components and, if the impact is sufficiently negative, may trigger their faults or failures, which eventually influence the project outcomes.
The method consists of three steps as follows:

1. Construction: construct the structure-function that indicates the state of the top events.
2. Development: develop the algebraic expression based on the effect rate of each component.
3. Reduction: simplify the expression of the structure function using basic laws of Boolean algebra (as the case study fault would be built on a small model, the author chose the simplified version of Boolean expression).

It is critical to define the failure modes for each level of components, that is, the manner that component failures are recognized. As the components are identified, the key to fault tree analysis is to understand how the fault of that collection leads to the failure of higher level and the project overall. The concept of failure mechanisms, failure modes, and failure effects are important in determining the proper interrelationships among different events in constructing a fault tree (Stamatelatos, M. et al., 2002). After an ERP system is reconstituted with the identified components whose failure modes are also defined, one can select proper logic gates to capture the relationships between different components and construct a fault tree. While it is often straightforward to select fault tree gates to represent the failure mechanisms between ERP components based on objective information, it is not unusual that opinions of key stakeholders such as management and key users are needed to finalize the selection gate. That is why the case study model has been designed based on the previously implemented project. All the information and data was collected from the project´s documentation and personal notes of the project manager and solution architect. Communication and BPR risk have been defined as the most frequently cited cause of the project´s failure, although other causes were defined too.
After the fault tree is constructed, both qualitative and quantitative evaluation can be performed. The results from both qualitative and quantitative evaluations of the fault tree make it possible to identify the ERP components and implementation activities that are of critical importance. As a result, decision-makers are enabled to take either corrective or preventive measures to ensure ERP implementation success.

4. RESULTS AND DISCUSSION

4.1. INTRODUCTION

This chapter presents the results and findings of the survey and the case study. The survey response and sample size are conveyed. Qualitative findings are then provided with respect to the main objectives of this research, showing a reasonably well-balanced sample for this study (with some possible bias, as discussed previously) and key trends of the presented data. Quantitative measurements are being presented via case study based on the empirical data and adopted research methodology.

As stated in Chapter 3.4 -Data Collection Process, the provided information describes experiences of twenty-one companies implementing enterprise resource planning. The studied cases were developed using structured questioner. The questions dealt with project characteristics (budget, duration, the level of the complexity, Business sector, project management issues (project sponsorship, project team make-up and a mix of internal/external team members), and implementation challenges. In addition to identifying the risk factors associated with technology, organizational fit, changes, communication, and people factors.

A positive response was received from various professionals of the ERP project implementation team. Participants showed interest in the current research and its findings which once more proves the need of knowledge adding to this subject and the research actuality.

4.2. SURVEY RESULTS

This section provides a univariate analysis of the sample data. Tables and graphs illustrate the results and trends, together with discussion.

The distribution of positions in the ERP project implementation team skewed towards project managers and implementation consultants. Almost the half of the response were from Implementation consultants, and more than 30% were from project managers or members of the project management team. The phenomenon is possibly due to the relatively high interest of the topic showed by this professionals.

4.2.1. Project´s characteristics

One of the key goals of the survey was to understand how different projects are behaving against studied risks. With the simple questions, included into the survey asking to provide the main characteristics of the analyzing projects such as duration, budget, the level of project´s complexity (1-low; 2- medium, 3-high) and type of the business. With this, it has been possible to identify profiles of the projects, and after filtering and grouping data, select cases with different profiles in order to generalize the findings.

Figure 4.2-1 Project budget and duration present the connection between budget and duration of the project. Note that budget does not include the cost of the ERP itself (license) as well as the cost of hardware, the maintenance and support after project´s closure and cost of organizations´ project team. It includes the billable time for a project manager (including external), solution architect,

implementation team (internal and external), costs for organizing workshops and training, and other direct and indirect costs regarding the project´s implementation.

As it is clearly stated by provided data the project´s duration is not always an indicator for the bigger budget. Among presented projects, the longest ones with the duration of 24 months have not the biggest budget, but they are in the range from 1,5 mln to 2 mln USD budget, which is comparable significant. Meanwhile, the one with the biggest budget had the implementation time of 18 months. Though, there is some correlation between these two variables as an evidence of the statement is the given data, with the observation that projects with less than one year implementation period, have a budget no more than one mln USD. The presented chart also provides information about the connection of the projects´ complexity. It is obvious that not always complex projects would take more time and investments. It has been asked to the participants to identify the level of complexity based on their personal subjective experience (author could not define any other more accurate way for finding this variable, as usually Project Plans and Business Requirements and Solution design documentations don't include this information). The definition of the complexity is based on the implemented modules, requirements, customizations. The chart is based on Rad, Yellow, Green (RAG) logic. The red bars were defined as the most complex ones, Yellow ones had medium complexity, and the green one was nominated as a low complexity project. As the data states, there is no project with the lowest complexity which would have longer implementation period and a compatible bigger budget. In contrast, there are projects with the higher complexity and comparable less budget and period or a two-year project exceeding the one million USD budget were medium complex, these facts supporting the hypothesis author stated, that longer period and significant investments are not defining the level of complexity of the project. Nevertheless, it is an obvious fact that there is some correlation between these three characteristics of the project.

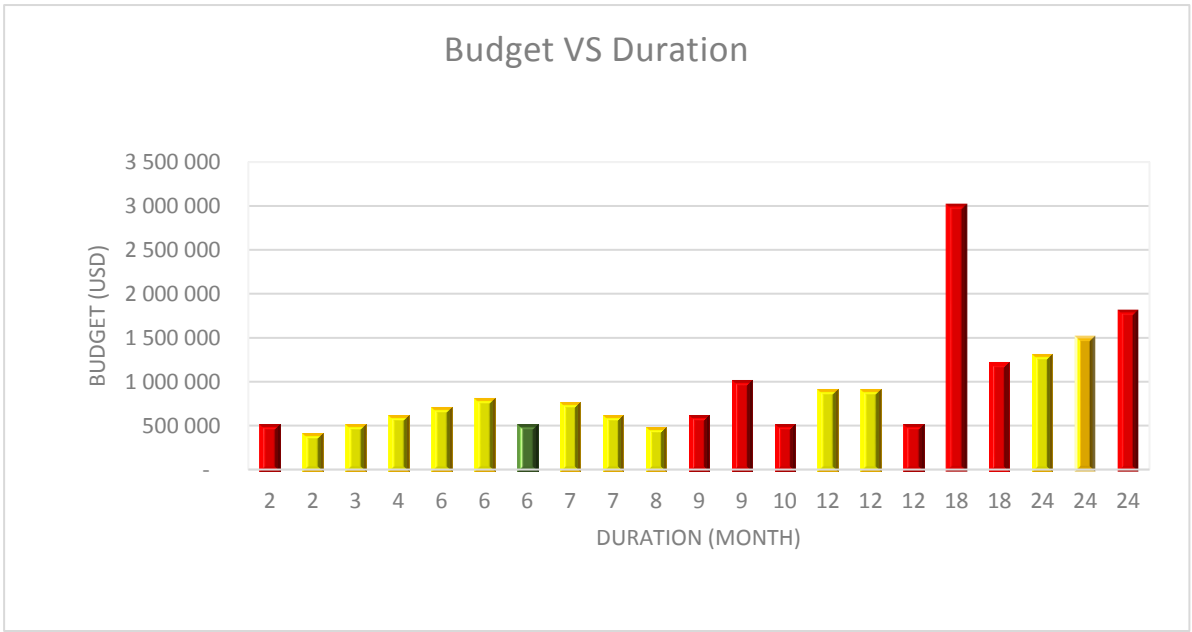

Figure 4.2-1 Project budget and duration

The next characteristic of the ERP implementation project is the sector of the business, the project was held. Below given pie chart (Figure 4.2-2 Business sector) provides information on the organizations´ type breakdown.
The majority of the presented projects were implemented in the Profit organizations and the NGOs (a bit more than seven and five responds for each organizational type accordingly).

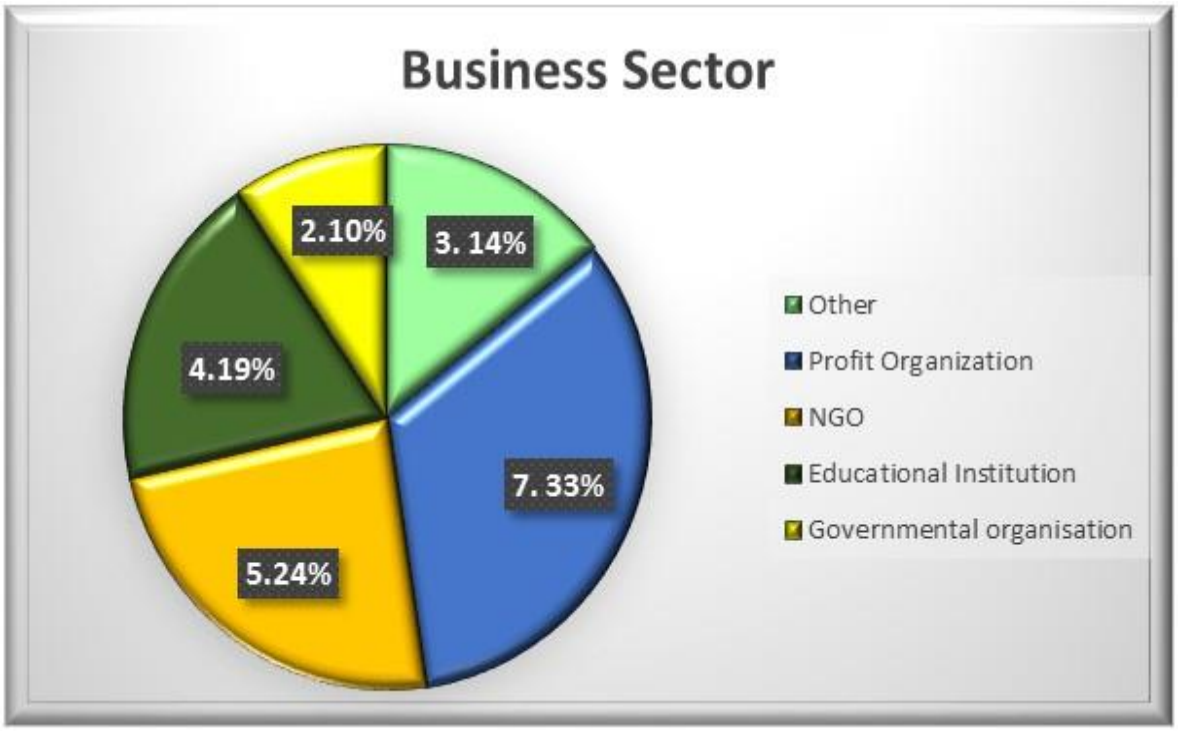

Figure 4.2-2 Business Sector

More than half projects implemented in the Profit organizations were identified as complex ones (4 of 7 Profit organization´s projects). The second type of the organization is NGO, five out of 21 projects were implemented in NGO.
The third organizations are educational institutions (four projects out of 21). These top three organizational types are the main targets of the UNIT4, especially in North American market. That is why 76% of analyzing projects were implemented in these markets.
From the presented data one can note that author presented different project´s profiles, to provide a more general overview and minimize the bias of the analysis.
After defining the profiles of the projects, author aimed to gather general information of project´s risk management.

4.2.2. Risk management

The next two questions were with the regards to general risk management. As it has been discussed previously, one of the main business risks of ERP projects is a commitment of the managers. It has been aimed to uncover who was responsible for risk management plan design and follow up and how were taken the decisions of risk management actions and the participation of the managers in the project. The follow Table 4.2-1 is a matrix of risk management performance and techniques. Among possible variants on who was the risk management performer was Customer, ERP Vendor, Both Parties and External manager. The table also presents basic follow up techniques of risk

management actions. The table is constructed based on the grouped data collected from survey responses.

Technique/performer	Customer	Vendor	Both parties	External project manager
Weekly plan	3	2	1	
Based on RM plan		3	2	1
Based on current status		2	2	1
based on Informal communication last minute decisions	2		2	

Table 4.2-1 Risk management techniques

As the data states, the most “not organized” performer is the Customer. In five Projects out of 21 customers was the responsible for risk management. None of the five had a risk management plan, risk follow up was taken place during weekly project team meetings (three projects), and decisions were made based on weekly reports. In two cases there was no follow up at all, customer, as a main responsible for risk management, would be informed of the rising risk in last minute, usually based on informal communication.

In a contrast of this approach in those cases, where project management was implemented by the vendor, the project team would follow the Risk Management Plan (3 projects out of 7). Making decisions according to the weekly plans and current status have been options with the similar experiences (two projects per each technique). As the data states Vendor, being already experience in implementation has never left the project´s risk management actions and the decision to the last minute. In those cases when both parties were responsible for the project management, the statistics showed not favor for any of the discussed techniques. Weekly plans were not as usual as the other cases, which might be explained by the difficulty to gather the management from the two organizations for a weekly meeting. Other three discussed techniques (Based on RM plan, based on current status and informal decisions) were equally popular, two projects per technique.

In the last case, when to be external project manager was responsible for the risk management, the risk was being monitored according to the RM plan and based on the current status (one project per a technique).

The next question of the survey was to identify top 3 risks of the project. It has been asked to provide the most highlighted risks. The data of this question has been filtered and grouped, presented in the figure 4.2-3 Top Risks.

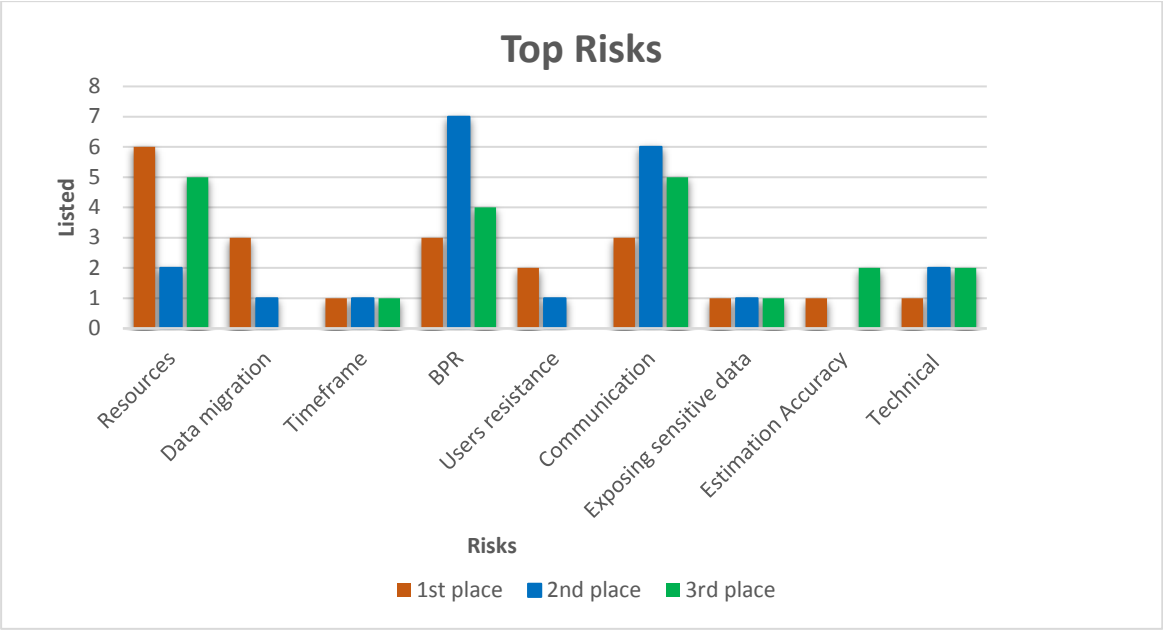

Figure 4.2-3 Top risks

The most popular risk in the first place is those connected with the human resources. This includes lack of skilled professionals, project team availability from the counterpart, commitment resources, stuff leave, top management engagement. As another common risk, in the first place responders mentioned data migration from the previous system. This risk has been separated from other technical risks as it is ERP specific and was specifically highlighted. Next ones with the similar records of popularity (in 3 projects ranked as the top first risk) are communication and Business processes re-engineering risks. This fact would be another prove of the actuality of the current research topic, as statistical data claims that the studied risk are being considered quite common in ERP projects. On the other hand as the most popular risk at the second place were BPR and communications risks (in 7 and six projects accordingly).

From 14 out of 21 analyzed projects, these risk would be considered one from the top 3, which clearly states that these risks are not project or business sector specific.

The other listed risks as users' resistance, data security, project´s estimation accuracy and technical risk have minor results in the provided data.

The next two sections of the survey specifically regarded the studied communication and BPR risks.

4.2.3. Business Process Re-engineering risk

This part of the survey was specifically regarding BPR risks. Participants provided more details on projects business processes, type of the changes and challenges during implementation. It also has been asked to identify the impact of BPR on the projects regarding timeframe and budget.

According to the examples, only two cases did not include BPR, all the other Projects were expecting changes in processes. These two Projects were comparably minor with less implementation time and budget. Samples also claimed that those projects requiring more changes were implemented mostly in Profit Organisations (3 out of 5 projects). The possible explanation of this phenomenon might be the fact that in order to maximize the efficiently of the organization, corporations are more willing to adopt changed and follow the new way of working.

According to the studied examples, in all cases where the ERP solution was “forcing” organizations to add, remove and re-design existing business processes at the same time, projects was covering more than a half of organization’s all processes, in all these cases the mentioned risk was considered in the project plan. This can be explained in a sense that organizations were aware of upcoming changes awaiting of possible risks.

In contrast to this, more than 30% (seven cases) of analyzed projects did not have BPR risk included in the project plan, where only in two out of seven projects no process changes happened (the same cases mentioned above), the other five included changes. We were focused especially on this projects, where business processes changed, but no risk prediction or management plan was prepared. The characteristics of that Projects introduces in the table 4.2-2- BPR in projects

Project	Business covered by ERP	Re-designed business process?	Implemented Changes
1	80%-100%	>20%	Redesigned
2	50%-80%	<20%	
3	50%-80%	<20%	
4	80%-100%	>20%	
5	20%-50%	NA	Eliminating processes

Table 4.2-2 Projects without identified BPR risk

In the majority of this projects (1-4) customer was responsible for the project plan creation and the risk management. Only in the last Project risk management actions of which were implemented by the ERP Vendor, had an RM plan. Later in this chapter, the impact of BPR risk on this projects would be discussed.

The other fourteen projects were also covering more than half of the customers’ business, presenting new processes and redesigning the existing ones. In all of this projects the BPR risks have been considered.

For all those projects which include BPR risk in the project plan it has been asked to provide feedback on how the risk has been considered in the plan, what was the plan of action looked like and if it was realistic compared to the actual implementation. From the fourteen projects including BPR risks in the project plan, the majority claimed that plan was poor, processes were misled and not well described, the action plan was missing and gaps were not identified. Only three projects included accurate risk identification and management descriptions. In none of this projects, risk had an impact on the budget, though two of them run after deadline with the slight difference. The other one had neglectable deflection compared to the project plan. This fact states that even with the listing of the risk is not enough, there is a need for accurate prediction of the behavior and action plan regarding the risk. A valuable finding was that in all of this projects BPR was one of the top risks and all the decisions regarding the risk were made by the steering committee.

Regarding those projects where BRR risk was not identified as a possible risk to occur and management actions were not included in the project plan, but projects covered changes in the Business processes, the risk impacted projects both in terms of timeline and budget. Results are presented in the Table 4.2-3 Impact of BPR.

N	Implemented Changes	How did the BPR impact the project? (time/budget)
1	Process Redesigned	Deadline was broken for two month
2		Deadline was broken for one month and budget exceeds 15% budget
3		Not significantly
4		Deadline was broken for three months and budget exceeds 25% budget
5	Process Cut	Deadline was broken for four months and budget exceeds 33% budget

Table 4.2-3 Impact of BPR risk

The author analyzed the unique projects with no significant impact of BPR (project N3). Putting together data from the previous questions, it was clear that this projects had a minor process change, and before starting implementation, Customer took care of the needed actions and as the project was minor (it was easy to monitor and follow up the project) there were no major deflections from the project plan. Another insight from the project manager responsible for this implementation was that in the other case, with larger and more complex scope, it would be highly probable that both budget and duration of the project would be negatively affected.

In other tree projects where the impact was noticeable on the both variables, BRP risk was not identified as one of in top. And compared to the rest of analyzing cases, these ones were minor, with maximum one million USD budget and less than one year of implementation time. Another similar characteristic is that in most of the cases Customer was responsible for designing risk management plan and taking decisions (Projects 2, 4, 5).

Author granted attention on two other projects with top deflections. In both cases project run out of the budget, so the team had to stop implementation and restart the process months after. This "failed" project included redesigned processes, and Customer was responsible for making decisions regarding the risk management, though the vendor introduced the project plan. There was a claim that in both cases documentation regarding this risk was poor and misled, with no specific action plan and with a high-level description of the processes, without any details. Both of the projects had one-year implementation time and the budget of 900 K USD.

Discussed data claimed that projects which required BPR least more and had a bigger budget than the ones without any process changes. According to the examined cases in those projects where all three actions (add, change and remove a process) required a BPR risk has been listed on top. The customer was the responsible for the risk management, in the majority of the cases where projects did not have BPR requirements and solutions documented, all those cases had a bigger negative impact on ERP implementation. On the other hand, all the comparable successful projects were managed by a steering committee. In the projects where risk identification and management descriptions were accurately presented, BPR risk had no impact on the project budget. The projects not having BPR as one of the top risks impacted the most in terms of time and budget.

4.2.4. Communication risk

Project Management Institute claimed that in every invested dollar 56 cents are at risk due to ineffective communication (Daryna B. 2013). In addition to this Panorama consulting firm presented statistics supporting the idea that 45% of ERP projects running over budget because of the poor communication (Panorama ERP report 2016).

And according to another statistics, almost one-third of all the IT projects fail due to the communication issues (Bonnie E. 2015). The same source claims that this is one of the most important areas to improve, though during last six years communication templates, software, and support tools have been produced as much as there were during the last four decades, still communication is remaining one of the biggest gaps in IT projects.

According to data collected for this study, from the twenty-one projects only twelve had documented and in advanced submitted communication plans. It was noticeable that even in big projects (with the budget over 1,5 mln USD and implementation time more than a year) this factor was missed. Communication plans were missing from all the types of projects managers (Customer, Vendor or External manager). Regardless the fact which party was responsible for the project plan introduction and risk management, this stage was skipped. Next significant fact is that from total seven profit organizations´ projects four didn´t plan communication in advance and contrast to this, all the projects implemented in governmental organizations, had structured communication plans. Below, the table 4.2-4 Projects without communication plan presents main characteristics of the projects without planned communication. Though, in some of the presented projects communication, has been included in the list of top three risks.

Project	Duration (month)	Budget (USD)	Business Sector	Project´s plan responsible	Top risk?
1	9	600 000	Profit Organization	Customer	No
2	18	3 000 000	Profit Organization	External PM	Yes
3	3	500 000	Profit Organization	Customer	No
4	12	900 000	Health Organisation	Vendor	Yes
5	2	400 000	NGO	Both	Yes
6	7	750 000	Profit Organization	Both	No
7	10	500 000	Educational institution	Vendor	No
8	24	1 800 000	NGO	External PM	Yes
9	6	500 000	NGO	Both	No

Table 4.2-4 Projects without communication plan

On the other hand, responders claimed that in those Project Plans, where communication risk has been included and taken into consideration, the description was very high level and action plan was missing. According to the survey results, from the total twelve projects with the documented communication plan, only three had an accurate description of the risk and action plan (note, data is based on the objective judgments and outlook of the participants).

Another key finding of the survey was regarding the weakest element of the communication chain. The figure 4.2.4 Communication chain elements present the percent of each respond regarding the communication chain elements being considered as the weakest one.

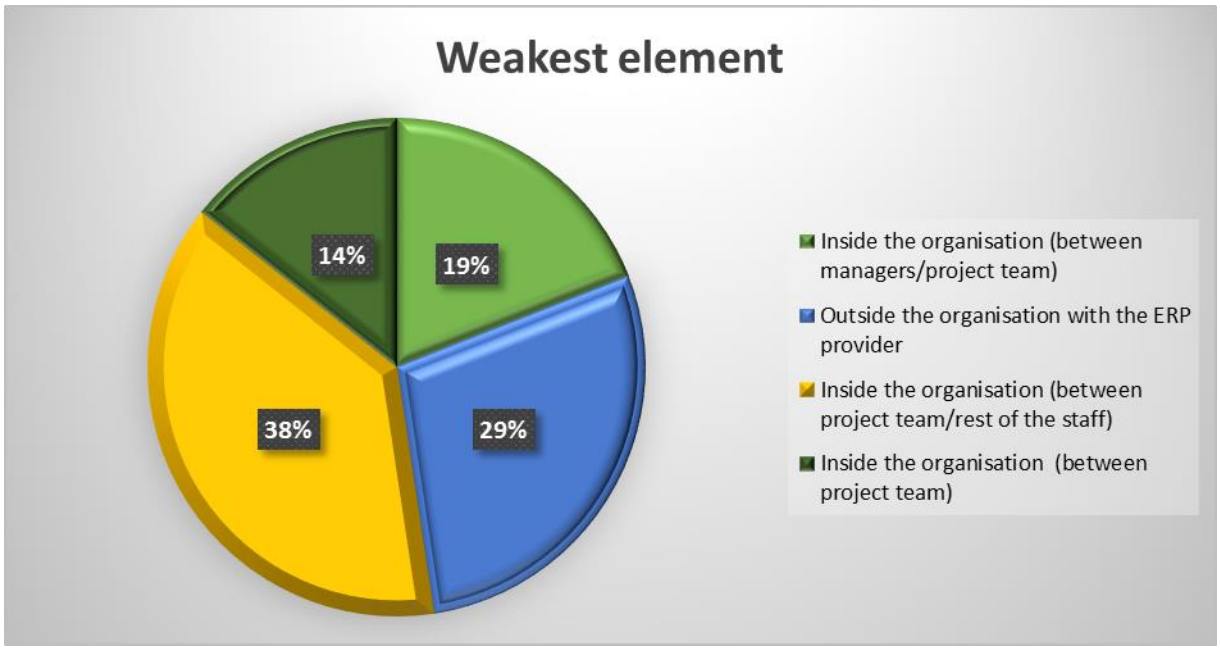

Figure 4.2-4 Communication chain elements

As the data obviously insists, 38 percent of the communication is failing inside the organization, between groups of people forming a project team and the end users. This element is significantly important as after the implementation project team is the key source of the knowledge and skills. A positive knowledge transfer climate may be a necessary condition to enable a high degree of knowledge transfer, so as to achieve a successful ERP implementation (Hung, W.-H., Ho, C.-F., Jou, J.-J., & Kung, K.-H. 2012). The second weakest element (29%) is communication between ERP provider and the Customer. A possible explanation of this might be not frequently and well-organised meetings, information transfer and difference of organizational culture (the author did not consider the language barrier as a factor, as all the projects were implemented in North America where English is a common language). Next, accordingly with 19% and 14% are running communications between the Project team and manager, and insight the Project team itself.

It has been considered significantly important to understand which element should be improved the first and what are the reasons for this behavior, are there any correlation between communication failure and project manager/decision maker origin.

The table 4.2-5 Communication in projects provides data on the weakest elements of studied projects' communication chain with the respect of Projects´ characteristics.

Project	Business Sector	Responsible for Risk Management	Responsible for Project Plan	Weakest element
1	Profit Organization	Customer	Customer´s PM	Outside the organization
2	Other	Customer	Customer´s PM	
3	NGO	Both parties	Vendor´s PM	
4	NGO	Vendor	Top manager(s)	
5	Other	Vendor	Vendor´s PM	
6	NGO	External	Steering Committee	
7	Other	Both parties	Customer´s PM	

8	NGO	Vendor	Customer´s PM	Managers and project team
9	Other	Customer	Customer´s PM	
10	Other	Customer	Top manager(s)	
11	Profit Organization	External	Steering Committee	Project team
12	Governmental organisation	Both parties	Steering Committee	
13	NGO	Both parties	Vendor´s PM	
14	Other	Vendor	Steering Committee	Project team and staff
15	Governmental organisation	Vendor	Steering Committee	
16	Profit Organization	Vendor	Vendor´s PM	
17	Profit Organization	Customer	Vendor´s PM	
18	Other	Vendor	Customer´s PM	
19	Profit Organization	Both parties	Steering Committee	
20	Profit Organization	Both parties	Steering Committee	
21	Profit Organization	Both parties	Customer´s PM	

Table 4.2-5 Communication in Projects

Provided data states that in those cases when the weakest element of communication chain is between Project team and the rest of the stuff, usually, Customer is not the one responsible for RM and Project plan. This supports the statement that if there is not an official responsibility of the Customer, she will not take care of the internal communication. On the other hand, in all the cases where the weakest element has been identified the one outside of the organization (Between Vendor and the Customer), all the parties fail to organize communication as there are examples of Customer, Vendor external PM being responsible for plan and manage the risks.

In the provided survey it has been asked to identify the influence of not efficient communication on the project. Among studied twenty-one project, there were only two projects not being impacted by communication risk regarding budget and timeline. In the rest of the cases, from the provided data, it is obvious that projects are mostly being delayed rather than run out of the budget. Even in those Projects where communication risk has been listed as one in the top, and Project plan designed with the respect of communication risk, in six projects, both duration, and the budget was affected. Even more, two of them run out of the budget more than 50%, and they stopped for a while, to be implemented later. The survey responds also claim that in both of this cases, there was not a clear communication plan defined, though the risk has nominated the top first.

In all seven Projects where communication risk impacted only Projects´ duration, it has been considered as one of the top 3 risks, and all of them had predefined communication plan. Still, the structure of the plan presented with the subjective judgment of the responders, usually being described not efficient one, but at least these projects had communicational structure. This fact also might be one of the reasons projects fitted into the budget.

In average delays due to this risk are from one to three month with the 25% of budget discrepancies. In those projects where the risk was identified during the planning phase the average delay time, was two and a half month with 22% budget discrepancy.

Overall the data analysis points that communication risk does not project specific. The impact and the volume of the risk depend on how it was planned and if the risk reduction actions as introducing communication plan have been performed beforehand. This statistics proves that ensuring

resource and project scheduling with the action and communication plan would help reduce the probabilities of failure. It is also significant for each element of communication chain to be controlled by the risk management responsible, especially outside the responsible´s environment, as that pointed to be the weakest one. According to data, the risk has impacted both on project timeline and budget, more frequently on duration.

4.2.5. Risk Management methodology

Another important question in the survey was regarding risk management techniques used during implementation. It has been asked to identify risk management methods and tools. Risk management methods used in these projects could be explained by the characteristics of the risks.
Collected data was grouped and filtered, it´s presented in the Table 4.2-6-Risk management techniques.

Project	Risk Management Techniques	
	BPR management	**Communication risk management**
1	Risk reduction	None
2	Risk reduction	Active monitoring and risk reduction
3	Risk reduction	None
4	Risk reduction	Risk reduction
5	Risk reduction	Risk reduction
6	Risk reduction	Risk reduction
7	Risk reduction	Risk reduction
8	Risk reduction	Active monitoring
9	Risk avoidance	Active monitoring
10	Risk avoidance	Active monitoring
11	None	Risk reduction
12	None	Active monitoring
13	None	Risk reduction
14	Active monitoring and risk reduction	Active monitoring
15	Active monitoring and risk reduction	Active monitoring
16	Active monitoring and risk reduction	Risk reduction
17	Active monitoring	Active monitoring
18	Active monitoring	Active monitoring and risk reduction
19	Active monitoring	Active monitoring and risk reduction
20	Active monitoring	Active monitoring
21	Active monitoring	None

Table 4.2-6 Risk management techniques

As data clearly states, the main risk management method in case of BPR risks was Risk reduction (in 8 out of 21 studied projects this technique has been used). Risk reduction was the most popular technique in ERP projects implementation. It is achieved either by decreasing the likelihood that the risk events would occur (risk prevention) or by mitigating the severity of losses should they happen (loss reduction), or both (Neal, H. 2010). The second run is Active monitoring, by active monitoring survey participants, would identify auditing actions by Project monitoring or follow-ups based on Project status reports. In those cases, risk management was

not proactive, but reactive, as project team would respond already raised the issue, while in a case of risk reduction, the actions were implemented before.
In three Projects no actions were taken at all, even though all these Projects included BPR. As a consequence of this were impacted both budget and duration of the Project. Two Projects followed the risk avoidance, as the projects have no Business processes changes. And the last three projects adopted the mixed technique of risk reduction and active monitoring, in all of these projects the steering committee was taking care of risk management and the projects were implemented in the profit organizations.
From the presented data one can conclude that the mixed technique in comparison with the others was the most efficient one as in all three cases only projects´ timeline was affected.
While analyzing communication risks, it is noticeable that Active monitoring was the most popular technique (used in eleven cases). This tool is being introduced in combination with others: meetings and risk reductions. In the case of arising issues, communication chain would be activated. In six Projects responsible followed risk reduction methods. Data states that in all of these cases the impact both on budget and project´s duration was the most significant up to 6-month delays with almost 60% budget discrepancy. And finally, in three cases no formal action has been taken to manage communication risk. All three were minor projects with the small indoor team, so the communication´s flow and management were pretty easy to organize, and no formal action have been implemented.
Overall, data claims that there is not a single method or a tool to effectively manage those risk. From all considered techniques the best is a combination of the pro and reactive actions.

4.3. CASE STUDY

The case study involves solicitation, collection, review and analysis of archived materials related to the ERP implementation project. The model is an implemented project. Data has been collected from the project´s documentation and personal notes of the project manager and the solution architect. Based on the analysis of Vose (2008) it has been suggested that each element should be discussed with the expert sufficiently so that experts can concentrate on estimating something that is tangible and easy to envisage. Based on all the data collected from the experts, the author created below presented model of a company and a project.

4.3.1. Description of the Company X

Company X is a City Council on the West coast in the United States. It has about 210 permanent employees. Due to its small size and concentration of the employees at one office, decision making in the company are normally centralized. The previous ERP system was not covering all the areas of processes, and it has been decided to adopt one more module of existing System which was in use already seven years, Human Resources management. Company X invested about 1.1 million US dollars in ERP system implementation project, slightly over the original budget. This was not the total cost of ERP ownership, as some costs including internal staff expenses seemed not to be counted. The company intended to rely solely upon its small in-house IT staff and the support from the selected ERP vendor, without resorting to the service

of external consultants. The team was devoted to the project on a full-time basis, which is composed of nearly 15 internal staff and about five from the ERP vendor organization, including one Project Manager, one Solution architect, one tester and two build consultants.

4.3.2. Project´s description

The responsible of Project plan and risk management plan was a project manager for the ERP provider organization, though all the decisions should be approved by Customer (Head of financial department). The company is also scheduled to complete the implementation within ten months, 3 of which would be spent on parallel operations.
According to the customer´s requirements, during the design phase, several new processes were added, some were changed, and one process was eliminated. It did not plan any software customization. The information flow inside the organization was quite slow, based on informal telephone calls and verbal communication. Only the reports and sanction would be presented via post or electronic mail. It has been planned to have a formal project team meeting at the beginning and the end of each phase. Also, each team would report to the stream lead, and twice a month a stream leads meeting would be organized. No communication plan rather than this has been introduced. Among the project´s outcomes, completion within budget was considered to be the most important to company X, followed by benefit realization and user satisfaction. Among the list of top risk factors, lack of top management support and involvement was considered as the one that has the most significant impact, on a second place was Business processes re-engendering, as Company X was adopting new processes in Human Resources module regarding employees' positions structure, followed by communication risk. These three considered being the critical factors that may impede the ERP system implementation from success. When asked about the aversion to different failures, failure to deliver expected benefits is ranked the highest one. On a second position, it was to meet system design requirements. The Customer would identify this project as a failed one if the requirements are not fully met and ERP solution will not provide all expected benefits.

4.3.3. Fault Tree Construction and Evaluation

The original project did not include risks assessment based on Fault tree methodology, all the calculation and findings are achieved by the author based on the Customer requirements and other data corresponding to the project. After analyzing the documentation and insights regarding the project, the author selected appropriate gates to construct a fault tree. The selection of gates depends on the requirements and expectations of the hosting organization (Limnios, N. 2007). In this case study, the project included only new HR module, as this one contained changed business processes. The other three modules (financials, logistics, and Projects Management) included minor changes which have been considered not significant for this study. Because HR module is essential for the city console, an OR gate is used under the top event; that is, the system cannot be successful when either of the submodules fails. In the lower levels, the definition of component failure differs, which is also reflected in the selection of Gates as both AND and OR gates are mixed. The fault tree diagram for the ERP system is depicted in Figure 4.3-1. In the figure, T represents the top event –

ERP system usage failure, E means intermediate events, and B stands for basic events. Table 4.3-1 Fault tree elements list the codes and their corresponding events in the fault tree. The last column of the table shows the communication and BPR risk impact on this module. The calculations are based on project´s risk management plan, where each risk includes risk assessment form. For example, B1 element in the table 4.3-1 Fault tree elements has no BPR risk, the element is impacted only by communication, and the impact has been identified as 50%. So the risk impact calculation would be probability x impact (20%x50%). In another example of Position register (B10), the calculation would be probability x impact of both elements, or 20% x (0.6+ 0.7) as it was a new process and this element has 60% of BPR risk impact and 70% of communication risk.

Code in Fault Tree	Failure Component	Probability of Occurrence	Impact Communication	Impact BPR	Risk impact (Calculation)
T	ERP System				
E1	Human resources				
E1.1	Personnel				
B1	Personnel registration	20%	50%		0.5x0.2=0.10
B2	Personnel transcripts	10%	60%		0.6x0.1=0.06
B3	Work schedules	10%	60%		0.6x0.1=0.06
E1.2	Absences				
B4	Absences	20%	70%		0.7x0.2=0.14
B5	Annual entitlements	10%	50%		0.5x0.1=0.05
B6	Personnel leave	10%	60%		0.6x0.1=0.06
E2	Payroll				
E2.1	Payroll processes				
B7	Payment agreements	15%	60%	70%	0.15x(0.6+0.7)=0.195
B8	Payments´ deductions	30%	80%	70%	0.3x(0.8+0.7)=0.21
B9	Payment transactions	30%	70%	70%	0.3x(0.7+0.7)=0.21
E2.2	Position administration				
B10	Position register	20%	60%	70%	0.2x(0.6+0.7)=0.14
B11	Position authorisation	30%	60%	70%	0.3x(0.6+0.7)=0.21

Table 4.3-1 Fault tree elements

After screening the components of HR module, a fault tree model could be constructed as displayed in Figure 4.3-1 Fault tree. It is simplified for the purpose of the study and could be substantially expanded to include many lower level events. The selection of the logical gates is based on the company‘s aversions to ERP system failures and the specification of this module and customer´s subjective understanding of success in ERP project.

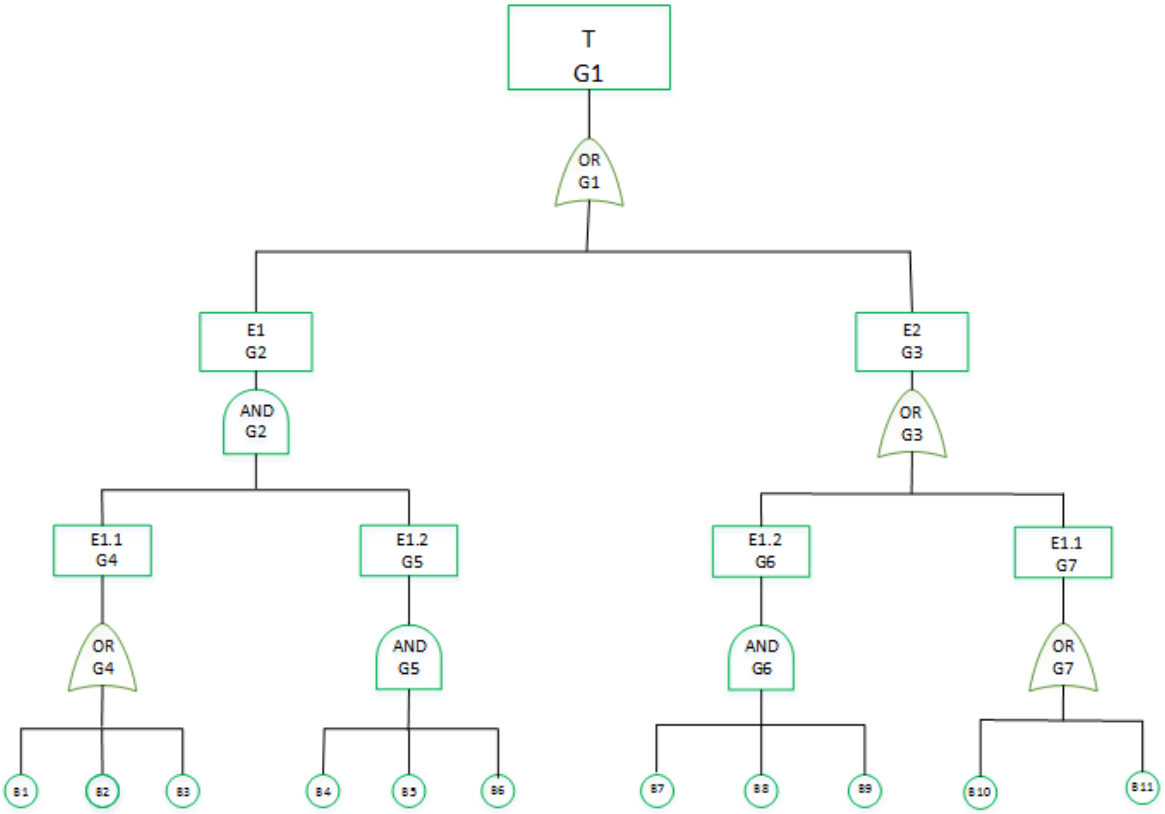

Figure 4.3-1 Fault tree

Based on the Boolean algebra, by using AND and OR laws where A and B input to AND gate result would be (AxB) and A and B inputs to OR gate would be (A+B) the probability of project to be failed or T event happen is

$$T=G1=G2+G3= (G4xG5) + (G6+G7) = (B1+B2+B3) \times (B4xB5xB6) + (B7xB8xB9) + (B10+B11) \quad (i)$$

By inserting the above-presented probabilities, the expression (i) would we shall reach the result of

$$T= (0.1+0.06+0.06) \times (0.14x0.05x0.06) + (0.195x0.21x0.21) + (0.14+0.21) = 0.35 \text{ or } 35\%$$

From the calculation above, one can find the failure probability due to these two analyzed risks was 35%. The case study confirms the idea that it is important to take care of the presented risks as the failure rate is quite significant. Another note is that the degree of risk is determined not only by the severity of negative impact but also the probability of occurrence, the finding that risk factors with severe negative impact may not have high probabilities to occur, has significant implications. It suggests that determining threats of various risk factors to cause ERP implementation failure, and subsequently devising risk response strategies, must consider both of the severity of impact and their probabilities. It is also important to note that these are not the only risks potentially affecting the project, though they were nominated as critical for the research proposes.

And in order to ensure all the expected benefits, including the once which were highlighted by Company X (integration within the whole organization, reduction or elimination of duplicate data

entry, and possible improvement of corporate performance with the introduction of the new module) all the relevant risk should be dealt.
It must be noted that the sample size is too small to generalize the findings, which is the limitation of the case study method.

5. CONCLUSIONS

In this chapter, the author presents the conclusion of the current thesis, here research questions are restated and discussed against the findings and the implications, the conclusion provides a summary of the research findings.
A post-positivist research philosophy, including both quantitative and qualitative elements, were adopted to accomplish this study, analytical survey analysis with the combination of the case study has been applied. An extensive review of the literature was undertaken, where the significance of the research was highlighted.
Overall the study addresses the research gap by providing empirical insight into the topic of Business processes re-engineering and Communication risks in ERP project's implementation. With the adopted approaches and collected data against each research objective, the author presented conclusions. The key purpose of the study is to provide detailed analysis and impacts of business processes re-engineering and communication risks on ERP projects research objectives were developed to guide this research.

1. Classify the responsible for BPR risk management considering project´s success.

To accomplish this objective, the author developed a set of survey questions expecting to gather data about of project manager, especially responsible for risk planning and management compared with the outcome of the projects. Among the possibilities on who was the risk management performer, were Customer, ERP Vendor, External Project Manager and Steering committee (including members of both parties). Based on the analyzed cases the most successful risk manager within these all was a steering committee, in all projects where BPR risk´s identification and management descriptions were accurately presented, BPR risk had less impact on projects timeline and budget. Contrarily, projects, where Customer managed BPR risk did not have well-documented risk description and management plan. With the lack of BPR requirements and solutions documentation, customer managed projects were the least successful. All the analyzed Projects implemented BPR, failed, where the customer has a project Manager. After steering committee the second successful risk manager was the External party, though the examples of externally managed projects were just two, the data claimed, that those projects also had comparably organized Risk management plan and actions. Next run Vendor with the less successful cases, though the projects managed by Vendor mere mostly well organized and documented. Projects success has been defined as the minimum discrepancy from project´s initial budget and timeline and maximum accomplishment of requirements.

2. Discover weakest element of communication chain and the impact of Communication risk on ERP project budget and timeline.

For the achievement of the second objective, the author analyzed data collected from the survey response regarding the communication risk, and it impacts on the project. After analyzing data, it has been concluded that communication risk is not a project specific. The impact and volume of the risk depend on how it has been planned. It is significant for each element of communication chain to be controlled by the risk management responsible, especially outside the risk manager´s environment. Data claimed that usually, the weakest element is the one not from the risk managers organization (environment). And according to the analyzed data, communication usually is failing

inside the organization, between the project team and staff. This element is significantly important as the main stakeholders are ERP systems end users. Therefore it is necessarily important to involve them into clear communication flow. It also has been found that Communication risk has impacted both on project timeline and budget, more frequently on duration (in average delays due to this risk are from one to three months). And the volume of impacts depends on risk reduction actions, project planning and management techniques. Projects with clear risk management plans, organized and well-described communication plans, were less impacted by communication risk.

3. Develop a framework to measure the probability of failure of ERP projects due to Business Processes Re-engineering and Communication risks.

For the performance of this objective, the author adopted Fault Tree Analysis approach and developed a tool assess the probability of Project´s failure due to BPR and Communication risk. Based on developed case study, risk assessment approach has been accomplished, which made it possible to tackle the risks in ERP system implementations. The formulation and implementation of the study primarily depend on the probabilities of risks, and on the connection between specific risk events, component failure. The form of critical ERP components and critical risk events in the obtained fault tree representations provides significant information about the vulnerabilities of the ERP implementation project. Since the probabilities of component failures or risk events are estimated under certain conditions, a natural choice to reduce such probabilities is to change these conditions, normally in the form of securing sufficient time and resources. As the objective required, the case study provides step-by-step instruction on fault tree construction, and risk assessment methodology. Though the described case did not suggest any risk management strategy, in particular, it gives tools to assess given risks and follow the most appropriate method to manage risks.

In summary, the research provides qualitative and quantitative analysis of BRR and communication risks on ERP projects implementations. The analyzed profiles of the 21 cases claimed that these risks are nor project or business specific. It also has been concluded that as a project manager, Customer fails most often, as statistically, she would not well document project´s requirements and solutions along with risk management actions plan. It has been noticed that well prepared and organized projects with the accurately described risks 'management actions have bigger chances to success, even if those projects would be more compels including more business processes. The evidence demonstrates communication is significantly important, and each element of the communication chain has a tremendous role in a project's success, as the impacts of communication risk on the projects are undeniable. Bad communication affects project both in terms of timeline and budget and in a case of not effective risk management this impacts might be tremendous, up to rolling the project to total failure. In this research, it has been found the quantitative impacts of BPR and communication risk on projects outcome. The studied case showed 35% of probability that these risks could direct the project into the failure. In addition to the main research conclusions, there were other quantitative and qualitative findings that are considered important towards progressing this research. There were discussed risk management techniques and methods used in analyzed projects. Concluding, the reported evidence one can sum up that there is not a single method or a tool to effectively manage analyzed risk. From all considered techniques the best is a combination of the pro and reactive actions.

6. LIMITATIONS AND RECOMMENDATIONS FOR FUTURE WORKS

The currents study aims to add value to the already existing knowledge in the area of risk management in Enterprise Resource Planning Projects. There are both theoretical and practical significance to continue the improvement of risk management in the high-stake strategic information system projects. Following the risk management approach developed in this research, further studies might be undertaken in the directions outlined below:

- The fault tree analysis method has been introduced to assess ERP implementation risks. It was focused to evaluate the effects of BPR and Communication risk on ERP projects failure. This approach can also be used to analyze and assess the other risks related to ERP implementation. However, depending on the variables with well-established measurement, the method must be further revised to incorporate.

- There are other findings and statistical data presented in the study, especially data gathered from the survey. It provides a qualitative analysis and outcomes of ERP projects implementation with the reference of BPR and communication risks. The statistical data further might be used for the discussed risk analysis and management.

This study thus fills a gap in the literature by establishing an approach to explore and evaluate the Business Processes Re-engineering and communication risks, by both qualitative and quantitative means. In addition, the majority of project risk management researchers so far are focused on cost and schedule risks and the research provides statistical data regarding the impact of the risks on Project´s timeline and budget. Since organizations are broadly adopting ERP systems, this study can become an addition to already accomplished researchers and knowledge and serve as a basis for further researches.
Although the risk management approach developed in this study is theoretically sound and practically useful, it has several limitations, which are discussed as follows:

- The geographical limitation of the presented data. As noted, all the data has been gathered from the Projects in North America. The business culture and all the subjective insights are related to the Western ERP systems implementation practice. Also, it must be noted that the sample size is too small to generalize the findings.
- Over-reliance on expert judgment. Survey responds and probability estimation are based on Subject matter expert's professional opinion. The collected data was crucial to obtain valid and useful results for the fault tree and accomplish qualitative analysis. However, there seems to an over-reliance on expert judgment especially to estimates demonstrated in the case studies. Because expert judgment might be biased, it is very important to make sure that the experts have sufficient knowledge and experiences to provide reliable insights and probability estimates, and the analysis is completed with vigor and consistency. As the implementation of ERP systems has seldom been standardized. Thus the conditions for the implementation of an ERP component may differ from the historical deployment of the same component, which makes the historical statistical information less relevant.
- Unfamiliarity to practitioners and need of training. As encountered in the case studies, the proposed approach is not familiar to practitioners. Thus the utilization of this approach for

the risk assessment should be preceded by adequate training about its principles and procedures.

The future studies are to be natural extensions to this research, they might become meaningful additions to the understanding and capability of decision makers and practitioners to successfully implement ERP systems and other types of strategic information systems in organizations.

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8. APPENDIX 1- QUESTIONNAIRE

1) What was your position in the project?

2) Provide a brief description of the project?

Duration (month)

Budget

Complexity (Low, medium, high)

3) When did the project start?
   - Less than a year ago
   - 1-2 years ago
   - More than two years ago

4) Type of customer business
   - NGO
   - Governmental organization
   - Profit organization
   - Other (please specify)

5) Who was the responsible for designing project´s Risk management plan?
   - Vendor
   - Customer
   - Both parties
   - None
   - Other (please specify)

6) Describe how the risks have been managed

7) Please list top 3 risks identified in the project

1st place

2nd place

3rd place

8) Who was making decisions regarding risk management?
   - Vendor´s project manager
   - Customers project manager
   - Top management
   - Project´s steering committee
   - Other (please specify)

9) Which percent of organization's business processes was covered by ERP?

   - Less than 20%
   - 20%-50%
   - 50%-80%
   - 80%-100%

10) Did the implementation process differed from the project plan
   - Yes, new processes have been added
   - Yes, processes have been cut
   - Yes, processes have been re-designed
   - No

11) Did the provided solution include new business processes?
   - Yes, more than 20% of covered processes
   - Yes, less than 20% of covered processes
   - No

12) Did the adopted ERP forced customer to change/redesign business process?
   - Yes, more than 20% of covered processes
   - Yes, less than 20% of covered processes
   - No

13) Were Business processes re-engineering (BPR) risk identified in Project Plan/ Risk Management plan?
   - Yes
   - No

14) Was BPR accurately introduced in the Project Plan (Provide your opinion)?

15) How did the BPR impact the project in terms of time and budget?

16) Describe the actions taken to manage BPR.

17) Was the communication risk identified in the Project Plan/Risk Management plan?
- Yes
- No

18) Was the communication risk accurately introduced in the Project Plan (Provide your opinion)?

19) Which element of communication chain was the weakest?
- Inside the organization (between project team)
- Inside the organization (between managers and project team)
- Inside the organization (between project team and rest of the staff)
- Outside the organization (communication with ERP provider)

20) How did the communication risk impact the project in terms of time and budget?

21) Describe the actions taken to manage communication risks?