ERP Implementation Projects: Risk Analysis and Management

Mirmigkos Konstantinos

SCHOOL OF SCIENCE AND TECHNOLOGY

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Student Name: Mirmigkos Konstantinos

SID: 1106180015

Supervisor: Assistant Professor Dr. Charisios Achillas

I hereby declare that the work submitted is mine and that where I have made use of another's work, I have attributed the source(s) according to the Regulations set in the Student's Handbook.

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Abstract

This dissertation was written as part of the MSc in Strategic Product Design at the International Hellenic University. The purpose of this study is to identify the critical risk factors during the implementation of an enterprise resource planning (ERP) system and further delineate the factors which have a negative impact on the outcome of such a project. ERP systems appear as the backbone of many business infrastructures, thereby providing essential information to managers to enhance decision making and create a competitive advantage for the organization. Despite the fact that the topic of ERP implementation is well researched, the success rate of such projects remains at low levels, justifying the importance of this research topic.

To fulfill the objective that was described above, this research is divided into two sections. The first section reviews the literature, and in particular, an investigation is conducted related to the risk factors during the implementation phase of an ERP system. A categorization is undertaken, which assists in tracking the most significant risk categories, and after further analysis is identified, the association with the most critical risk factors which can occur at all stages of the ERP implementation. In the second section of the research is designed a survey to identify the probability and the impact of the most significant risks that have been identified in the first part. A cross-sectional e-mail survey was sent to individuals with relevant experience in the implementation of ERP systems. To further analyze the collected data, there are also discussed the concepts of risk management and risk analysis, so that a comparison can be established between whatever is mentioned in the literature and what was stated by the survey respondents.

The results of this study provide evidence that factors associated with the project management and business processes are considered dangerous during the implementation stage, and at the same time, essential to the success of an ERP project. Risks correlated to senior management and executive commitment can also be deemed critical to the outcome of the project, as their probability of occurrence was very high in both literature and the survey. The analysis of the answers of the respondents offers some fresh insights into the current practice of ERP implementation.

Keywords: Risk Management, Enterprise Recourse Planning System, ERP, Implementation, Risk Factors

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Contents

Chapter 1: Introduction

In today's unpredictable business world, organizations face an exponential increase in data and quick changes in the economy. To cope with these modifications, organizations seek solutions to improve their capabilities to adjust their business processes to these fast changes to ensure their survival. ERP systems seem to be a solution to this dilemma, and they are becoming omnipresent in big corporations. Even small and medium-sized companies are considering implementing them to survive today's tough competitive world, and also in the hope of receiving competitive advantage through automation and information flow (Markkanen, 2018).

ERP projects are perceived as the most protracted, most expensive, and the most demanding IT-projects that an organization can undertake. According to Panorama Consulting's annual study, companies spend, on average, over a year on implementing an ERP system. Even the long time spend on ERP project does not guarantee success, but the exact opposite, an ERP project is more likely to fail than succeed (Markkanen, 2018). It is clear that an incomplete implementation of the ERP system generates can even lead to a certain reduction in business performance. For that reason, the failure of ERP system implementation has been a popular study subject studied in the past.

Research question

This research tries to identify the risk factors associated with the stage of implementation of an ERP software and analyze them to give a coherent picture of these factors as well as the areas within the organization, which could be harmful to the outcome of such a project.

The research methodology of data collection

To accomplish the objective that was outlined above, this research is divided into two parts. The first part is exploratory research and focuses on studying the problem and on reaching to an understanding of the different variables concerning the issue. The characteristic of the exploratory research is that it is flexible and can be modified when new data and insights related to the subject appear. This could be described as a funnel approach when asking a broad question, and the problem gets narrower as the research advances, and more information and data are revealed. As the question, "Which are the critical risk factors that influence the outcome of an ERP project?" is extensive, the exploratory research methodology is suitable to obtain more information on the subject and evaluate the risks from different angles. In the second part of the investigation, a survey is designed to identify the probability and the impact of the most significant risks.

Secondary data were used for data collection in the first part. ERP systems are an essential part of modern business, and therefore, they have been widely researched. With secondary data, this research identifies both raw and aggregated data, useful for further investigation to gain a better understanding and different perspectives on the research topic. The secondary data of this research have been obtained by conducting extended analysis and focusing on relevant literature, case studies, journals, and books published by a trusted party in recent decades. In the second part, as it was mentioned above, a questionnaire survey was designed, which was forwarded by e-mail to people with

relevant experience in the implementation of ERP systems. Extensive analysis regarding the questionnaire design and data collection process is conducted on the fourth chapter.

Chapter 2: Literature Review

This chapter is an introduction to the subject of research and, more specifically, refers to the concepts of the enterprise resource planning (ERP) systems, their evolution throughout the years, and their implementation phases, as they were outlined in the literature. A brief description is conducted related to the risk factors which were identified during the exploratory research, allowing us to detect the most critical risks, as they were described by various authors.

Overview of the ERP Systems

When an organization starts to grow, the intensity of management gets more complicated. The organizational information increases day by day, making it more challenging to retain proper management. In such a circumstance, it is beneficial to possess an information system that will be able to collect, save, and process that information faster and better than a group of people. Oxford dictionary (2018) defines ERP systems as an integrated computer system to manage all information and resources in relation to company's operations. An ERP is a valuable system to organize activities, decisions, and data flow across multiple different departments and functions within an organization. ERP applications affect all functional areas within the organization, such as accounting, human resources, finance, warehouse, sales, marketing, and production.

ERP systems record and collect all business activities, wherever they come from, meaning that information is available in real-time at all organization levels. They handle the majority of an enterprise's system requirements, and at the same time, provide integrated information solutions for better and more efficient management and planning of resources. By eliminating cross-functional coordination issues in the business process, the business is allowed to function in a coordinated way, guided by the information it receives from its environment. Thus, a firm implementing an ERP system can have benefits such as fast and accurate information gathering, quick decision making, low inventory cost, and general reduction of the overall costs, improved product quality, and, most importantly, improved interaction with its customers and suppliers.

The evolution of ERP system

The evolution of the currently known ERP system dates back to 1960. In the 1960s, when the primary source of competitiveness was cost, companies turned their attention to the computerized support to manage more efficiently their complex operations, minimize production cost, focus on high-volume production and manage efficiently large inventories. More specifically, the introduction of a computerized Reorder Point System (ROP) was enough to satisfy basic manufacturing planning and control. Thus, during this decade, the concept of Material Requirements Planning (MRP) came into life, which formed the basis of what later would be known as ERP.

The MRP system - the predecessor of Manufacturing Resource Planning (MRP II) and ERP - was developed to manage inventories in production, plan, and calculate when and how much material was needed to ensure smooth production flow for complex manufacturing processes. MRP was essential for implementing the materials planning concept in production management and control, but until the early 1970s, it was used only

by some US companies. Then, sales, capacity planning, and operations planning functionalities were affixed to the system, so it began to become a widely used tool for production. Gradually, in the 1980s, it expanded to the so-called MRP II or Manufacturing Resources Planning. MRP II emphasizes optimizing manufacturing processes by synchronizing materials with production requirements. With the shift in the scope of software applications, a change in manufacturing theory appeared as well, where competitive firms started to focus more on quality. MRP II systems had a few inherent drawbacks, such as limited focus to manufacturing activities, forecasting of mass production needs, and poor budgetary controls. The shortcomings of MRP II led to the development of a wholly integrated solution called Enterprise Resource Planning (ERP).

In the early 1990s, Gartner Inc., an American technology consulting company, introduced the term Enterprise Resource Planning (ERP). According to Gartner, the fundamentals of ERP are the same as with MRP II, while the main differences between ERP and MRP II are technological rather than functional, and are mainly evolving to client/server architecture, using graphical environments (GUIs). A key function of the ERP is the way users can design the application to make it easy to use. Additionally, ERP, as a set of business processes, is broader in scope and more effective in dealing with multiple business units, while at the same time, it is connected to all departments in a firm. All ERP packages started the same way down, including functions such as finance and accounting, logistics, database management, project management, and human resources management. However, in the 1990s, there were some functional innovations, such as the development of specialized software for specific functions. These included SCP (Supply Chain Planning), PDM (Product Data Management) and CRM (Customer Relationship Management).

ERP systems focused on back-office functions, but front office functions such as CRM, e-business systems, or supplier relationship management (SRM), became integrated by using Electronic Data Interchange (EDI) systems. The manufacturing process is extended to the entire supply chain across the firm, allowing both employees and their partners, such as customers and suppliers, to have real-time access to the system. ERP II was designed to integrate the firm's business processes to create a seamless information flow beginning with suppliers, going through the manufacturing process, and finally ending with the customer (Summer, 2005). Figure 1 shows the historical evolution of ERP systems in detail.

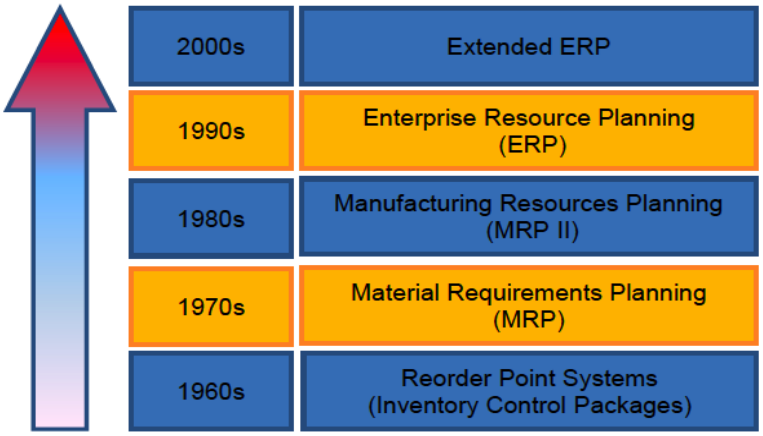


Figure 1. The historical evolution of ERP systems

The implementation life cycle model of ERP systems

The implementation process of ERP in any organization has several stages. It is starting with the project Initiation, and the next steps are related to Planning and Development. When these are completed, start the "Testing & Training" and "Review & Improve" phases before going live. The final level of the implementation life cycle is related to the Sustainability of the system. The details of the various stages are given below.

Phase 1: Initiation

The first phase of the implementation is related to the ERP project's approval within the organization. At the beginning must be created the needed documents, such as the project charter, which are going to address the objectives, tasks, goals, and deliverables of the project in each phase. Also, the business logic behind the implementation project, the investment details, the members of the first project team, their roles and responsibilities, should be clearly defined in a draft project plan. After the approval of the project charter by the project champion, the project manager can schedule a project kick-off meeting.

Phase 2: Planning

Planning (also referred to as the "Design" phase in the literature) is a critical stage in ERP implementation. Proper investigation and analysis must be undertaken within the organization regarding both its external and internal environments; the project team should select the appropriate ERP package for the organization, satisfying the current and future requirements. User requirements, best practice requirements, and Business Process Reengineering (BPR) requirements must be adequately defined. Gaps need to be analyzed to understand the current status and future position of the organization. Besides, analysis has to be performed concerning hardware and infrastructure specifications. Finally, a detailed project plan with schedules and cash flows should be adjusted.

Phase 3: Development

The purpose of the software development phase is to prepare the entire system for going live. Multiple activities are involved in this stage, such as completing any necessary customizations, developing user training, and importing data. Some organization processes might require to be heavily customized, and some may request the full adoption of the software vendor modules. Considerable effort is demanded to integrate existing applications and databases into new software and hardware systems. All developments require functionality testing to ensure the adequacy of ERP systems.

Phase 4: Testing and Training

One of the most significant reasons for ERP failure is that the installed products are not meeting the stakeholders' expectations. In the fourth step of the ERP implementation plan, end-user training begins. Structured training must be provided to the end-users so that their feedback will be useful for improvements. Until this point, the core implementation team has been developing and proving out the new processes. At this time, all other users are involved in the system and check the quality of the implemented product.

Phase 5: Feedback and Review

This phase is about the collection of feedback from various users. Reviewing their claims and making required changes is an essential part of this step. This also helps the project team with the evaluation of the deployment plan, so they will be able to finalize the deployment method.

Phase 6: Deployment and Go-Live

When all the pieces are in place, and the pilot runs have been completed, the project and implementation team will evaluate the project and make the final go or no-go decision, introducing the new ERP solution to the organization. Before going live, the final data must be loaded and validated. Post-implementation re-review shall be undertaken after they go live. Afterward, the project team can deliver the project to the support team. Prior to the initiation of the project termination procedure, the project team must be sure that employees have been appropriately trained, they are able to start working with the new system, and completely stop using the old one.

Phase 7: Sustain

This phase consists of additional activities like enhancements, adjustments, system configurations, and bug fixing. The support team should run continuous status reports validating that the correct procedures are being followed, ensuring that the organization will derive the maximum values from the ERP system. ERP implementation success should be measured in years–not days, weeks, or months. Anyone can be successful immediately after going live on a new solution. The true measure of achievement is how well the processes hold up over the years and withstand inevitable changes, such as employee turnover, business expansion and mergers, and other potentially unsettling events.

The complete ERP implementation life-cycle is illustrated in Figure 2. The efforts needed by the project team during various phases of the ERP implementation life cycle are depicted in Figure 3.

Figure 2. ERP implementation life cycle framework.

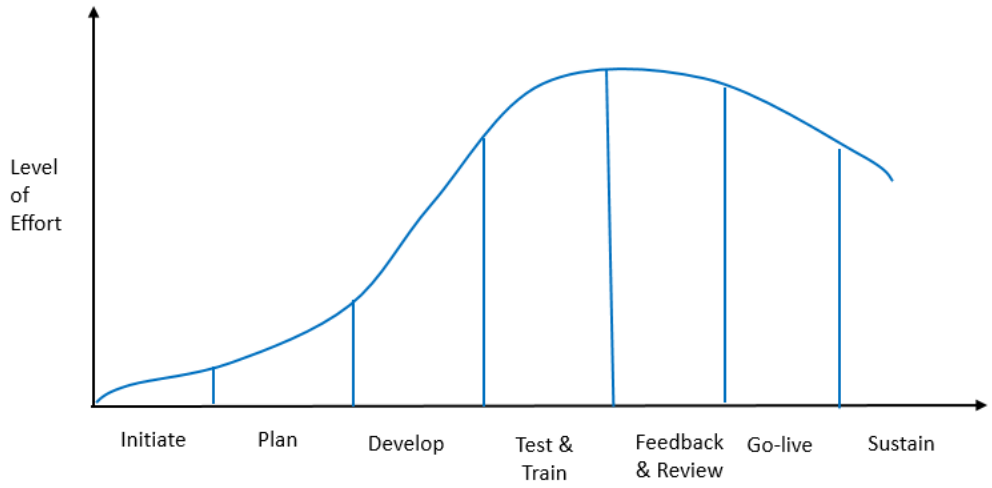


Figure 3. ERP implementation life cycle – effort graph.

Implementation risks - frequency analysis

With the help of the existing literature, this chapter investigates essential risk factor categories by examining studies that have investigated risk occurrences. This frequency analysis is trying to identify the most relevant risk factors by coupling different studies that have had similar methods and goals. The most critical risk factors which were classified in this section will be further examined in the next chapter.

Table 1. Risk factor categories in the literature

Risk Factor Categories	Number of instances in literature	Rank #
Business Process	31	1
Top (Senior) Management	30	2
Project management	24	3
Strategic Planning	22	4
Integration process	19	5
Consulting	18	6
Change Management	17	7
Stakeholders	17	8
Project team	15	9
Training	13	10
Complexity	13	11
User involvement	8	12
ERP Selection	8	13
Testing	8	14
Communications	8	15
Financial	5	16
Leadership	3	17
Priorities	3	18
Technology Planning	3	19

After reviewing 65 articles, 40 applicable items picked out to the research. In total, 19 different risk categories were formed, and the number of times different categories were mentioned in the relevant articles is displayed in Table 1.

The business process appears as the most cited risk factor. Business process re-engineering and re-design related to ERP are the areas with the most significant risks. Also, support from top management, the commitment, and involvement of the senior management are quite important during the ERP implementation process, and the potential risks from these sections could be quite harmful for the organization. Within the strategic planning category were included risks related to lack of strategic goals and inconsistencies related to business analysis.

Some of the studies explored in this paper may have used similar articles as a data source. Therefore, the result of the study may not be precisely accurate, but it offers a solid base for a literature study, even though it only examined 40 sources. It gives a strong indication that the business processes and the top management include multiple risks and have a vital role in the successful implementation of an ERP project. Figure 4 shows that business processes and top (or senior) management were cited in over than half of the literature reviewed. Project management and Strategic Planning were also listed often, and several authors, e.g., Muscatello and Chen, (2008) and Chakravorty, Dulaney, and Franza (2016), emphasized their meaning to ERP project outcome even though they might not have reached the highest frequency.

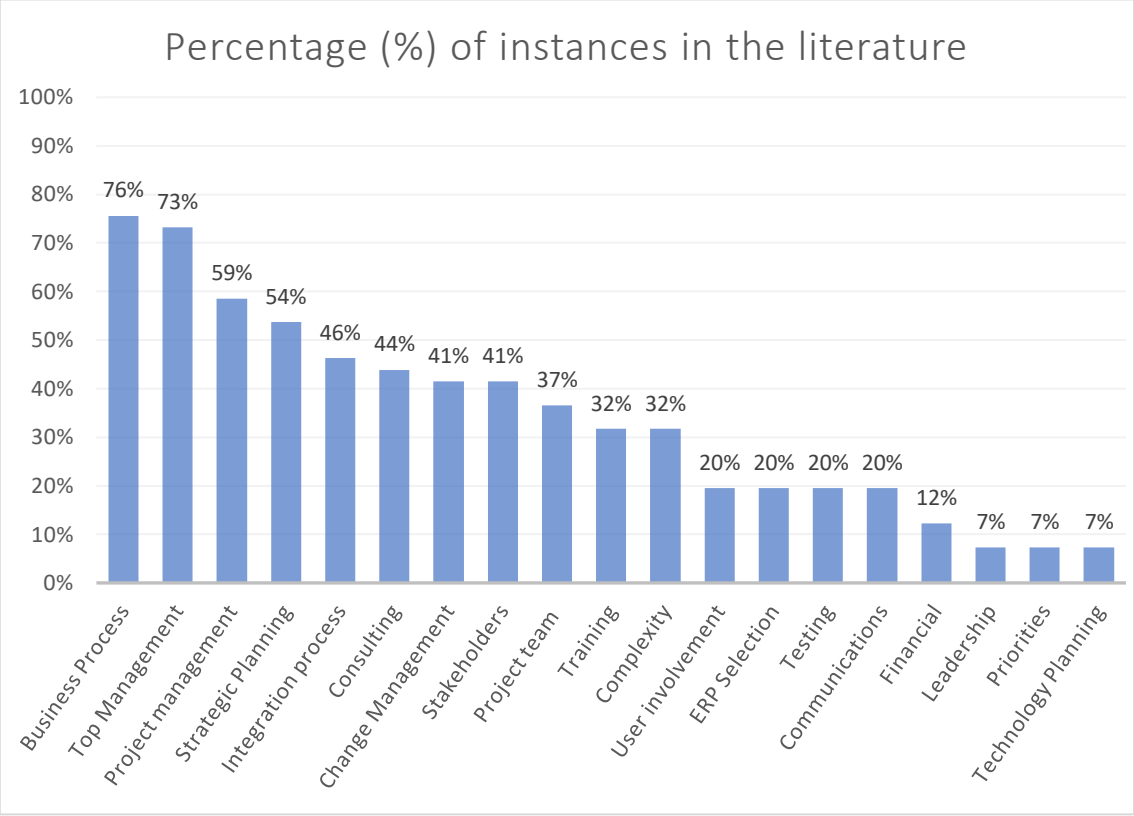


Figure 4. Risk factor instances in literature

Within the third chapter will be conducted an extensive analysis of the critical risk factors. In the fourth and fifth chapter, after analyzing the data of a survey, is going to be detected if the risk factors, as discussed earlier, have a significant impact on the overall outcome or ERP project, as it has according to the frequency analysis conducted in the literature review.

Chapter 3: Critical Risk Factors of ERP implementations

This segment identifies critical risk factors of ERP implementations based on a critical analysis of scholarly and managerial literature. Within each element, extended reference is conducted regarding the potential risks which may come up during the implementation phase of an ERP project. These sections include strategic initiatives, business process, executive commitment, project management, project team, project leadership, training, communications, and technical support.

Strategic Initiatives

Business success is not necessarily assured when the organization's internal functions are integrated prosperously, but the company can define its strategic goals clearly and whether the system would help to achieve these aims or not (Tarhini et al., 2015). The organization should be able to use the needed information to improve profitability, efficiency, and to drive to successful integration. The size and complexity of the efforts are influenced by whether the implementation is focused on the value chain, and therefore involves sales and distribution, materials management, and production planning modules, or whether it is focused on supporting the value chain, and therefore includes financials and human resources modules. The size and complexity of the implementation are further influenced by the strategy chosen to roll out the modules (Berchet and Habchi, 2005).

Furthermore, the implementing organization needs to prioritize having a clear understanding of the strategic goals for ERP system implementation and key people everywhere the organization needs to have a clear, compelling vision of the organization's operations about the implementation procedures (Reitsma, Hilletofth and Mukhtar, 2018). To measure the impact of the ERP system on the company's strategic goals, the organization should also have to develop performance measurements (Eckartz et al., 2009).

ERP projects require cross-functional teams who have different goals and for international projects in different cultures and languages (Hong and Kim, 2002). Therefore, conscious effort to manage the communication between the project group and a transparent business model of how the company should operate during the implementation phase are essential and allow firms to have strategic goals in place before undertaking an ERP implementation (Fui-Hoon Nah, Lee-Shang Lau and Kuang, 2001).

Additionally, throughout the ERP life cycle, a clear business plan and vision are required to steer the direction of the project. A business plan that outlines recommended strategic and tangible benefits, a timeline, and an analysis regarding the potential risks, costs, and the needed resources are critical. Eckartz et al. (2009) also stated in their article that a lack of guidelines could have a negative impact on achieving specific goals related to the information system. On the other hand, the existence of the before-mentioned plans allows the organization to maintain its focus on business benefits and provide the type of business intelligence that is required to achieve the expected business growth.

Risks related to the strategic initiatives are displayed in Table 2.

Table 2. Risks factors related to the Strategic Initiatives

No.	Risk Name	Description
1	The organization does not have clear strategic IT goals	The organization does not have proper strategic IT goals.
2	The ERP is not related to the business goals	The organization does not have a clear relationship between the ERP system and its strategic and business goals. Therefore, ERP does not support the organization's goals.
3	Lack of strategic guidelines regarding the IT planning	Written guidelines do not exist to structure the strategic IT planning in the organization.
4	Lack of continuous evaluation of the strategic goals	The organization does not analyze to measure the impact of ERP on the company's strategic objectives.
5	An analysis of risks, costs, and resources has not been conducted	An investigation regarding the potential risks, costs, and the necessary resources has not been coordinated before the implementation.

Business Process

Companies implementing ERP systems do not understand well the relationship between their existing business processes and how they are going to be affected by the ERP. As Jarrar, Mudimigh and Zairi (2000) mentioned in their journal, companies may discover that the software does not support one of their essential business processes. At that point, there are two options. They can either adjust the business processes to accommodate the software (Selvakumar, 2011), which means significant changes in long-established ways of doing business, or they can modify the software to fit the process, an action that is not suggested by the ERP vendors (Jarrar, Mudimigh and Zairi, 2000). So, significant BPR (Business Process Re-engineering) might be required if the ERP is to realize its full potential, and, as Marsh (2000) suggested, this procedure should focus on identifying and improving the efficiency of critical operations, on restructuring important non-value-adding activities, and to eliminate inefficient processes.

Reengineering should be undertaken to ensure that the strategic objectives mentioned in the previous section are feasible and to create a uniform response from all aspects of the business. Selvakumar (2011), and Scott and Vessey (2002), stated that during the design and implementation of new business processes, multiple company users should be involved, structuring a project team with common goals. Within the project team should be included both internal managers and staff members with experience of the old internal systems and vital knowledge of cross-functional business relationships. Improvement becomes a shared task when the whole team shares the same goals. The organizations should also have a Business Blueprint, so they would be able to recur on a detailed documentation with the required activities that have to be completed, and the deliverables of each phase of the implementation (Boltena and Gomez, 2012). Using reengineering

methods to develop a homogeneous vision representing the company's processes after the ERP implementation, a firm is more likely to reduce uncertainty and achieve success.
To achieve such results, change management is essential, starting at the project phase and continuing throughout the entire life cycle. As it was mentioned by Selvakumar (2011), many companies make assumptions of how implementation will affect the culture and the structure of their organization, while people are not ready or not willing to change. Cultural changes related either to the human cost element, or human psyche, do not occur magically and must be handled by all managers with the utmost care, responsibility, and precision, to control members' resistance to change (Aladwani, 2001).

Change Management

Change management involves effectively balancing authorities in favor of a change over forces of resistance. Organizations, groups, or individuals resist the changes that they either recognize as a threat or believe that will affect their habits negatively. Employees are unwilling to learn new techniques, or the IT department is reluctant to change due to attachment to its product. For the end-users, the implementation of an ERP system means that their computer-related tasks are going to be performed in a different computer environment (Jarrar, Mudimigh and Zairi, 2000).

Moreover, from an organizational point of view, the organization structure might be impacted while implementing an ERP solution for the firm. To achieve this structure transformation, change management techniques are required, involving changing of roles, procedures, and policies within the company (Tarhini et al., 2015). As (Motwani, Subramanian and Gopalakrishna, 2005) noted, an organizational culture where the employees share common values and goals and are receptive to change is most likely to succeed in ERP implementation. However, change management has to be structured within an overall Business Process Management methodology to achieve its goals (Jarrar, Mudimigh and Zairi, 2000). From the business perspective, the need for Business Process Reengineering (BPR) to fit system functionalities or already embedded business processes could be considered as the most critical effect of implementing ERP solutions (Tarhini et al., 2015).

As part of the change management efforts, formal education and training should be provided to users who are involved in the design and implementation of business processes and the ERP system, depending on the experience and level of each employee (Selvakumar, 2011). Project progress and succession are critically dependent on their team members. The main body of the project team should come from the company itself, but also some cross-functional and multi-skilled users are required in the implementation team to be involved in the design and implementation of new processes.

Moreover, user training, education, and support should be available and highly encouraged from the beginning of the project. The existence of a performance system to monitor the progress of ERP change management efforts is quite important (Aladwani, 2001), and change agents also play a significant role in the implementation to facilitate change and communication (Motwani, Subramanian and Gopalakrishna, 2005). The main approaches to achieve this, sought-after, people involvement, and commitment is an open environment, characterized by open communication and trust (Berchet and Habchi, 2005).

Risks related to the business processes and change management techniques are displayed in Table 3.

Table 3. Risks factors related to the Business Processes, and Change Management

No.	Risk Name	Description
6	Business processes are modified during the implementation of the ERP system	The organization does not understand well the relationship between their existing business processes and how they are going to be affected by the implementation of the new ERP system.
7	Leadership does not support BPR (Business Process Reengineering)	The administration is not willing to change part of the business processes to fit the ERP software.
8	Cross-functional members are not involved in BPR team	The business process redesign team does not include cross-functional and multi-skilled company users that have vital knowledge of the organization.
9	Employees reject changes	Employees do not share common values, goals, and are not receptive to change.
10	Employees do not understand how their actions impact the organization	Employees are not aware of how their actions impact the operations of other functions within the organization.

Executive Commitment

To ensure that the implementation is going to be performed successfully, top management is advised to look beyond the technical specifications of the project, to the organizational requirements. Senior management ought to perceive before the implementation efforts how the enterprise will be benefited from this procedure and acknowledge the need for long-term support throughout the implementation of this new technology (Sherer and Alter, 2004). The degree to which executives understand the specific benefits of an ERP system and encourage the implementation of new policies and ideas for the implementing ERP system is referred to as top management support (Woosang, 2011). Top management support, commitment, and leadership have been identified in the literature as the most important critical success factors in organizations embarking on ERP implementations, as they ensure a stable system rollout and smooth change management (Al-Mashari, Al-Mudimigh and Zairi, 2003).

Managers and executives believe that ERP systems help their organization achieve greater business benefits. However, when it comes to the design, implementation, and management of the ERP project, they seem to be mystified regarding what business needs the ERP system must meet and which decisions must be taken to be prepared for the implementation, maintenance and user support (Muscatello and Chen, 2008). They must be committed with their own involvement and willingness to allocate valuable resources to the implementation effort (Sherer and Alter, 2004). The needed people should be provided for the implementation and the appropriate amount of time to complete each task and each step of the application should be given to the project team (Jarrar, Mudimigh and Zairi, 2000). Depending on the changes in the schedule and the completion

of milestones and deliverables, senior management should also be able to legitimize new goals and objectives (Umar et al., 2016).

Multiple executives are having a hard time understanding that ERP implementation is not merely a package installation. As Al-Mashari, Al-Mudimigh and Zairi (2003) noted, ERP implementation is about people, not processes or technology. Unlike any other software scheme, an ERP system does not merely amendment employees' computer screens, as the previous generations of software packages did; it transforms the way they do their jobs and how the company does business (Muscatello and Chen, 2008). The organization goes through a significant transformation, and the management of this change has to be carefully planned from a strategic viewpoint as the implementation scheme is a long journey of fine-tuning, upgrading, and continual learning. Top management must completely understand the degree of the changes which will happen within the organization, support the new project and be comfortable with the fact that the decisions their planners address can have an intense impact on the entire organization's supply chain (Chen, 2001).

Risks related to the top management and executive commitment are displayed in Table 4.

Table 4. Risks factors related to the Top Management, and the Executive Commitment

No.	Risk Name	Description
11	Top Management is doubtful regarding ERP investment	Upper management is sure they wish to invest in an ERP system.
12	Top Management is unaware of the ERP system benefits	Senior management does not invest the time needed time to understand the benefits of the ERP system.
13	Top Management resist change and smooth system rollout	Senior management ensures smooth change management and system rollout.
14	Top Management undervalues the need for long term support for the ERP System	Senior management recognizes the need for long term ERP support for the implementation of new technology.
15	Top Management does not provide the required time and resources	Senior management is willing to allocate valuable resources and give the appropriate amount of time to the implementation effort.

Project Management and Project Team

The structure of the project team is essential and must convey the strong will to ensure the existence of representatives of various company functions (Motwani, Subramanian and Gopalakrishna, 2005). Within the project team should be included internal managers and staff that have vital knowledge of cross-functional business associations and a good understanding of the old internal systems (Boltena and Gomez, 2012). The project team must be able to adapt and deal with the different kinds of problems that occur during the implementation process. Well-designed strategic targets help to keep the project team on track throughout the entire implementation process (Al-Mashari, Al-Mudimigh and Zairi, 2003). As Muscatello and Chen (2008) mentioned, anyone who can access the

documentation of a large-scale ERP project will detect that unanticipated and late-breaking circumstances almost always shape the final product. Changes such as adding a new process, module, or department after the project has been scoped and started may lead to a "never-ending" project.

To prevent scope problems, the implementation teams should take a disciplined approach to project management, including a clear definition of objectives, development of a work plan, and establishment of a resource requirement plan (Huang et al., 2004). Furthermore, change control procedures must be clearly defined by the firms, and everyone must be held attached to them, or else, tension might be caused between the project team and those who do not get the changes they want. If adequate attention is not given to this manner, then the system implementation may take longer to be completed, and the resulting misalignment may inhibit the use and acceptance of the system (Holland and Light, 1999). Improvement can be achieved with more regular meetings and reviews, more precise scheduling of delivery for system modules, and other means for exercising tighter control over projects (Motwani et al., 2002). Most of all, organizations need to make sure that a project charter or mission statement exists, and appropriate project evaluation measures are included during ERP implementation (Huang et al., 2004). There should be proper follow up of all company requirements, and the specified demands should be mapped into the system. It is paramount to nail down the project specifications and have them documented and signed by the senior management and users. User acceptance testing and quality inspections to track the completion status of project milestones and deliverables are signs of proper project management (Umar et al., 2016).

The success of any project depends critically on its team members. The ERP project team needs to consist of the best people of the organization and within it, must be involved a project champion and members of different functions, (Reitsma, Hilletofth and Mukhtar, 2018) both with business and technical knowledge (Selvakumar, 2011). It is also essential to understand the need of external consultants when team members lack experience, or a part of expertise is missing internally. The organization should establish a knowledge transfer mechanism, by which, consultants' role is defined clearly, and their skills and expertise are acquired and transferred adequately to the IT members, so they will be able to solve any problems without the help of the external consultants after the completion of the installation. The reinforcement of a "team environment" is crucial to the overall progress of an ERP implementation. Members of the project team should be encouraged to support each other and strive toward common goals (Woosang, 2011). The project should also be divided into manageable sub-projects that can be worked on separately from the entire project (Motwani et al., 2002), and put more attention on the critical management aspects while managing the project (Boltena and Gomez, 2012).

Risks related to project management and the project team are displayed in Table 5.

Table 5. Risks factors related to the project management, and the project team

No.	Risk Name	Description
16	The project schedule and objectives are not defined clearly	During the ERP implementation, a comprehensive work plan, the project objectives, schedule, and tasks to be performed are not defined clearly.
17	Milestones are not used to measure the project completion rate	Project is not managed successfully since measurements and project milestones are not used to track the completion status of project tasks.
18	The project team mix is not well structured	Either project team is not composed of representatives of various company functions, or its members do not have the required experience and knowledge of the internal systems.
19	External consultants are not part of the project team	External consultants were not used when the team members did not have the required skills, experience, or technical knowledge.
20	Team members do not accept their roles and responsibilities	The responsibilities of project team members are not established and accepted by all members.

Project Leader

Proper project management of ERP-projects goes far beyond the technical implementation of the system. Centralized project management should exist to avoid excessive duplication efforts. To achieve that, the existence of a project leader (or project champion as it was suggested in the literature) for the ERP project is mandatory, so there will be a business perspective and commitment, that is going to drive consensus, supervise the entire life cycle of implementation (Jarrar, Mudimigh and Zairi, 2000) and vend the project throughout the organization (Sumner, 2000).

During the chartering phase, the project leader's expertise is crucial (Markus and Tanis, 2000) as he should be focused on the technicalities of rolling out the project and making the system working as one business unit while ignoring the interpretations and opinions of members out of this activity (Boonstra, 2006). As Motwani, Subramanian and Gopalakrishna (2005) stated, transformational leadership is critical to success as well. If the project leader does not know what to do at specific decision-making periods, it creates a significant problem. The leader must be experienced, be able to provide motivating guidance, continually strive to resolve conflicts, and manage resistance. In addition, the project leader should communicate adequately with the software company and identify the problems which might not be appropriately addressed (Yildirim and Kusakci, 2018). It is vital for the project champion to be accepted by the team, to be aware of the skills and knowledge of all team members and understand the circumstances where the assistance of external consultants, with expertise in areas where team members lack knowledge, is mandatory. All of these qualities help to address the organization's business needs better and orchestrate the allocation of resources (Reitsma, Hilletofth and Mukhtar, 2018).

The leader should be working closely with the team members to involve users with the implementation process and business process reengineering (BPR) from each department that is engaged in the implementation procedure. A research has been conducted by Selvakumar (2011) in a multinational manufacturing corporation, where it was observed that the organization selected several persons and a leader among themselves and called them power users. Power users were selected from the most knowledgeable and authoritative personnel and starting from the first days of the implementation, the needed training and education was provided to them, so they will be prepared for doing BPR and implementing ERP modules. An extensive analysis of users' training is going to be conducted in the next chapter.

Risks related to the project leader and project team are displayed in Table 6.

Table 6. Risks factors related to the project leader

No.	Risk Name	Description
21	ERP project leader is inexperienced and unaware of business goals.	The ERP Project leader is not experienced enough, and he is not able to address the organization's business needs.
22	The ERP project leader is unable to provide motivating leadership.	The ERP Project leader is not able to provide motivating leadership to the team.
23	EPR project leader is unable to resolve conflicts and manage resistance.	The ERP Project leader is not able to resolve conflicts and manage resistance.
24	ERP project leader is unaware of the team's skills and knowledge	The ERP project leader is not working closely with all the team members, and he is not aware of the team member's skills and knowledge. Therefore, he can not understand the cases where the expertise of external consultants is required.
25	ERP project leader is not accepted by all team members.	All team members do not commonly accept the ERP project leader and do not have trust in his skills and experience.

Training

ERP skills are in acute shortage attributable to the high demand for individuals with a decent understanding of business and ERP systems. The fundamental process changes brought about by the ERP implementation have made providing sufficient and timely training to project persons, managers, and users, a crucial requirement (Kumar, Maheshwari and Kumar, 2003). An evaluation regarding the training needs usually uncovers several education and skills deficiencies. Rectification of training deficiencies can be achieved in three possible ways: reassignment and outsourcing of some operations, or replacement of staff and hiring of new personnel with substantial knowledge in ERP systems, or education of managerial staff and key employees.

Before the user could use an ERP system efficiently, he needs to learn the business processes that were revised during the system implementation. As Sarkis and Sundarraj (2003) stated, in most cases, firms engage in two types of training: fundamental ERP systems education and technical training in the usage of the ERP software. The training should contain operation skills of the new system, procedural training, revised business process, and management change. The user training should not only focus on software procedures but also the management changes and the concepts of process-orientation.

Both managers (as users) and end-users must have a common perception of the purpose of the training, which is provided as part of the implementation process and will improve their confidence and understanding of the ERP system. Before managers design an appropriate education program, they must understand the difference between theirs and the end-users' perceptions about what is being proposed. The study of Seng Woo (2007), points out that users regard training as not essential, and they only attend because they get forced by senior managers. Not having a clear view of how training works for them does not allow them to understand the purpose of training (Reitsma, Hilletofth and Mukhtar, 2018). The most considerable differences between end-users and user-managers have a significant relation to the training mechanisms, the length, and detail of the training and the users' confidence level after the completion of the entire training program (Amoako-Gyampah, 2004).

There were many challenges in training the project team members and the users as well. Organizations might face difficulties in finding enough people from their functional groups to conduct the training. Training material (documentation) should be well-constructed, and the time period that the training sessions will be scheduled must be scrutinized. Formal education and training should be provided from the beginning of the implementation to the users who are involved in the business process redesign procedure (Sherer and Alter, 2004). In addition, a proper investigation should be carried out regarding the training costs, as they are often underestimated and might be multiple times greater than initially anticipated. Training users for a more extended period might be cost-prohibitive, or training users too early might lead to forgetfulness. Besides, other implementation activities might hinder an organization's ability to process the needed training (Amoako-Gyampah, 2004).

Risks related to the training are displayed in Table 7.

Table 7. Risks factors related to the training

No.	Risk Name	Description
26	User training needs are not appropriately identified	User training needs have not been adequately identified early in the implementation of the training materials, and training sessions have not been customized for each specific job.
27	Training content and length are not designed well	A formal education program has not been developed appropriately to meet the users' requirements regarding the purpose, duration, and detail of the training.
28	User training has been conducted either too early or too late	The organization does not have a clear view of which is the best time period for users to attend the training. Training users, either too early or too late, might lead to forgetfulness or education and skills deficiencies.
29	Users are not aware of the importance of their training	Users do not have a clear view of how important it is to attend and how they will benefit from their training.
30	User training stops after the end of the project	ERP training stops after the completion of the project. Therefore, education is not an ongoing procedure, and users are not able to refresh their skills.

Communications and Technical Support

As Kumar, Maheshwari and Kumar (2003) stated, managers have found ERP implementation projects as the most difficult system development projects. Within the "Business Process" section was declared that organizations fail to reconcile the technological imperatives of the enterprise systems with their business needs; the logic of the system may collide with the philosophy of business processes. People are naturally resistant to change, and it is not very easy to implement a system within an organization without the required cooperation.

Thus, upfront and ongoing communication to all organizational employees affected by the new ERP system is necessary to keep them informed of how the system can help them do their jobs better. Multiple researchers pointed out the effective management of the communications between project members and continuous support as critical success factors that lead to successful ERP implementation (Tarhini et al., 2015). A shared vision of the organization and the role of the new system and structures should be delivered to all employees. Effective communication tells everyone in advance what is happening, including the scope, objectives, and activities of the project (Berchet and Habchi, 2005). Also, maintaining an open information policy for the project and close communication and collaboration between external consultants and employees is a way to avoid the various communication failures and have a significant impact on the success of such a project.

To ensure success, organizations should run pilot testing and debugging of hardware and software (Sherer and Alter, 2004) by populating the technical system with organizational data before going live (Singla and Goyal, 2007). The literature recognizes that a common problem among ERP applications is to assume that the ERP implementation finishes after

the system goes live and disband the implementation project team after the system goes live (Ahmad and Pinedo Cuenca, 2013). The organizations should set-up a dedicated QA environment which will remain active and functional even after the completion of the implementation, to resolve any issues that may arise after the installation of the ERP system and ensure accuracy and preciseness of data.

Risks related to the communications and technical support are displayed in Table 8.

Table 8. Risks factors related to the communications, and the technical support

No.	Risk Name	Description
31	Miscommunication regarding the role of the I.S. to all or any staff members	All employees do not have a clear view of the new system's purpose and its relation to the organization's vision. There might also be a miscommunication regarding the scope, objectives, and tasks of the ERP implementation project.
32	Lack of culture with shared values and common aims	Lack of a common organizational culture has an impact on the implementation team's ability to share knowledge and perspectives across diverse functions during the implementation.
33	The organization does not promote open communications	The organization does not support Enterprise-wide open communication and information sharing policies.
34	Adequate testing has not been conducted before the ERP system goes live	Lack of proper testing could degrade the efficiency or effectiveness of the ERP system if the hardware and software contain serious bugs.
35	The project team is disbanded when the ERP system goes live	The implementation team should remain active and functional after the system goes live, and the IT staff should be able to resolve any issue that may arise after the installation of the ERP system.

Chapter 4: Research Approach

This chapter presents the methodology used to collect the required data, the limitations which were identified related to either the collection process or the people involved, as well as part of the findings that have been derived from the research.

Data Collection

The method which was selected for primary data collection was a questionnaire survey that has been emailed to the participants. Unlike the interviews, where the data is generally collected by means of note-taking on open-ended questions, questionnaires provide a predetermined set of questions that do not differ from person to person. It is a combination of closed questions and statements that can be cumulated to form the quantitative analysis. The participants can mark their answers on the basis of yes/no for direct questions, select one or more responses from multiple alternatives, or rank by Likert scale for statements. The creation of a structured questionnaire that examines the instances that were identified during the literature review will bring forth a well-rounded study with quantitative data analysis.

Questionnaires are a form of a written interview that can be carried out by mail, telephone, or face to face. It is a relatively cheaper way to obtain a considerable volume of data quickly and efficiently. The researcher does not have to be present at the time of data collection, which makes it time productive. A problem often recognized is that some respondents may lie in the questionnaire to look good. To avoid that, the questionnaire used in this research requests the respondents to be anonymous.

Research Scopes and Limitations

Since this research study is conducted using questionnaires based on the literature research instead of using a specific case study, the research is not limited to one particular industry or area. A survey was designed and forwarded to people who had completed at least one ERP implementation project in the past. The respondents were either members of the organization that were developing and selling the information system (vendors), or members of the organization which was interested in installing the system internally. In both cases, the respondents participated in the implementation phase either as members of the implementation team or were involved in this process to oversee and supervise.

The only limitation of the scope is that this research focuses on ERP projects in the private sector. The implementation may be different in the public sector. Even though both of them face similar obstacles and have identical goals, theories and thoughts in this research may not be directly applicable in the public sector as the public sector can be more complex and have procedures as well as legislation that does not apply to the private sector.

Another limitation may be that there is a lack of research material in unsuccessful projects because companies are reluctant to report and give details related to their failed projects (Chakravorty, Dulaney and Franza, 2016). Which is not surprising, as this type of sensitive information can give the public too much insider information and reveal the company's weaknesses. This could affect why application failure rates are steep as they

are, as companies are reluctant to provide researchers with data. The aforementioned may affect the outcome of the current research, as there may not be enough quantitative data to analyze and provide a solid answer to the thesis question. Also, as this analysis is conducted using an exploratory research approach, it does not focus on providing a definitive answer, but it is focusing on gathering more information on the main topic.

Questionnaire design

The questionnaire has been designed based on a thorough review of the secondary data, which have been collected from various sources, such as reference books, journals, articles, Internet, and discussed in Chapter 3: Critical Risk Factors of ERP Implementations. After generating **59** questionnaire items for the most significant risk factor categories, these items were distributed to the supervisor of the dissertation and an ERP consultant with previous experience in multiple implementation projects for an academic review, to indicate either to keep, delete, or modify each question. It took approximately one week to complete this analysis, which focused on assessing whether the data accurately measured the proposed categories according to the definitions provided and whether any additional areas had to be covered.

Based on the feedback from the reviewers, three sections have been merged, and two categories and **59** questions have been deleted. Thus, the size of the questionnaire has been significantly reduced, and better coherence was achieved. As a result, the final survey consisted of 43 questions and three components:

- Respondent profile section,
- Company profile section, and
- Risk factor section.

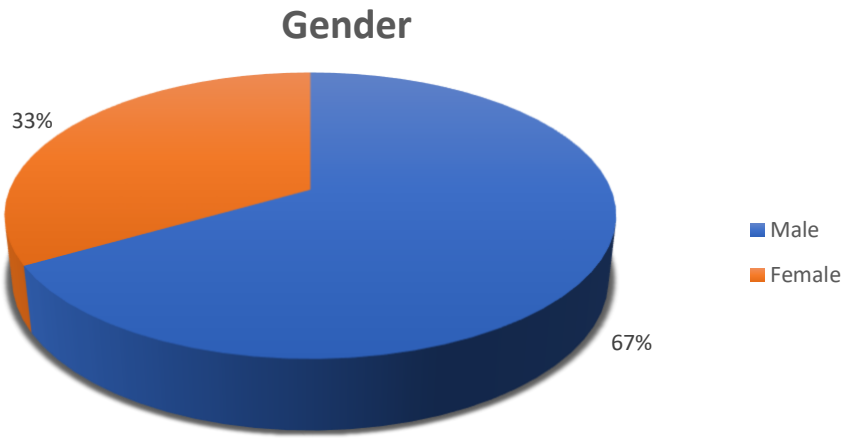
The first two parts consisted of four questions each one, while the third part had seven sub-sections with a total number of 35 items, 5 for each sub-section. In the Appendix are displayed:

- The risk register (Table 1), including all the risks which were examined with the survey,
- The survey questions related to the respondent and company profiles (Tables 2 and 3),
- The survey questions related to the risk factors (Tables 4 to 10), including also the mean and standard deviation values, and
- the items which were excluded from the survey (Table 11) after the completion of the review.

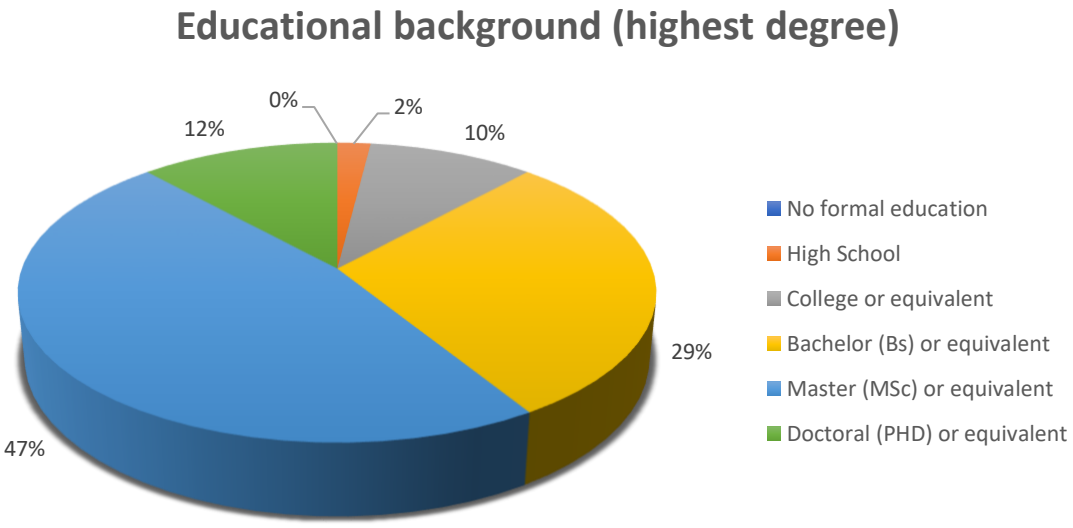
The survey was sent through email to approximately 200 employees. The selection criteria for this sample were related to the background of each respondent, his current job position, and his experience on projects related to the implementation of ERP systems. The respondents were asked to categorize each item using a 5-point Likert scale with a score of 1 labeled "This risk was not addressed", and a score of 5 labeled "Very High Risk Level". Using these labels allows us to detect both the level of the risk that was addressed during the implementation, but also provides us the probability level. Three weeks after the initial mailing, 51 questionnaires have been submitted to the online survey, resulting in a response rate of 25.5%.

Sample Demographics - Respondent and Firm Profiles

The target group of the survey in this study was people who had participated in ERP implementation projects. A web questionnaire was constructed, and approximately 200 members of the Greek market were invited to engage with the research. The sample was chosen because these members had expertise in the implementation of at least one ERP project. All the respondents are assured that their responses would be kept confidential. A total of 51 questionnaires were returned, 34 of which were answered by men (67%) and 17 by women (33%).

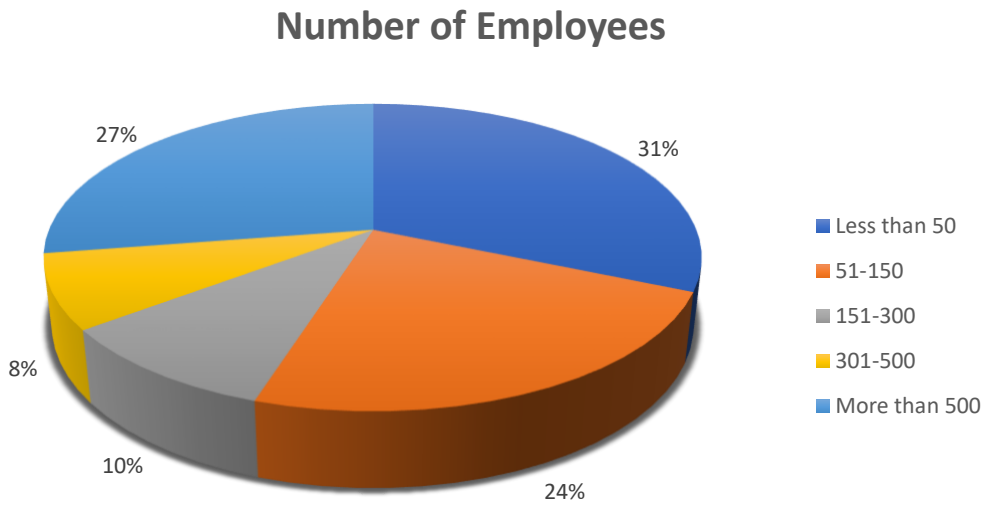


The respondents were asked to identify their positions within the firm, their educational background, age, and gender. The profile of the final sample of 51 questionnaires included upper-level executives (16%), middle-level managers and consultants (59%), junior-level consultants and employees (23%), and external consultants (2%). Almost half of the respondents had an educational background of a Masters (MSc) or equivalent degree (47%).

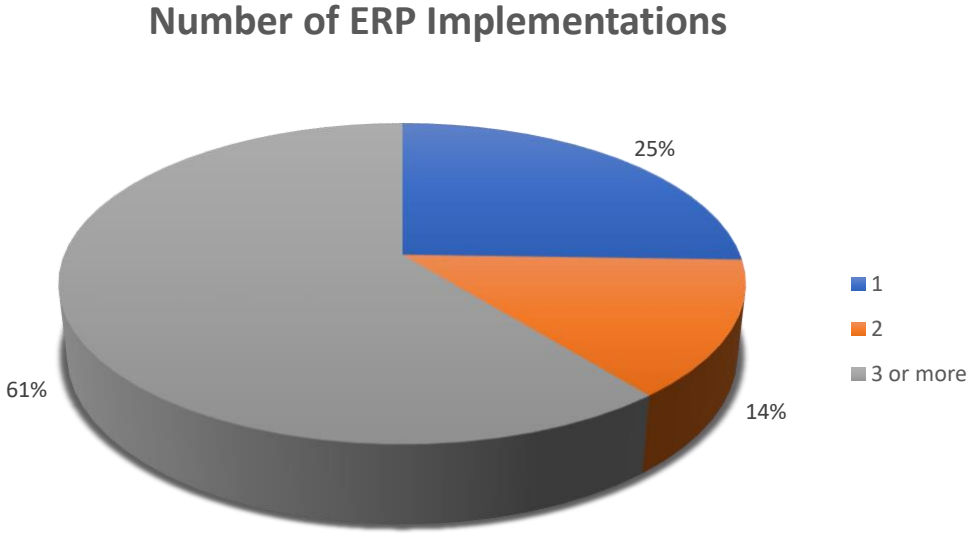


In addition, information related to the profile of the organization was required, such as the size of the organization, the number of years the organization operates, and the number of ERP implementations that have been conducted within the firm. Almost half

of the firms had been in business for a time period between 15 and 30 years (43%), while at the same, in the question related to the number of employees within the company, it has been observed that prices were evenly distributed across all available choices, with options a. "Less than 50" (31%) and d. "More than 500" (22%), having the most responses.



The vast majority of the respondents had experience from three or more implementations of similar systems (61%), some of them were working on their first ERP system implementation (25%), with some having an experience of two implementations (14%). Furthermore, more than 73% of respondents had worked with more than one ERP system, as their organizations were actively using multiple systems in the same facility.



A summary of the demographic characteristics for the sample are presented in Appendix, in Tables 2 and 3, respectively.

Chapter 5: Risk Management

All business activities involve numerous risks, especially when taking in a new investment project like ERP systems implementation. No company can act without accepting any risk, and the expected revenue from the business must be related to the risks involved. The task of risk management in the ERP project is to identify the potential risks of ERP projects concerning the company's goals and to eliminate or minimize them. The risk is defined as a result of uncertainty on the company's primary objectives, and impact is considered to be a negative deviation from expected. These deviations can only be managed if they are identified and understood in advance. Hence, this thesis uses the basics of risk management, where the first step is to identify the risk and evaluate the risk.

Usually, in risk management, the probability of the risk is calculated. The current thesis does not assess any particular case study provided by an organization. Therefore, the risk analysis is based on the literature review, and the probability calculation will be executed with the data which were collected through the online survey.

Risk analysis

Risk analysis of an information system is the process of identifying and evaluating the security risks that the system introduces into the operations of an organization. With this process are also defined the costs of a potential disaster that might be incurred by a possible problem. This determines the degree of risk of the information system and the security requirements that exist. In addition, it is also calculated the cost of preventing any damage, so that risks can be handled appropriately on a rational basis.

Risk is assessed by identifying threats and vulnerabilities, then identifying the probabilities and impacts of each risk. In a risk analysis, both the negative and the positive results of an event can be analyzed. Within the current chapter will be conducted a review of the risk factors which were identified in the literature. Most of them cause issues and have a negative impact on the completion of the ERP implementation projects, and therefore the operation of the organization. There are two types of risk analysis, which will be discussed in the following sections, qualitative analysis, and quantitative analysis. According to PMI, quantitative analysis, together with qualitative analysis, can yield the best possible results on the risks that may arise in a project or activity.

Qualitative Data Analysis

Qualitative research involves gathering a great deal of information about a small number of people and trying to develop a conceptual framework for the topic, e.g., a categorization of factors affecting the implementation process of an ERP project. The outcome is a full and rounded understanding of the behavior and actions of a few individuals.

The qualitative analysis aims to prioritize the risks recorded in the literature. It begins with the collection of information on the identified risk factors and results in their classification as "Low," "Medium," or "High" risks. Once the threats are detected, they can be grouped according to their importance and the probability of occurrence and represented in a risk matrix.

		Impact				
		No Risk Level	Low Risk Level	Medium Risk Level	High Risk Level	Very High Risk Level
Likelihood	Very High	(M)	(M)	(H)	(H)	(H)
	High	(L)	(M)	(M)	(H)	(H)
	Medium	(L)	(M)	(M)	(H)	(H)
	Low	(L)	(L)	(M)	(M)	(H)
	Very Low	(L)	(L)	(L)	(L)	(M)

H: High risk, that is unacceptable, and an immediate reaction is required.
M: Medium risk, a reaction might be necessary.
L: Low risk, no immediate action is needed but simple monitoring.

Although qualitative analysis does not provide accurate results, it is the one most frequently used by stakeholders. This is because it is more easily accessible, requires less execution time and less work by those who execute it.

Quantitative Data Analysis

To conduct the required classification that was mentioned previously in the "Qualitative Analysis" and review the risk level of the factors that were detected in the literature, the second type of analysis is required, which is called Quantitative Analysis. Quantitative analysis is a superset of qualitative, as it includes all its elements but also mathematical analysis. This analysis is essentially the quantification of qualitative analysis. Its purpose is to describe in detail each risk and to prioritize among the threats recorded in the risk register (Appendix, Table 1), allowing us to find the overall degree of risk of the project. The occurrence of risk is based on two causing factors (threats and vulnerabilities) and broken down into two components, impact and likelihood.

The quantitative analysis provides more robust handling on the probability and impact of the risk since it quantifies both of them. Such a review is costly, time-consuming, and may require a large amount of data. Only a few selected risks may be subjected to this kind of analysis. As mentioned in Chapter 4 (Questionnaire design section), a categorization took place, and some questions related to specific risk factors were removed. These risk factors were either not detected in the implementation phase, such as the selection of the appropriate vendor, which is conducted in the "Planning" phase, or the number of references in the literature was not notable enough, indicating that these risk factors were not significantly related to the outcome of an ERP implementation plan.

Based on the risk register list, a qualitative analysis has been performed for the selected risks with the Expected monetary value (EMV) analysis. EMV analysis is recommended for beginners because it is quite simple to implement and does not require a lot of data gathering, and analysis can be performed using simple mathematics. After defining the likelihood and the impact, the degree of exposure is defined, as follows:

$$EMV = likelihood \times impact$$

EMV analysis is used to calculate the average outcome of uncertain scenarios by multiplying probability with the effects of each risk. In this research, the investigation of each risk is performed individually, but a further analysis could be conducted regarding the category of each threat, by calculating the EMV for each risk factor and summing them up, as follows:

$$EMV' = \sum(likelyhood \times impact)$$

Priorities must be set for the likelihood of any danger and the consequence that it can have on the organization. The probability and consequence sizes must be quantified and evident by the analysts who designate them. Typically, word scales that create specific levels are used to express these sizes. Below are provided some definitions of the likelihood of risks and their impact, according to the Project Management Institute (PMI) formulated in 2000 (Pmi.org, 2020).

Table 9. Likelihood of risks according to PMI

Likelihood	Description
Very High	Probability of occurrence from 80% to 100%
High	Probability of occurrence from 60% to 80%
Medium	Probability of occurrence from 30% to 60%
Low	Probability of occurrence from 10% to 30%
Very Low	Probability of occurrence up to 10%

Table 10. Impact of risks according to PMI

Impact	Description	Project Objective			
		Cost	Schedule	Scope	Quality
Very Low	Consequence level up to 10%	Cost increase more than 0%, but less than 5%	Overall project schedule delay more than 0 days and less than 1 week	Scope decrease barely noticeable	Quality reduction barely noticeable
Low	Consequence level from 10% to 30%.	Cost increase more than 5%, but less than 10%	Overall project schedule delay more than 1 week and less than 2 weeks	Minor areas of scope are affected	Quality reduction does not affect vital functionality
Medium	Consequence level from 30% to 50%.				
High	Consequence level from 50% to 70%.	Cost increase more than 10%	Overall project schedule delay more than 2 weeks	Major areas of scope are affected; Scope reduction unacceptable to the client	Quality reduction requires client approval
Very High	Consequence level from 70% to 90%.				

Following is an example of a risk exposure according to the scales previously presented by the PMI for the likelihood of each risk occurring and the consequence it can have on

an organization. The values determined by multiplying the Impact Rating with Risk Probability, as shown in the table below.

		Impact				
		No Risk Level ($\overline{x} = 0.05$)	Low Risk Level ($\overline{x} = 0.2$)	Medium Risk Level ($\overline{x} = 0.4$)	High Risk Level ($\overline{x} = 0.6$)	Very High Risk Level ($\overline{x} = 0.8$)
Likelihood	Very High ($\overline{x} = 0.9$)	(M4) $\overline{EMV} = 0.05$	(M2) $\overline{EMV} = 0.18$	(H3) $\overline{EMV} = 0.36$	(H2) $\overline{EMV} = 0.54$	(H1) $\overline{EMV} = 0.72$
	High ($\overline{x} = 0.7$)	(L1) $\overline{EMV} = 0.04$	(M2) $\overline{EMV} = 0.14$	(M1) $\overline{EMV} = 0.28$	(H3) $\overline{EMV} = 0.42$	(H2) $\overline{EMV} = 0.56$
	Medium ($\overline{x} = 0.5$)	(L2) $\overline{EMV} = 0.03$	(M3) $\overline{EMV} = 0.10$	(M2) $\overline{EMV} = 0.20$	(H4) $\overline{EMV} = 0.30$	(H3) $\overline{EMV} = 0.40$
	Low ($\overline{x} = 0.3$)	(L3) $\overline{EMV} = 0.02$	(L1) $\overline{EMV} = 0.06$	(M3) $\overline{EMV} = 0.12$	(M2) $\overline{EMV} = 0.18$	(H4) $\overline{EMV} = 0.24$
	Very Low ($\overline{x} = 0.1$)	(L4) $\overline{EMV} = 0.01$	(L3) $\overline{EMV} = 0.02$	(L1) $\overline{EMV} = 0.04$	(L1) $\overline{EMV} = 0.06$	(M4) $\overline{EMV} = 0.08$

H: High risk (high exposure), that is unacceptable, and an immediate reaction is required.
M: Medium risk (medium exposure), a reaction might be necessary.
L: Low risk (low exposure), no immediate action is needed but simple monitoring.

The above table clearly shows that along with classifying the report as low, medium, or high, the existence of a numerical description makes it much easier to identify the risk groups that need to be addressed immediately. The risks have been grouped into subcategories to achieve a more noticeable separation. Specifically, the risk in the H1 category is more dangerous than the risk in the H2 type, and this, in turn, is more dangerous than the risk in the H3 group. The same categorization is applied for medium and low risks. So, the degree of risk from the largest to the smallest, starting from the most severe risk to the most harmless, is defined as follows:

$$H1 > H2 > H3 > H4 > M1 > M2 > M3 > M4 > L1 > L2 > L3 > L4$$

Assumptions

In the first phase, an analysis was performed on the results obtained from the research. As expected, it was observed that most of the respondents, due to their experience with project implementation of corresponding systems, were able to provide reliable information regarding the likelihood and the impact of a risk.

As noticed in Appendix, Tables 4 to 11 show relatively high likelihood rates, which is to be expected since this study, as mentioned in frequency analysis in Chapter 2, examines the factors with the highest probability of occurrence within the literature. Thus, because of the high incidence of these risks, if these values had to be grouped in the risk matrix correlating with the impact, all values would be either in the "High" or "Very High" area.

Therefore, to better visualize the results, considering the probability level is high enough for all risks, an assumption will be conducted, that will separate the "High" and "Very High" sections to five equal levels as it is defined in the tables below.

Likelihood	Description
Very High	Probability of occurrence from 96% to 100%
High	Probability of occurrence from 92% to 96%
Medium	Probability of occurrence from 88% to 92%
Low	Probability of occurrence from 84% to 88%
Very Low	Probability of occurrence up to 84%

Impact	Description
Very High	Consequence level from 80% to 88%
High	Consequence level from 72% to 80%
Medium	Consequence level from 64% to 72%
Low	Consequence level from 56% to 64%
Very Low	Consequence level up to 56%

A new risk matrix will be created with new likelihood rates, as it is displayed in the table below:

		Impact				
		1. No Risk Level ($\overline{x} = 0.52$)	2. Low Risk Level ($\overline{x} = 0.6$)	3. Medium Risk Level ($\overline{x} = 0.68$)	4. High Risk Level ($\overline{x} = 0.76$)	5. Very High Risk Level ($\overline{x} = 0.84$)
Likelihood	5. Very High ($\overline{x} = 0.98$)	(M4) $\overline{EMV} = 0.51$	(M2) $\overline{EMV} = 0.59$	(H3) $\overline{EMV} = 0.67$	(H2) $\overline{EMV} = 0.74$	(H1) $\overline{EMV} = 0.82$
	4. High ($\overline{x} = 0.94$)	(L1) $\overline{EMV} = 0.49$	(M2) $\overline{EMV} = 0.56$	(M1) $\overline{EMV} = 0.64$	(H3) $\overline{EMV} = 0.71$	(H2) $\overline{EMV} = 0.79$
	3. Medium ($\overline{x} = 0.90$)	(L2) $\overline{EMV} = 0.47$	(M3) $\overline{EMV} = 0.54$	(M2) $\overline{EMV} = 0.61$	(H4) $\overline{EMV} = 0.68$	(H3) $\overline{EMV} = 0.76$
	2. Low ($\overline{x} = 0.86$)	(L3) $\overline{EMV} = 0.45$	(L1) $\overline{EMV} = 0.52$	(M3) $\overline{EMV} = 0.58$	(M2) $\overline{EMV} = 0.65$	(H4) $\overline{EMV} = 0.72$
	1. Very Low ($\overline{x} = 0.82$)	(L4) $\overline{EMV} = 0.43$	(L3) $\overline{EMV} = 0.49$	(L1) $\overline{EMV} = 0.56$	(L1) $\overline{EMV} = 0.62$	(M4) $\overline{EMV} = 0.69$

In the following table (Table 11) is defined the probability and the risk level of each threat that has been identified. Based on the risk list is determined the exposure of each risk to make the quantification of qualitative analysis.

Table 11. Risk factors exposure report

Number	Likelihood	Impact	Exposure	EMV
R1	2 (88%)	3 (0,709)	M3	0,624
R2	1 (84%)	3 (0,654)	L1	0,549
R3	4 (94%)	3 (0,694)	M1	0,652
R4	4 (94%)	3 (0,694)	M1	0,652

R5	1 (84%)	1 (0,568)	L4	0,477
R6	3 (90%)	3 (0,662)	M2	0,596
R7	2 (88%)	3 (0,705)	M3	0,620
R8	2 (88%)	2 (0,623)	L1	0,548
R9	4 (96%)	3 (0,705)	M1	0,677
R10	4 (96%)	3 (0,713)	M1	0,684
R11	3 (90%)	2 (0,619)	M3	0,557
R12	3 (90%)	2 (0,639)	M3	0,575
R13	3 (90%)	3 (0,686)	M2	0,617
R14	3 (90%)	3 (0,650)	M2	0,585
R15	5 (98%)	4 (0,780)	H2	0,764
R16	3 (92%)	4 (0,721)	H4	0,663
R17	5 (98%)	3 (0,698)	H3	0,684
R18	4 (96%)	4 (0,717)	H3	0,688
R19	2 (88%)	1 (0,564)	L3	0,496
R20	4 (94%)	3 (0,690)	M1	0,649
R21	2 (88%)	3 (0,694)	M3	0,611
R22	4 (94%)	3 (0,674)	M1	0,634
R23	3 (92%)	3 (0,678)	M2	0,624
R24	2 (86%)	3 (0,662)	M3	0,569
R25	3 (92%)	3 (0,654)	M2	0,602
R26	5 (98%)	3 (0,670)	H3	0,657
R27	4 (96%)	3 (0,682)	M1	0,655
R28	3 (92%)	3 (0,658)	M2	0,605
R29	3 (92%)	2 (0,607)	M3	0,558
R30	3 (90%)	3 (0,650)	M2	0,585
R31	3 (92%)	3 (0,701)	M2	0,645
R32	4 (96%)	3 (0,666)	M1	0,639
R33	3 (92%)	3 (0,650)	M2	0,598
R34	5 (100%)	5 (0,8)	H1	0,800
R35	2 (88%)	3 (0,686)	M3	0,604

All risks have been grouped in their categories, allowing us to define the probability and impact for each category. These variables allow us to conduct a quantitative analysis of each risk category and calculate its exposure with the aid of the risk matrix.

Table 12. Risk category exposure report

Risk Category	Likelihood	Impact	Exposure	EMV’
Strategic Initiatives	2 (89%)	3 (0,664)	M3	0,591
Business Processes – Change Management	3 (92%)	3 (0,682)	M2	0,627
Executive Commitment	3 (92%)	3 (0,675)	M2	0,621
Project Management – Project Team	4 (94%)	3 (0,678)	M1	0,637
Project Leader	3 (91%)	3 (0,673)	M2	0,612
Training	4 (94%)	3 (0,654)	M1	0,615
Communications – Technical Support	4 (94%)	3 (0,701)	M1	0,659

Risk Management Strategy

In a scenario that takes place in the near world, if the implementation and risk management teams are aware of the risk register, they will be able to understand the significance between the project operations and the identified risks in the risk report. That would allow them to find the appropriate means either to prevent or to deal with them if they occur. The methods of dealing with threats are avoidance, transfer, mitigation, and acceptance.

Table 13. Evaluation of ERP implementation risks

Number	Likelihood	Impact	Exposure	Priority
R34	5	5	H1	1
R15	5	4	H2	2
R18	4	4	H3	3
R17	5	3	H3	4
R26	5	3	H3	5
R16	3	4	H4	6
R10	4	3	M1	7
R9	4	3	M1	8
R27	4	3	M1	9
R3	4	3	M1	10
R4	4	3	M1	11
R20	4	3	M1	12
R32	4	3	M1	13
R22	4	3	M1	14
R31	3	3	M2	15
R23	3	3	M2	16
R13	3	3	M2	17
R25	3	3	M2	18
R33	3	3	M2	19
R6	3	3	M2	20
R14	3	3	M2	21
R30	3	3	M2	22
R28	3	3	M2	23
R1	2	3	M3	24
R7	2	3	M3	25
R21	2	3	M3	26
R35	2	3	M3	27
R12	3	2	M3	28
R24	2	3	M3	29
R29	3	2	M3	30
R11	3	2	M3	31
R2	1	3	L1	32
R8	2	2	L1	33
R19	2	1	L3	34
R5	1	1	L4	35

The acceptable risks must be monitored to check their status during the implementation of the system. The risks that need to be reduced, either the likelihood of occurrence or the consequence they may have, must be found in some alternative plans to be implemented either before or after their appearance. Finally, the risks to be avoided are those that can have the most significant impact on the implementation and operations of the system, and alternative ways should be found to eliminate them.

For example, the risk "Adequate testing has not been conducted before the ERP system goes live" has an H1 exposure rate and is considered to be the most important, whereas the risk "The ERP is not related to the business goals" has an L1 exposure rate and is considered less significant. The table below shows the classification of risks according to their exposure, and the priority of each risk (Table 14). Despite the fact that the “Training” factor was identified on having an M1 exposure level, is comparatively lower in the ranking than factors "Business Processes & Change Management" and "Executive Commitment". This is due to the fact that the EMV' value is calculated with the likelihood and impact rates, which were at the lowest values they could get in that particular field.

Table 14. Evaluation of ERP implementation risk categories

Risk Category	Likelihood	Impact	Exposure	Priority
Communications & Technical Support	4	3	M1	1
Project Management & Project Team	4	3	M1	2
Business Processes & Change Management	3	3	M2	3
Executive Commitment	3	3	M2	4
Training	4	3	M1	5
Project Leader	3	3	M2	6
Strategic Initiatives	2	3	M3	7

Chapter 6: Results and Discussions

This thesis has been conducted by performing exploratory research using secondary data intending to find an answer to the research question: What are the risk factors of ERP project? To fulfill this goal, the meaning of the ERP system to the organization and its relationship to the organization's operations had to be understood. The literature indicated that the riskiest life stage of an ERP project is the implementation phase, and therefore, the investigation focused on this field. Pointing out that the risks of ERP projects are either formed in the implementation phase, or the outcome of risks related to the outcome of the project (i.e., goals, costs, and resources) appear especially at this phase, even though they have been caused by improper management in previous stages.

After receiving a coherent picture of ERP systems, the research for the risk factors of ERP project was undertaken. During the literature review, a frequency analysis of the critical risk factor instances was conducted. Findings in the frequency analysis showed that factors associated with business processes, senior management, project management, and strategic planning, emerged as the most widespread, as these topics are the most discussed and have the most references in the literature. After identifying the most critical risk categories, a comprehensive analysis has been performed both to these categories and the risk factors which were located within these groups. However, it would be unwise to draw firm conclusions on the strength of the results of only a literature review. After the completion of this analysis, a questionnaire has been designed, which focused on the most important risk factors identified in the literature and was forwarded to people who had previous experience with at least one ERP implementation project. The purpose of the research is to confirm whether the factors identified in the literature are actually related to threats identified during the implementation of an ERP system by qualified people in similar situations.

Through the findings of the survey, a slight differentiation has been identified regarding the factors that occur more regularly in implementations that took place in the real-life, and their impact level for the project. A quantitative analysis has been performed, allowing us to determine the exposure rate for each category and receive the ranking list for each group of risks, with the aid of the risk matrix, which was defined in Chapter 5. Table 15 shows the differentiation in the ranking between the risks identified in the literature and those generated after analyzing the survey results.

Table 15. Risk factor categories ranking of the survey vs. the literature.

Risk Category	Survey Ranking	Bibliography Ranking
Communications & Technical Support	1	15
Project Management & Project Team	2	3 & 9
Business Processes & Change Management	3	1 & 7
Executive Commitment	4	2
Training	5	10
Project Leader	6	17
Strategic Initiatives	7	4

It is acknowledged that many of the risk factors have been classified at the same level both in the literature review and quantitative survey analysis. Risk categories related to

project management, business processes, and executive commitment are in the top ranks in both lists. On the other hand, the strategic planning category, which was very high in the literature analysis, seems to hold the last position in the responses, which probably means that currently is given more emphasis on this risk category, and a more reliable analysis is handled related to the strategies and goals of the organizations, causing a reduction of the threats that occur related to this section. In addition, the communications and technical support categories, which were considerably low in the literature review, appear to maintain the highest degree of risk in the survey analysis. In the Appendix are also included graphic representations of the risk categories depending on the position of the respondents within their organization and their educational background.

Any organization that wishes to implement a new ERP system must consider the above-mentioned risks and take necessary actions to prevent threats or minimize their effect. Lack of empirical studies concerning communications and technical support during the development of an ERP project was recognized. Therefore, this thesis suggests further research, and careful studies via empirical methods should be guided towards these risk factors as they are tightly related to the ERP project outcome.

Additionally, further investigation should probably have to be conducted that will focus only on ERP systems, which are associated with a cloud environment, as this type of system is growing exponentially from 2017 as it was stated by Panorama Consulting Group (2020). Cloud ERP is more convenient to control and requires a smaller investment in the long term than on-premises ERP systems. Cloud ERP data are also accessible through any device with internet access, adding a level of convenience to the cloud versus the on-premises ERP. Most importantly, cloud ERP enables businesses to make better use of their data and to work smarter (Alagna, 2020). However, security is a huge aspect of these systems that involve high risks. A cloud environment is associated with many risks such as confidentiality, privacy, integrity. Even though cloud ERP has many benefits, organizations need to consider those security risks related to the cloud before moving into the implementation of a cloud-based environment.

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Appendix

Table 1. Risk register

Number	Risk Description
R1	The organization does not have clear strategic IT goals
R2	The ERP is not related to the business goals
R3	Lack of strategic guidelines regarding IT planning
R4	Lack of continuous evaluation of the strategic goals
R5	An analysis of risks, costs and resources has not been conducted
R6	Business processes are modified during the implementation of the ERP system
R7	Leadership does not support BPR (Business Process Reengineering)
R8	Cross-functional members are not involved in BPR team
R9	Employees reject changes
R10	Employees do not understand how their actions impact the organization
R11	Top Management is doubtful regarding ERP investment
R12	Top Management is unaware of the ERP system benefits
R13	Top Management resist change and smooth system rollout
R14	Top Management undervalues the need for long term support for the ERP System
R15	Top Management does not provide the required time and resources.
R16	The project schedule and objectives are not defined clearly
R17	Milestones are not used to measure the project completion rate
R18	The project team mix is not well structured
R19	External consultants are not part of the project team
R20	Team members do not accept their roles and responsibilities
R21	ERP project leader is inexperienced and unaware of business goals
R22	The ERP project leader is unable to provide motivating leadership
R23	EPR project leader is unable to resolve conflicts and manage resistance
R24	ERP project leader is unaware of the team's skills and knowledge
R25	ERP project leader is not accepted by all team members
R26	User training needs are not appropriately identified
R27	Training content and length are not designed well
R28	User training has been conducted too early/late
R29	Users are not aware of the importance of their training
R30	User training stops after the end of the project
R31	Miscommunication regarding the role of the I.S. to all or any staff members
R32	Lack of culture with shared values and common aims
R33	The organization does not promote open communications
R34	Adequate testing has not been conducted before the ERP system goes live
R35	The project team is disbanded when the ERP system goes live

Table 2. Respondent profile

Gender	**Count**	**Percentage**
Female	34	67%
Male	17	33%

Age Group	**Count**	**Percentage**
18 – 24	1	2%
25 – 34	22	43%
35 – 44	17	33%
45 – 54	9	18%
55 – 65	1	2%
65 or older	1	2%

Position in the organization	**Count**	**Percentage**
Junior Level (Junior Consultants and other employees)	12	24%
Middle Level (Head of Department, Business Managers, Consultants, etc.)	30	59%
Upper Level (Top Management, Business Executives, etc.)	8	16%
	1	2%

Educational background (highest degree)	**Count**	**Percentage**
No formal education	0	0%
High School	1	2%
College or equivalent	5	10%
Bachelor (Bs) or equivalent	15	29%
Master (MSc) or equivalent	24	47%
Doctoral (PHD) or equivalent	6	12%

Table 3. Company profile

Years in Operation	**Count**	**Percentage**
Less than 5	13	25%
6 – 15	5	10%
15 – 30	22	43%
More than 30	11	22%

Number of Employees	**Count**	**Percentage**
Less than 50	16	31%
51 – 150	12	24%
151 – 300	5	10%
301 – 500	4	8%
More than 500	14	27%

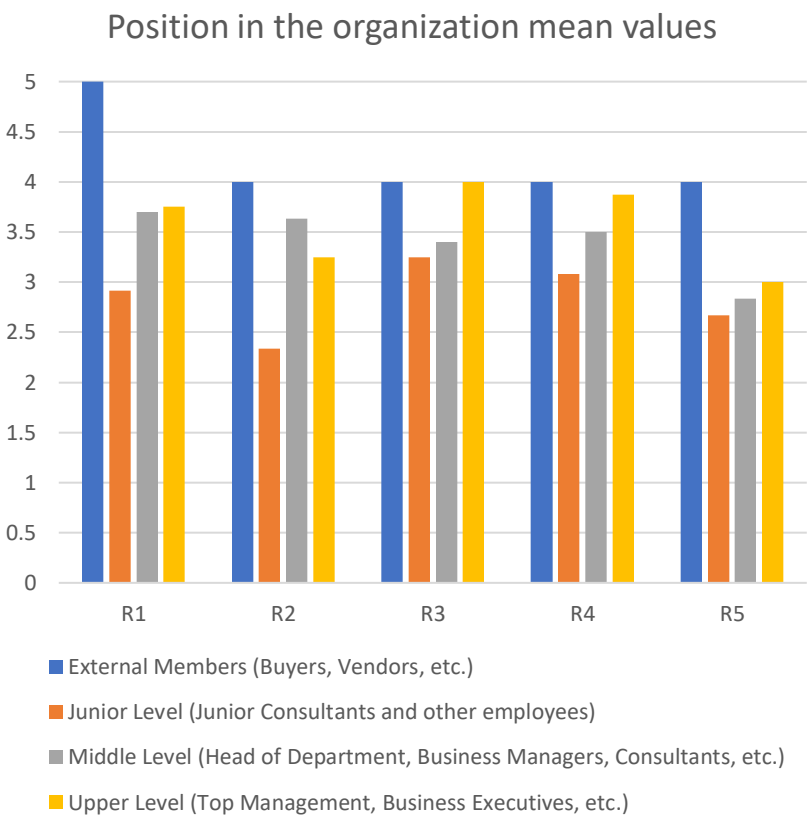
Number of ERP Implementations	**Count**	**Percentage**
1	13	25%
2	7	14%
3 or more	31	61%

Multiple ERP Systems in the Same Facility	**Count**	**Percentage**
Yes	37	73%
No	14	27%

Table 4. Strategic Initiatives

Statement/Question	No Risk Level	Low Risk Level	Medium Risk Level	High Risk Level	Very High Risk Level
Organization does not have clear strategic IT goals	6 (12%)	5 (10%)	6 (12%)	23 (46%)	11 (22%)
The is not related to the business goals	8 (16%)	7 (14%)	5 (10%)	25 (50%)	6 (12%)
Lack of strategic guidelines regarding IT planning	3 (6%)	6 (12%)	11 (22%)	26 (51%)	5 (10%)
Lack of continuous evaluation of the strategic goals	3 (6%)	5 (10%)	15 (30%)	21 (42%)	7 (14%)
A risk and cost analysis has been conducted before the implementation	8 (16%)	10 (20%)	17 (34%)	14 (28%)	2 (4%)

Indicator	Mean	Std Dev	Likelihood
Organization does not have clear strategic IT goals	1,27	3,549	88%
The is not related to the business goals	1,297	3,275	84%
Lack of strategic guidelines regarding IT planning	1,027	3,471	94%
Lack of continuous evaluation of the strategic goals	1,046	3,471	94%
A risk and cost analysis has been conducted before the implementation	1,046	2,843	84%



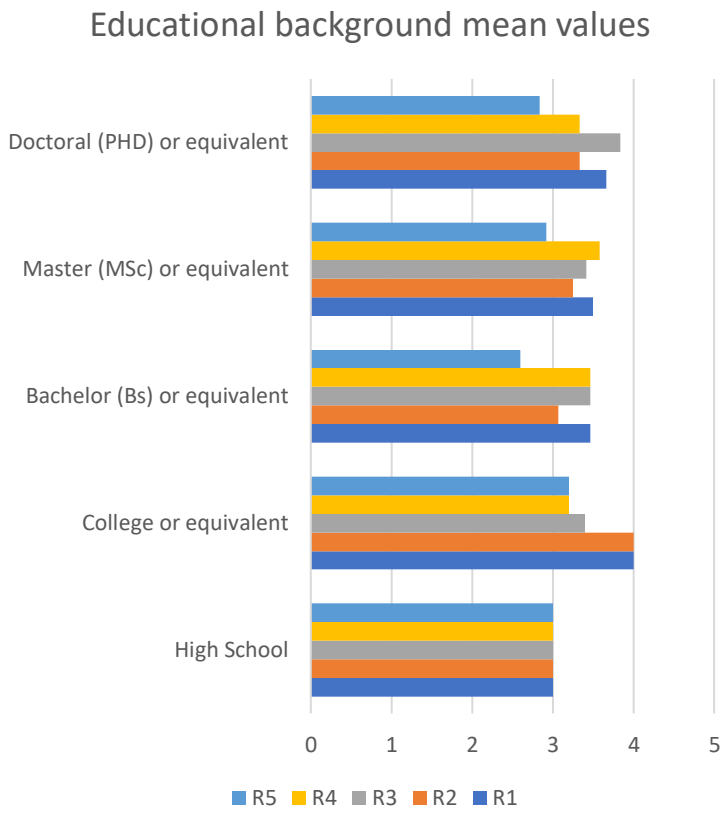
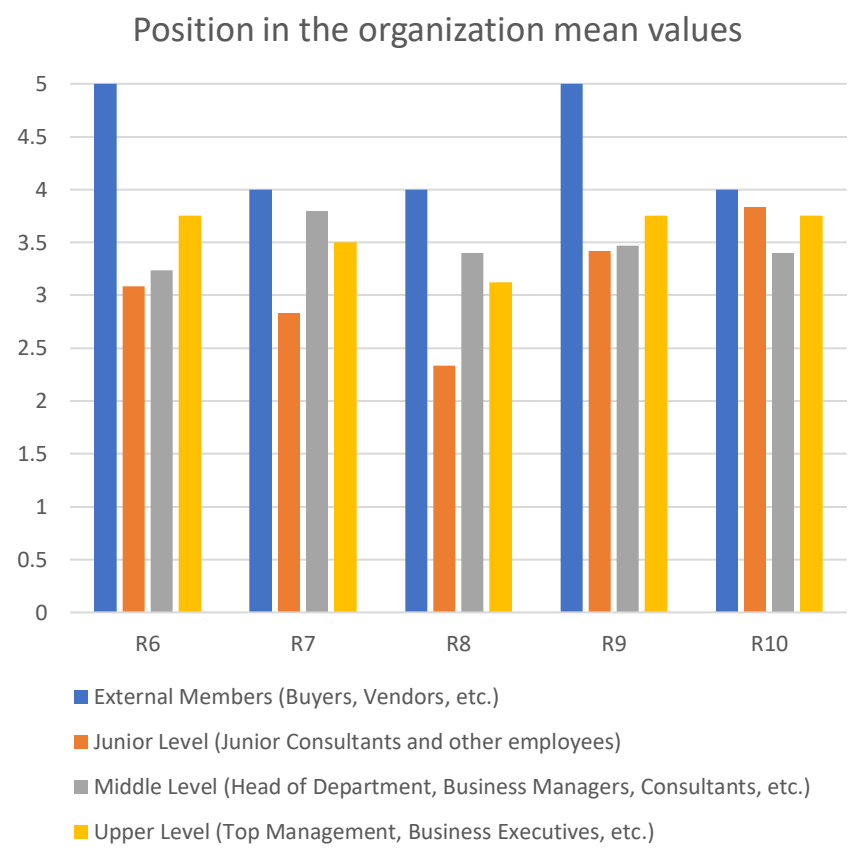


Table 5. Business Processes & Change Management

Statement/Question	No Risk Level	Low Risk Level	Medium Risk Level	High Risk Level	Very High Risk Level
Business processes are modified during the implementation	5 (10%)	6 (12%)	13 (26%)	22 (44%)	5 (10%)
Leadership does not support BPR (Business Process Reengineering)	6 (12%)	5 (10%)	10 (20%)	16 (32%)	14 (28%)
Cross-functional members are not involved in BPR team	6 (12%)	10 (20%)	11 (22%)	20 (40%)	4 (8%)
Employees reject changes	2 (4%)	6 (12%)	14 (28%)	21 (42%)	8 (16%)
Employees do not understand how their actions impact the organization.	2 (4%)	4 (8%)	14 (28%)	25 (50%)	6 (12%)

Indicator	Mean	Std Dev	Likelihood
Business processes are modified during the implementation	1,122	3,314	90%
Leadership does not support BPR (Business Process Reengineering)	1,317	3,529	88%
Cross-functional members are not involved in BPR team	1,177	3,118	88%
Employees reject changes	1,027	3,529	96%
Employees do not understand how their actions impact the organization.	1,027	3,569	96%



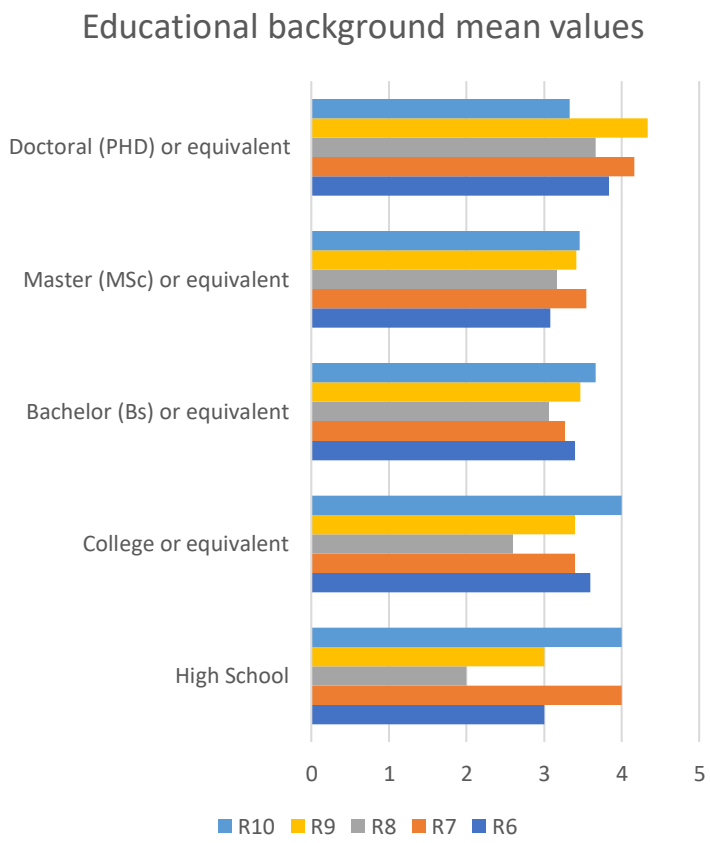
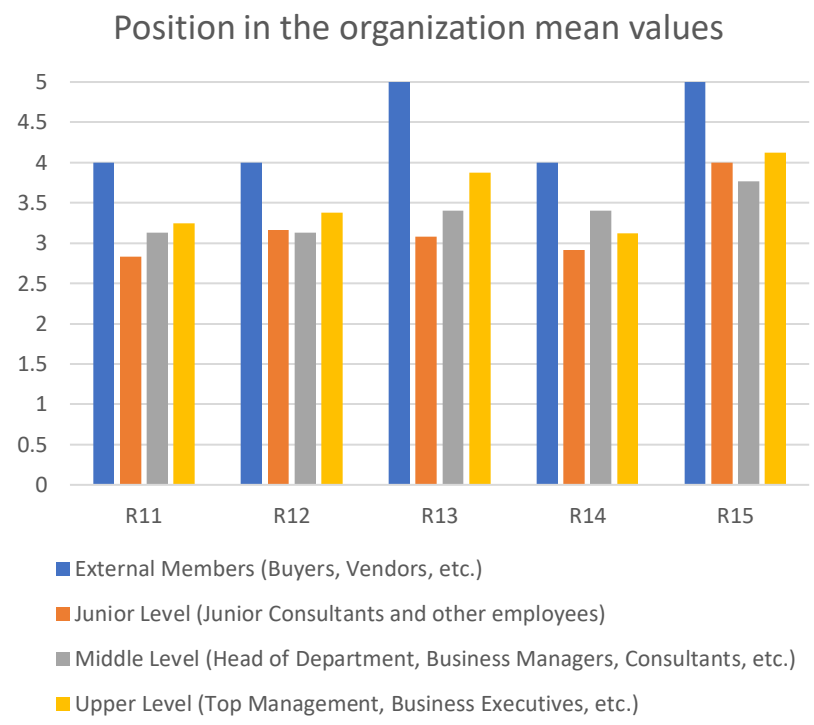


Table 6. Executive Commitment/Senior Management (S.M.)

Statement/Question	No Risk Level	Low Risk Level	Medium Risk Level	High Risk Level	Very High Risk Level
The organization's S.M. is doubtful regarding the investment	5 (10%)	10 (20%)	14 (28%)	19 (38%)	3 (6%)
The organization's S.M. is unaware of the benefits	5 (10%)	7 (14%)	17 (34%)	17 (34%)	5 (10%)
The organization's S.M. resists change and smooth system rollout	5 (10%)	5 (10%)	13 (26%)	19 (38%)	9 (18%)
The organization's S.M. undervalues the need for long term support for the I.S.	5 (10%)	7 (14%)	12 (24%)	24 (48%)	3 (6%)
The organization's S.M. does not provide the required time and resources	1 (2%)	4 (8%)	10 (20%)	20 (40%)	16 (32%)

Indicator	Mean	Std Dev	Likelihood
The organization's S.M. is doubtful regarding the investment	1,1001	3,098	90%
The organization's S.M. is unaware of the benefits	1,1139	3,196	90%
The organization's S.M. resists change and smooth system rollout	1,1875	3,431	90%
The organization's S.M. undervalues the need for long term support for the I.S.	1,0926	3,255	90%
The organization's S.M. does not provide the required time and resources	1,0926	3,902	98%



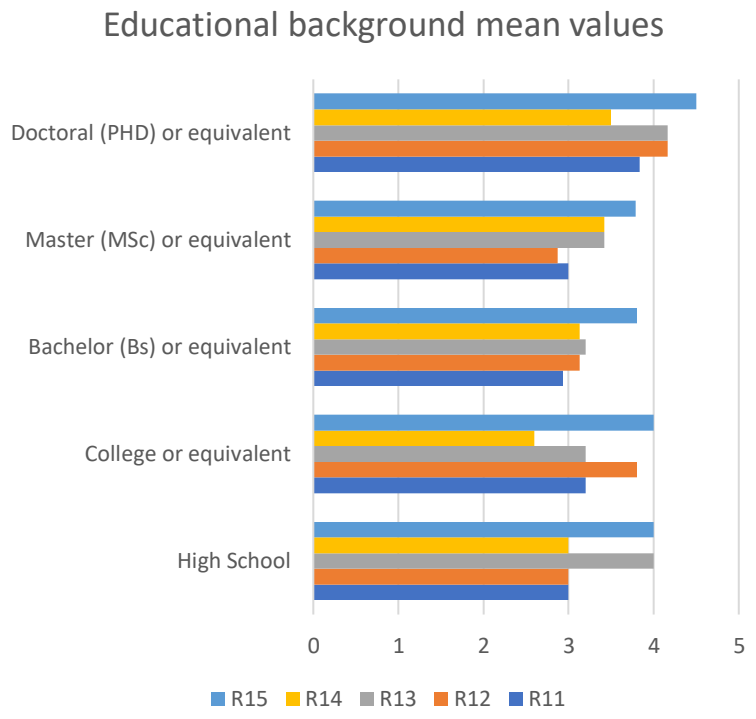
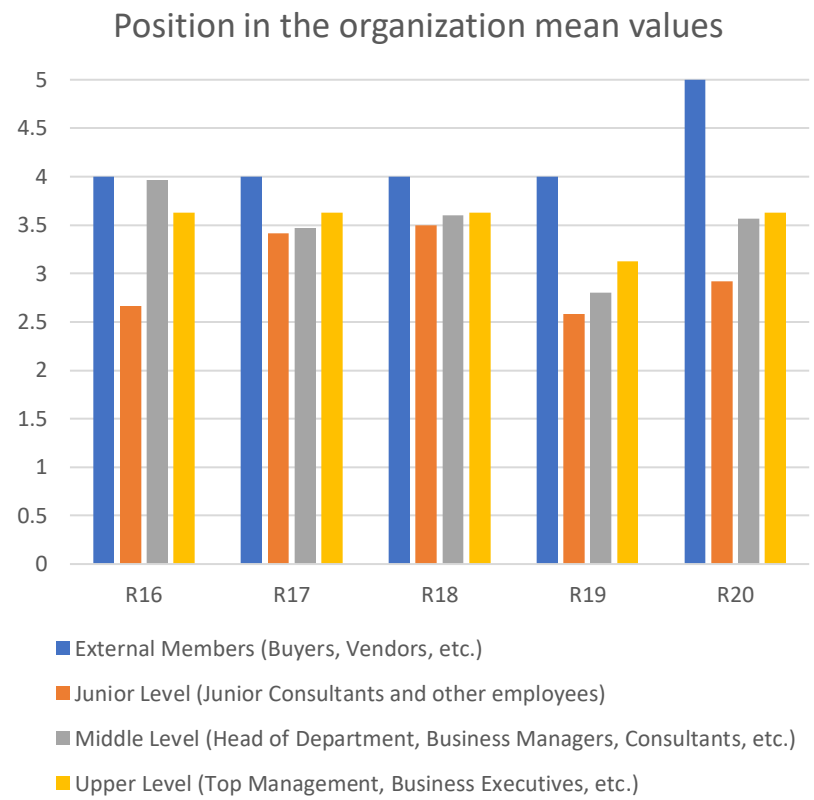


Table 7. Project Management & Project Team

Statement/Question	No Risk Level	Low Risk Level	Medium Risk Level	High Risk Level	Very High Risk Level
Project schedule and objectives are not defined clearly	4 (8%)	3 (6%)	10 (20%)	26 (51%)	8 (16%)
Milestones are not used to measure project completion rate	1 (2%)	4 (8%)	21 (42%)	19 (38%)	6 (12%)
The project team mix is not well structured	2 (4%)	6 (12%)	13 (26%)	20 (40%)	10 (20%)
External consultants are not members of the project team	6 (12%)	16 (32%)	12 (24%)	15 (30%)	2 (4%)
Team members do not accept their roles and responsibilities	3 (6%)	9 (18%)	9 (18%)	22 (44%)	8 (16%)

Indicator	Mean	Std Dev	Likelihood
Project schedule and objectives are not defined clearly	1,0785	3,608	92%
Milestones are not used to measure project completion rate	0,8803	3,490	98%
The project team mix is not well structured	1,0616	3,588	96%
External consultants are not members of the project team	1,1083	2,824	88%
Team members do not accept their roles and responsibilities	1,1083	3,451	94%



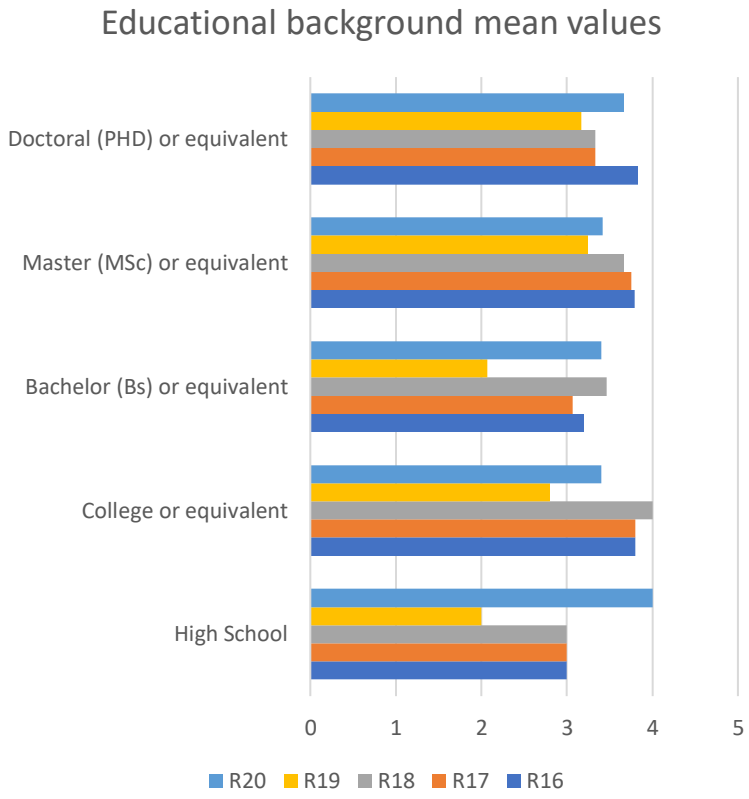
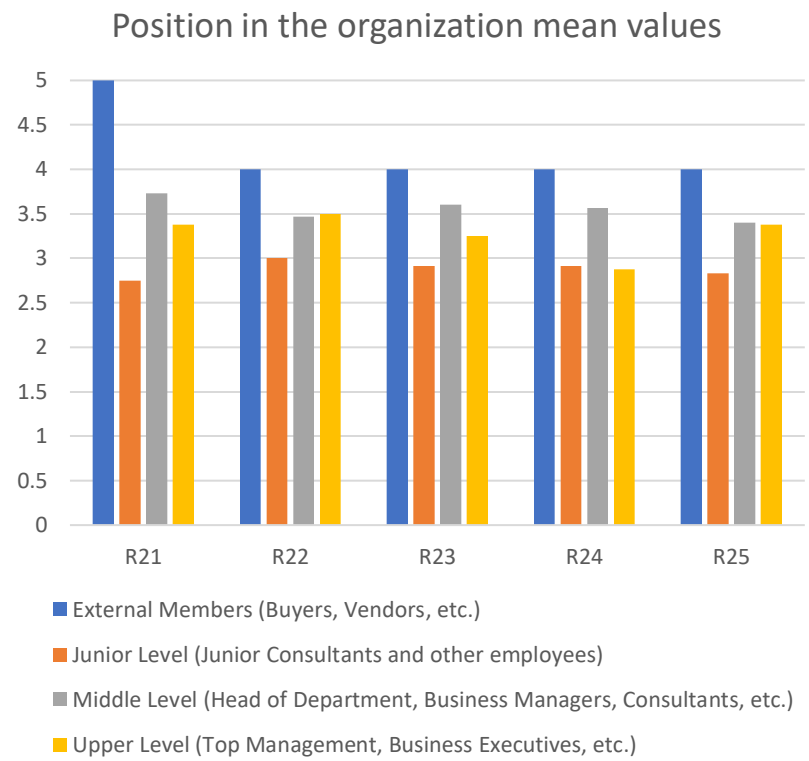


Table 8. Project Leader

Statement/Question	No Risk Level	Low Risk Level	Medium Risk Level	High Risk Level	Very High Risk Level
The Project Leader is inexperienced and unaware of business goals	6 (12%)	6 (12%)	12 (24%)	12 (24%)	15 (30%)
The Project Leader is unable to provide motivating leadership	3 (6%)	6 (12%)	16 (32%)	21 (42%)	5 (10%)
The Project Leader is unable to resolve conflicts and manage resistance	4 (8%)	7 (14%)	12 (24%)	21 (42%)	7 (14%)
The Project Leader is unaware of the team's skills and knowledge	7 (14%)	2 (4%)	14 (28%)	24 (48%)	4 (8%)
The Project Leader is not accepted by all team members	4 (8%)	7 (14%)	18 (36%)	15 (30%)	7 (14%)

Indicator	Mean	Std Dev	Likelihood
The Project Leader is inexperienced and unaware of business goals	1,3469	3,471	88%
The Project Leader is unable to provide motivating leadership	1,019	3,373	94%
The Project Leader is unable to resolve conflicts and manage resistance	1,1328	3,392	92%
The Project Leader is unaware of the team's skills and knowledge	1,14	3,314	86%
The Project Leader is not accepted by all team members	1,14	3,275	92%



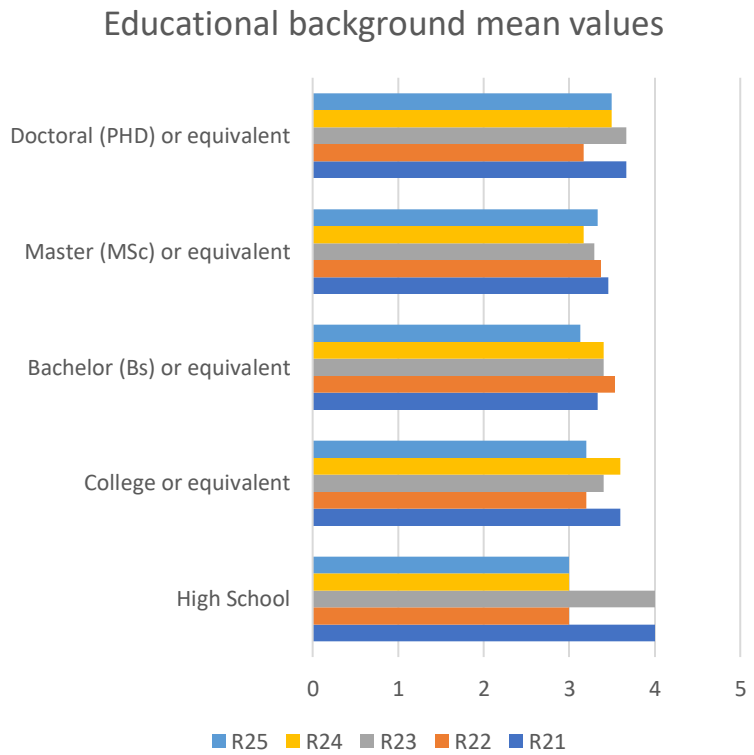
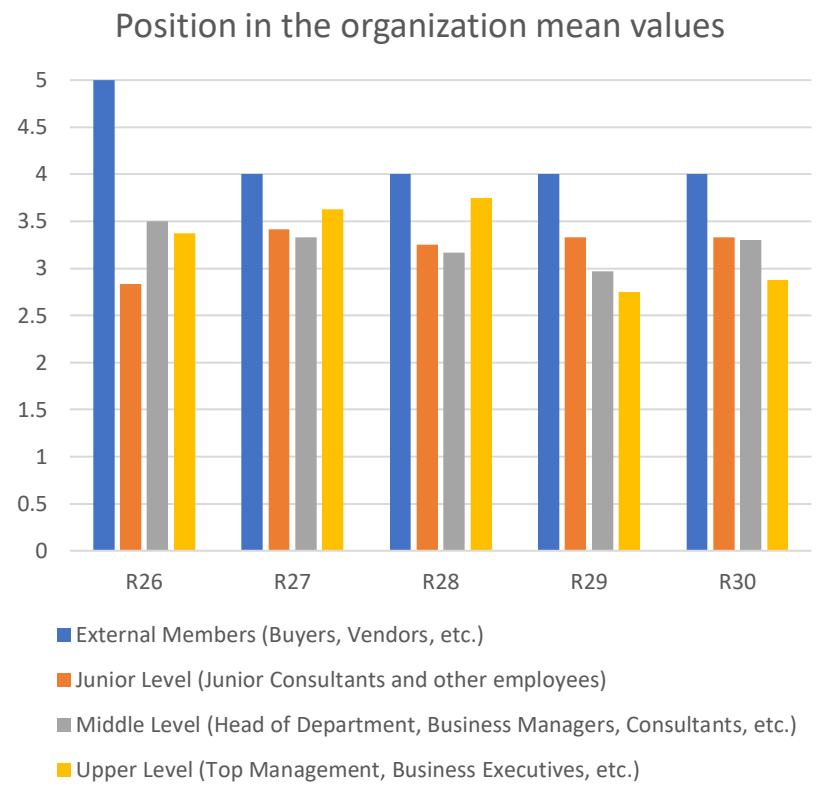


Table 9. Training

Statement/Question	No Risk Level	Low Risk Level	Medium Risk Level	High Risk Level	Very High Risk Level
User training needs are not appropriately identified.	1 (2%)	12 (24%)	10 (20%)	24 (48%)	4 (8%)
Training content and length are not designed well	2 (4%)	7 (14%)	13 (26%)	26 (51%)	3 (6%)
User training has been conducted too early/late	4 (8%)	10 (20%)	12 (24%)	17 (34%)	8 (16%)
Users are not aware of the importance of their training	4 (8%)	12 (24%)	17 (34%)	14 (28%)	4 (8%)
User training stops after the end of the project	5 (10%)	8 (16%)	14 (28%)	17 (34%)	7 (14%)

Indicator	Mean	Std Dev	Likelihood
User training needs are not appropriately identified.	0,9965	3,353	98%
Training content and length are not designed well	0,9418	3,412	96%
User training has been conducted too early/late	1,1882	3,294	92%
Users are not aware of the importance of their training	1,0763	3,039	92%
User training stops after the end of the project	1,0763	3,255	90%



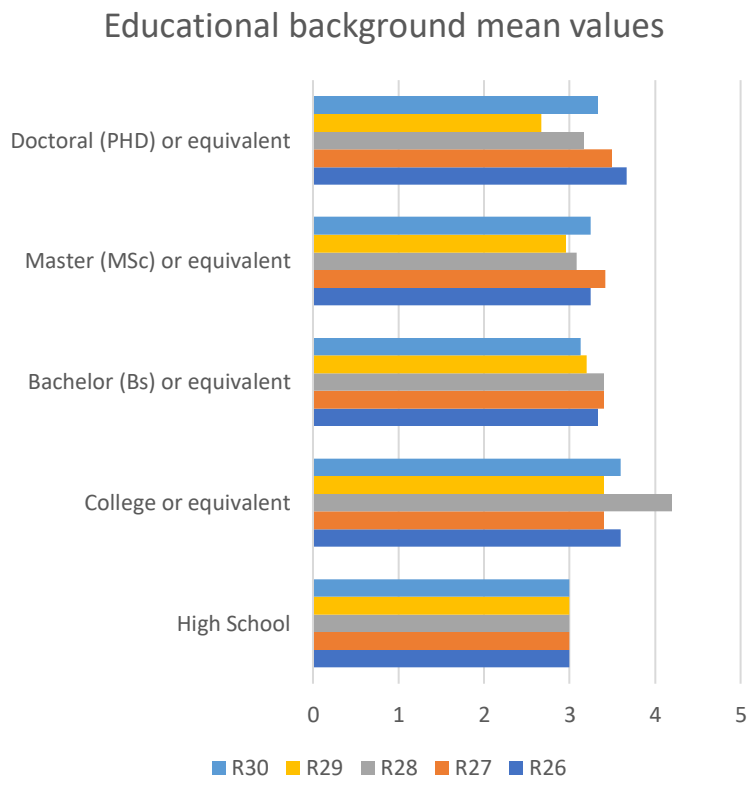
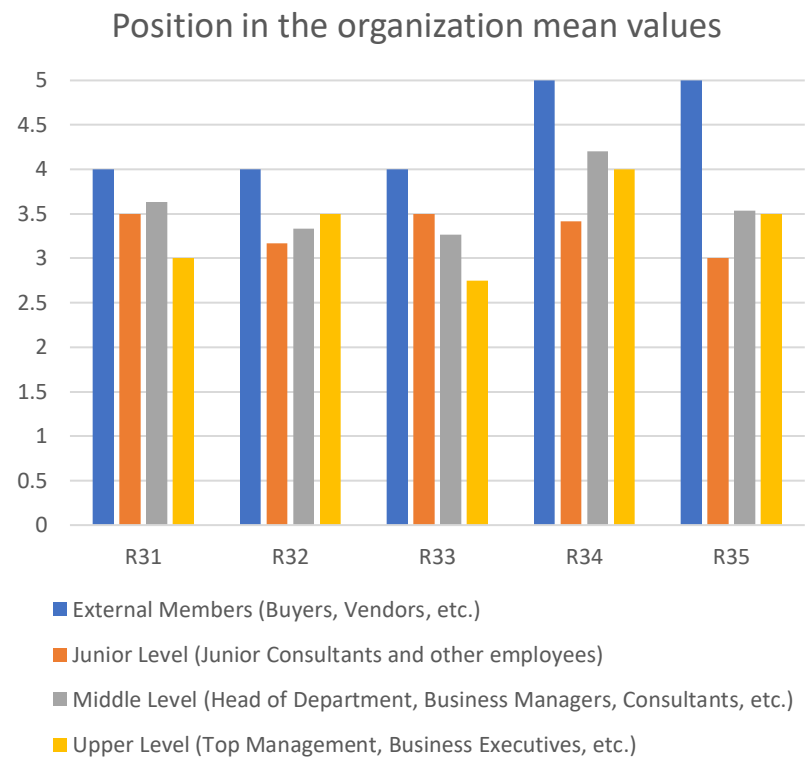


Table 10. Communications & Technical Support

Statement/Question	No Risk Level	Low Risk Level	Medium Risk Level	High Risk Level	Very High Risk Level
Miscommunication regarding the role of the to all or any staff members	4 (8%)	3 (6%)	12 (24%)	27 (53%)	5 (10%)
Lack of culture with shared values and common aims	2 (4%)	4 (8%)	22 (44%)	21 (42%)	2 (4%)
The organization does not promote open communications	4 (8%)	5 (10%)	21 (42%)	16 (32%)	5 (10%)
Adequate testing has not been conducted before the goes live	0 (0%)	5 (10%)	7 (14%)	22 (44%)	17 (34%)
The project team is disbanded when the goes live	6 (12%)	8 (16%)	5 (10%)	22 (44%)	10 (20%)

Indicator	Mean	Std Dev	Likelihood
Miscommunication regarding the role of the to all or any staff members	1,0271	3,510	92%
Lack of culture with shared values and common aims	0,8406	3,333	96%
The organization does not promote open communications	1,0362	3,255	92%
Adequate testing has not been conducted before the goes live	0,9381	4,000	100%
The project team is disbanded when the goes live	0,9381	3,431	88%



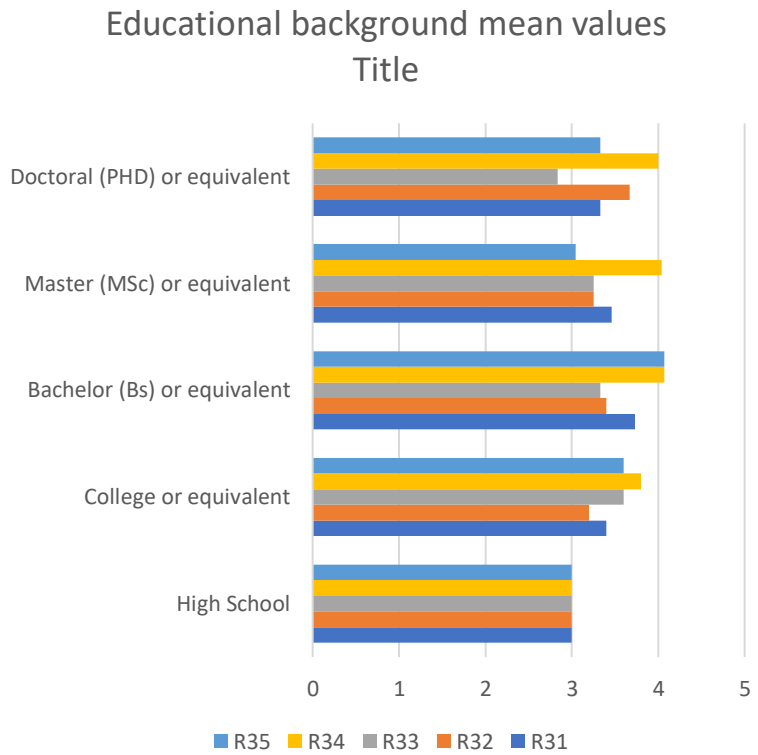


Table 11. Deleted Questions

Number	Questions
Q1	The organization has an open communication and information sharing policies are promoted by the organization (during the implementation phase).
Q2	Enterprise wide culture and structure change is promoted by the executives.
Q3	All employees are aware of the scope, objectives and tasks of the ERP implementation project.
Q4	Training materials and training sessions have been customized for each specific job.
Q5	It is not clear which is the best time period to conduct the training.
Q6	Formal education and training is not provided from the beginning of the business process redesign procedure.
Q7	The overall ERP architecture has not been established before deployment.
Q8	There is a high level of business process knowledge within the ERP entity.
Q9	A demo run has not been performed before the system going live.
Q10	The IT staff is not able to efficiently implement ERP system upgrades.
Q11	The IT staff is not able to analyze the technical impact of proposed system changes.
Q12	A high degree of technical expertise in the IT organization does not exist in the organization.
Q13	Executives do not champion the ERP project.
Q14	Which of the following factors were most important for the vendor selection (select all that apply): 1. Financial situation 2. History 3. Number of previous implementations 4. Support 5. People 6. Other…"
Q15	Which of the following are the most important elements for the project team (select maximum 3 items): 1. IT skills 2. Motivation 3. Past accomplishments 4. Reputation 5. Flexibility 6. Key player involvement 7. (add other...)"
Q16	Key people in the implementation team (select all that apply): 1. Functional personnel and management 2. IT personnel and management 3. Top management 4. IT consultants 5. ERP vendor 6. Parent company employees 7. Management consultants 8. Hardware vendor"