



A Qualitative Study of Risk Mitigation in Enterprise Resource Planning Implementations

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Abstract

Due to a large number of failed Enterprise Resource Planning (ERP) implementations in recent years, these projects are considered a risky endeavor for organizations of all sizes. Given the fact that the majority of research regarding these Critical Failure Factors has been conducted based on large enterprises, small and medium enterprises (SMEs) may be unable to implement the mitigation strategies suggested in these studies. To examine this topic, a qualitative study was conducted with seven SMEs and one large enterprise in various phases of an ERP implementation. In analyzing the data, the results revealed that communication, collaboration, and visibility among all stakeholders within an ERP implementation led to the mitigation of the risks identified in previous projects. Because SMEs make up 99.7% of the employer firms in the United States, it was important to gain understanding on this population, given their constraints and limited research compared to larger enterprises.

Introduction

Depending on the source or survey, researchers have estimated between 70% and 85% of ERP implementations fail based on metrics such as cost, schedule overruns, or overall fit (Ravasan & Mansouri, 2015; Sudhaman & Thangavel, 2015). Stories such as “HP’s Perfect Storm of ERP Problems,” “Definitely Not a Sweet Experience for Hershey,” and “Waste Management Trashes its Fake ERP Software” have outlined how companies have lost millions after implementing a new ERP solution (Conteh & Akhtar, 2015; Mo & He, 2015). In more extreme cases, organizations such as FoxMeyer Drugs and Shane Co. have filed for bankruptcy because of failed ERP implementations (Haddara & Hetlevik, 2016; Joia, Macêdo, & Oliveira, 2014; Love, Matthews, Simpson, Hill, & Olatunji, 2014). Large enterprises can utilize large budgets and pools of skilled resources for an ERP implementation. This is not the case for SMEs. SMEs are represented by a range of inherent characteristics that distinguish them from large enterprises, such as ownership type, structure, culture, and market (Amba & Abdulla, 2014). Concerning the issue of IT/IS adoption, SMEs have been found to be constrained by

limited resources, limited IS knowledge, and lack of IT expertise (Bansal & Agarwal, 2015). Major projects face increased external and internal risks when compared to large organizations. Externally, SMEs are more fragile than large companies and face greater difficulty in obtaining credit (Zach & Munkvold, 2012). Such external risks could lead SMEs to delay the project of ERP implementation or forego it altogether. Internally, SMEs may find it difficult to implement re-engineering projects due to limited resources. Overall, SMEs may face greater challenges in adopting technology as compared to large enterprises given the constraints mentioned above (Zach & Munkvold, 2012).

Chen and Dwivedi (2007) note that company size is significant in comparing ERP implementations of large enterprises and SMEs. The authors go on to explain that a company with 20 employees and a company with 500 employees have different ways of managing their information systems (Chen & Dwivedi, 2007). There are more barriers to an ERP implementation for SMEs than there are for large businesses due to the high capital investment and skilled manpower involved in implementing and operating an ERP solution (Chen & Dwivedi, 2007). Research has shown that some issues are proved to be crucial for small companies but not for large enterprises, such as proper system implementation strategy, clearly defined scope of implementation procedure, proper project planning, and minimal customization of the system selected for implementation (Zach & Munkvold, 2012). In addition to the budget constraint, varying issues have been documented in the case studies of large-scale and SME deployments. Appendix A outlines the top-ten failure factors for ERP implementations for large enterprises and SMEs respectively.

Even though ERP systems were initially developed to run large scale enterprises, SMEs are increasingly motivated to introduce ERP implementations (Upadhyay, Basu, Adhikary, & Dan, 2010). In an SME environment, once approved, a full annual IT budget could be spent on ERP implementation efforts. A survey of manufacturing firms revealed that the ERP investment tends to be relatively heavier for small companies (Upadhyay, Basu, Adhikary, & Dan, 2010). In one study, researchers found that ERP implementation costs, as a percent of revenue, range from 0.82% for large firms to 13.65% for SME firms. One reason for this range in costs as a percent of revenue could be that there are economies of scale working for the larger firms (Bohórquez & Esteves, 2008). In addition to original software and consulting costs, poorly implemented and managed solutions result in a 2% increase in operating costs and administrative costs and add at least one more full-time employee. Given the “hidden costs” of ERP implementations, SMEs must have an understanding of the Total Cost of Ownership of an ERP application before embarking on a project of this magnitude. Figure 1 compares large enterprises and SMEs regarding organization size and initial contracted implementation budgets as compared to the organization’s annual revenue. In analyzing the chart, it can be seen that SMEs have an increased probability of a failed implementation based on the implementation budget and resource availability metrics.

Company	Revenue	Implementation Budget	Percentage of Annual Revenue	Number of Employees
Texas Instruments	\$12B*	\$250M*	2.083%	34,759**
Nike	\$24.1B*	\$400M*	1.660%	44,000**
Waste Management	\$13.6B*	\$100M*	0.735%	44,300**
FoxMeyer Drugs	\$5B**	\$100M**	2.000%	2,700**
SME A	\$100M***	\$1.6M***	2.912%	479***
SME B	\$36.3M***	\$671,985***	3.308%	500***
SME C	\$95M***	\$432,690***	2.674%	390***
SME D	\$30.9M***	\$1.5M***	4.854%	198***

Figure 1: Comparison of Large Enterprise versus SME implementation budgets

Sources

*- Krigsman, Michael. 2013

** - Waligum, Thomas. 2009

*** - Big Three ERP Firm. 2014

In studies conducted in large enterprise environments, successfully implemented ERP applications allow an organization to gain a competitive advantage by saving resources and by responding to the ever-changing business environment (Mahdavian, Wingreen, & Ghlichlee, 2016; Sudhaman & Thangavel, 2015). Additionally, a successfully deployed ERP system can increase customer satisfaction, reduce inefficient spending, strengthen sales and forecasts, reduce inventory turn-around times, and enhance employee productivity (Maas, Fenema, & Soeters, 2014). Because large enterprises have been implementing ERP solutions since the mid-90s, SMEs view an ERP solution as the magic bullet to set them apart from the competition – but this belief is due to their lack of experience and knowledge of ERP implementations. In a recent survey of 122 SMEs, it was discovered that only 32 percent of those that implemented an ERP solution recouped their investment in their ERP application (Krigsman, 2013). In the same survey, the respondents go on to say the main factors were attributed to cost and timeline overruns (Krigsman, 2013). From this survey, it can be seen that failed and improperly planned ERP implementations can have lasting effects on SMEs.

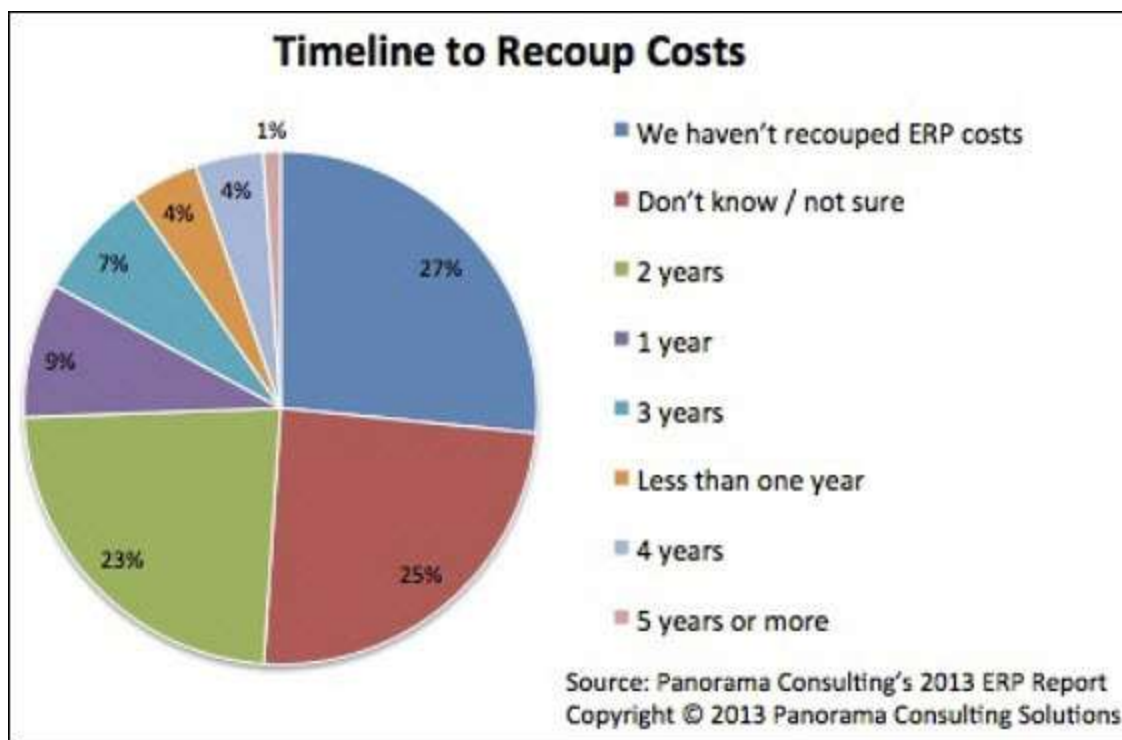


Figure 2: Timeline to Recoup Costs (Source: Panorama Consulting)

According to Huin (2004), unless the differences between SMEs and large enterprises are clearly conceived, the ERP project continue to be “slow, painful, and at times even unfruitful” (p. 516). In researching large enterprises and SMEs, Ondrej and Munkvold (2011) discovered that large enterprises have more successful implementations than SMEs because of ownership type and organizational maturity level. Based on the research of SME ERP implementations, as well as the empirical evidence in various ERP implementation environments, various factors that led to failed ERP implementations in large enterprise and SME environments have been uncovered. In this study, the Critical Failure Factors of SMEs compared to large enterprises and will conclude with how SMEs can mitigate these potential risks throughout the implementation life cycle will be analyzed.

The ERP Life Cycle

Several ERP life cycle models have been reported in the literature to emphasize critical phases and related activities during an ERP project. These models have phases comprising processes of pre-implementation, implementation, and post-implementation (Hustad & Olsen, 2013). From Figure 3, it can be seen that even though organizations follow different standards throughout the ERP Life Cycle, the phases in each standard are somewhat similar in nature. To expand further on these methodologies, Markus and Tanis (2000) developed an implementation project methodology entitled the “Enterprise System Experience Cycle.” This methodology consists of four phases: 1) **The Project Chartering Phase** is comprised of executive buy-in and acceptance, preliminary budget decisions, definitions of business case, and solution constraints; 2) **The Build Phase** involves the configuration of the system, developing a detailed project plan,

preparing the end users for the new system, and getting the end users up and running; 3) **The Shakedown Phase** is critical and involves stabilizing the system, eliminating bugs, and getting the company back to normal operations as quickly as possible; and 4) **The Onward and Upward Phase**, which comprises maintenance of the system, supporting the users, getting results, and upgrading decisions. In the subsequent sections, each phase will be described in more detail.

No	Standard	Phases
1	PMBOK	Initiation, Planning; Executing, Monitoring and Control, Closing
2	ICB IPMA	Initiation, Planning; Executing and Control, Analysis and Correcting action, Closing
3	ASAP	Preparation, Blueprint, Realization, Final preparation, Go-Live and Support
4	AIM	Definition, Operation Analysis, Solution Design, Build, Transition, Production
5	MBS Partner	Diagnostic, Analysis, Design, Develop and Testing, Deploy, Live and Support
6	The Total Solution	The Value Proposition, Reality Check, Aligned Approach, Success Dimension, Delivering Value
7	Fast Track	Scoping and Planning, Visioning and Targeting, Redesign, Configuration, Testing and Delivery
8	GOST	Preparation, Blueprint, Develop documentation, Deploy, Testing, Live and Support
9	ISO 10006	Initiation, Conception, Planning, Executing and Control, Monitoring, Closing

Figure 3: Project Methodologies (Source: Jiang, J.J.; Klein, G. 1999)

2.1 The Solution Discovery background

In the empirical research, most SMEs look at their business application from a tactical perspective and selected a limited solution or a pre-configured plug-and-play solution. This decision causes an organization to build their business process around the application, resulting in many workarounds and processes that need to be performed manually outside of the system. Additionally, as these companies grow over the years, they tend to find themselves with many disparate applications with less than desirable data. When companies realize they have outgrown their current application, they tend to migrate toward the idea of implementing an ERP solution. In a recent study, 68% of SME managers are aware that their success and growth are dependent on a powerful IT solution. Furthermore, 72% believe that flexibility during growth is reliant on the IT landscape (Hustad & Olsen, 2013). In comparison to large enterprises, large organizations can review white papers and publications outlining successful implementations of the large ERP vendors to establish a list of potential partners to review their solutions. Though metrics such as

flexibility and vendor support are vital to both large enterprises and SMEs, Appendix B outlines the differences in decision-making criteria between these two groups.

2.2 The Planning Phase background

After the contracts have been signed, and the project has been scoped, the planning phase begins. Though the initial timeline for the organization has been scoped, only when the company initiates the Project Kickoff engagement with their new partner will they realize the actual project timeline. During an interview, an ERP consultant stated that in his years of experience in engaging in project kickoffs, over 80% of customers have unrealistic deadlines. In a study regarding Critical Failure Factors in Information Systems (IS) projects, one organization stated that the main failure factor of their implementation was due to the underestimation of the project timeline (Momoh, Roy, & Shehab, 2010). Given the fact that the ERP provider performs these types of implementations on a normal basis, the organization could look to this new partner as a liaison to assist them in planning the implementation.

2.3 The Execution Phase background

Based on the premise that the Implementation Execution Phase is the most critical phase of the ERP life cycle, as depicted in Figure 4, the majority of resources, time, and capital will be consumed during this phase. Because of the number of activities performed during this phase, SMEs and large enterprises may break this phase up into sub-phases. In most implementations, the Steering Committee formed during the Solution Discovery phase will be a part of the implementation throughout the life of the project. Though the implementation will consume a significant amount of their time throughout all sub-phases of the Implementation Execution Phase, almost all employees within an SME will be a part of a particular sub-phase of the ERP implementation. In comparing this to large enterprises, because most large enterprises will implement an ERP solution at a site or select sites, a large number of employees will not be included in the Implementation Execution phase but will instead receive training on the new application during the Project Closure phase.

ERP project stage	Selection	Execution	Usage	Total
Common risks	8	10	1	19
Company-specific risks	2	11	6	19
Total	10	21	7	38

Figure 4: Potential Risk Factors by Phase (Source: Hsin Chen and Ching Fang Wu. 2005)

2.4 The Deploy/Project Closure Phase background

Once the dust has settled, and the organization has been operating in their new ERP environment for some weeks, the Steering Committee will usually reconvene to close the ERP implementation. Though the work may be done with the first phase and the project was considered a success, additional phases may be required to ensure the most optimal solution for the organization.

Critical Risk Factors for SME Implementations

In the onsite research and consulting engagements, the research found that some large enterprises and SMEs that have considered their previous ERP implementation a failure. In addition to these new project kickoffs, organizations that have deemed Phase I of the implementation a failure, triggering a “re-implementation” of their existing application. In this section, the reasons why these organizations failed in their ERP implementation efforts will be outlined in detail.

In one study, Costello, Sloane, and Moreton (2007) compared the ERP implementations in large enterprises and SMEs. In this study, the researchers identified the following critical factors that were only apparent in SME ERP implementations:

- Realized Benefits
- Internal Pressures
- IT Sophistication
- IT Infrastructure
- Evaluation Framework

3.1 Solution Discovery Phase

The Solution Discovery Phase builds the foundation for a successful implementation. External forces tend to have more impact on small businesses than they do for large firms. In many cases, a company may adopt a technology due to the influences exerted by its trading partners and/or its competitors, having no relation to the technology and organization itself (Zach & Munkvold, 2012). Without assistance from individuals who have previously performed an ERP implementation, SMEs could potentially be doomed before the project is initiated. Below, potential failure factors are listed that could potentially cause a project to fail before the software contract is signed.

3.1.1 Neglecting to assign a full-time Project Manager to the Project

In some failed SME ERP projects I have been a part of, the Project Management duties have normally been allocated to the Director of IT or IT Manager. Though this individual may be competent to perform these functions, the project may become delayed and run over budget because the Project Manager was continually trying to balance the implementation and his or her daily duties throughout the life of the project. In comparing this approach to successful implementations in large enterprise environments, large organizations will have a Project Management Office (PMO) comprised of certified resources whose main duties are to work on projects within the organization. If these organizations do not have resources with previous IT implementation experience, they will set out to hire a resource with these qualifications. In a survey conducted of 92 firms that considered their project a failure, Figure 5 outlines that two of the top three factors are hinged upon a successful Project Manager.

1	Project Planning
2	Corporate Culture
3	Project Management and Control
4	Business Process and system design
5	IT/IS Professionals
6	Information Technology
7	Users
8	Corporate Management
9	Politics
10	Business Planning

Figure 5: Survey of Top Failure Factors (Source: Eli Hustrad and Aurilla Bechina, 2011)

3.1.2 Lack of expert involvement

During the Solution Discovery Phase, large enterprises will hire or internally assign a resource with extensive experience in various disciplines. This resource will travel to each site, review each process, and communicate with the end users regarding their “pain points” with the current process or software application. Subsequently, the resource will then document the current state and future state to include within the RFP. Ruivo, Oliveira, and Neto (2015) discuss that resource constraints (time, finance, and expertise) in SMEs are based on the concept of the resource-based theory. The resource-based theory emphasizes an understanding of the internal capabilities that enable organizations to secure competitive positions and the importance of internal resources in a company (Ruivo, Oliveira, and Neto, 2015). Though these findings have been uncovered from past implementations, SMEs continue to fail at this process by neglecting to bring in subject-matter experts to review current business processes. To combat the resource constraints of subject-matter experts, some SMEs will bring in any available resource from respective departments because the subject-matter expert must perform his or her daily duties.

Though these resources will be able to discuss and document their current business processes, the process fails during the process re-engineering steps. Because these resources sometimes lack experience within the organization from an end-to-end perspective, they also lack the industry experience to propose suggested business process re-engineering directives. In one SME environment, because this process was not thoroughly covered, the organization selected a solution that did not fit in with the strategic direction of the Board of Directors. Additionally, when a business process review is not conducted in the early phases, companies may find themselves performing this process in the middle of the implementation, potentially causing project schedule and budget overruns.

3.1.3 Settling for “out of the box” solutions

During the vendor review process and sales cycle, some SMEs opt for the “out of the box” option because of the cost aspect as compared to a full ERP implementation. In a large-scale survey of 2,647 SMEs, it was nearly unanimous that IT managers support the view that fit with current processes as the most important selection criterion (Laudon & Laudon, 2012). In their study, Snider, Silveira, and Balakrishnan (2009) outline that compared to large enterprises,

SMEs may rather choose to adapt ERP systems to the business processes by the use of customizations and modifications. Even though IT managers understand the importance of an optimal ERP solution, CFOs and Executive Management incur a knee-jerk reaction when comparing the cost of the solution. Over the last few years, vendors have taken a solution that companies have implemented and have pre-configured these applications to create a plug-and-play solution, stating that the architecture was built based on “best practices” (Chang, Wang Jiang, & Klein, 2013). In their research of large enterprises and SMEs, Zach and Munkvold (2012) found embedding standard business processes based on best practices in many cases will not meet the unique needs of a particular organization. They go on to say finding the right fit between ERP systems and the business processes of the target organization is recognized as critical for successful ERP implementation (Zach & Munkvold, 2012).

In one case study, the end-users slowly began to develop Excel spreadsheets and Access databases to perform their daily processes. This approach ultimately caused the firm’s plug-and-play solution to become a legacy system in less than two years, restricting them from recouping their initial implementation costs. During an interview with the consultant on the project, upon completion of the project, the interviewee stated the efforts to customize an ERP solution to match the organizational best processes far outperforms the option of changing current business processes to match the capabilities of the selected ERP solution.

3.1.4 Management viewing an ERP project as an IT project

In many SMEs, where the executive management has no experience with an ERP implementation, executives view implementations as an IT project instead of a company-wide project. In one study, one researcher concluded that SMEs tend to have insufficient knowledge to implement ERP systems successfully (Garg & Garg, 2013). In a recent study, as seen in Figure 6, it was uncovered that the largest key to avoiding implementation failure is executive buy-in and support. As stated in earlier sections, all departments within an organization will be involved in the implementation, making it critical to ensure the subject matter experts of each department are included throughout the life of the implementation. In reviewing the literature, many researchers state the number-one risk in failed implementations was the lack of top management commitment and support (Ravasan & Mansouri, 2015; Bansal & Agarwal, 2015). In another article, the authors stated, “top management needs to constantly master the continuous standardized benefit realization plans to control ERP outcomes and to fully internalize the benefits of this technology” (Pishdad, Koronios, Reich, & Geursen, 2014, p. 367).

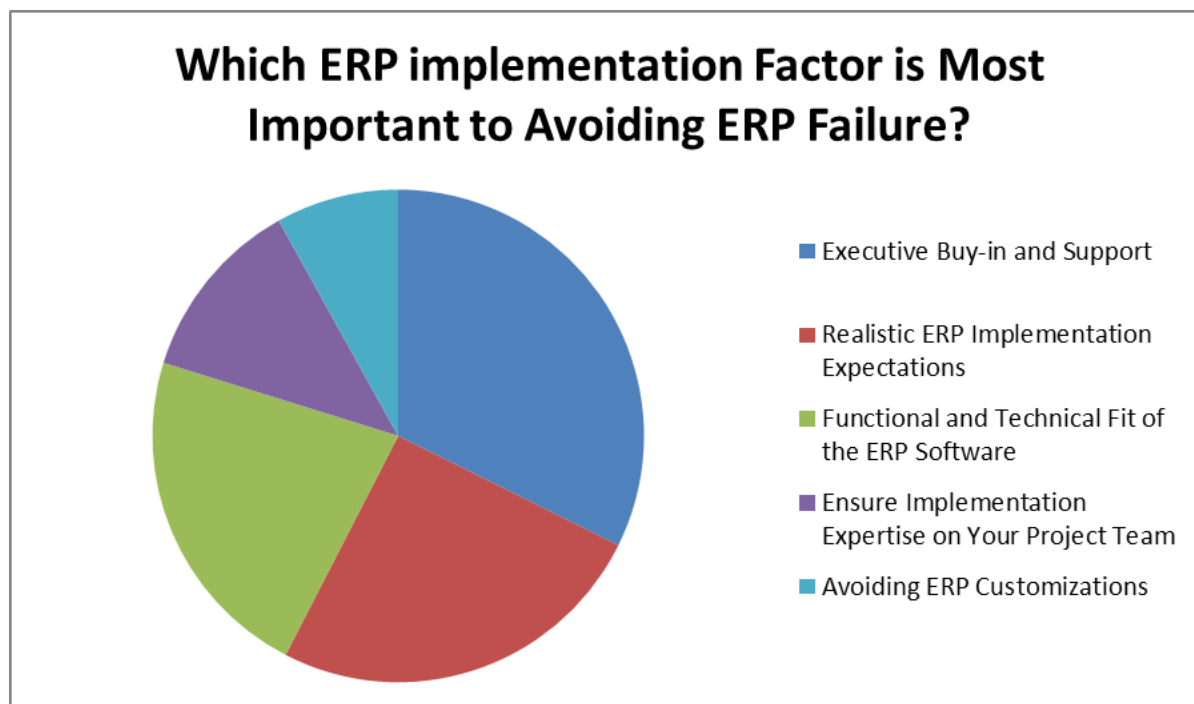


Figure 6: Keys to Avoid Implementation Failure (Source: Panorama Consulting)

3.2 The Planning Phase

During the Planning Phase, risks can arise from a scheduling and budgeting standpoint between the SME and their software provider. Without effective communication between both the SME and the vendor's Project Manager, issues could potentially arise that could span the life of the implementation. Below are failure factors that have been uncovered upon the conclusion of an ERP implementation in an SME environment.

3.2.1 Inaccurately budgeting the project

Though SME implementations may be considered a success at the termination of the project, as outlined in Figure 7, Panorama Consulting estimated that approximately 65 percent of ERP implementations go over budget. In another study, Ravasan and Mansouri (2015) found that SMEs with failed implementations on average spend 178% of their original implementation budget. Because of these statistics, it may be imperative for SMEs to focus additional attention on budgeting during the planning phase. In an interview with a Project Manager for a large enterprise implementing an ERP application, she said "during contract negotiations with our ERP vendor, we worked closely with representatives from our PMO who had previous experience implementing SAP. Because of this experience, they suggested we propose a fixed bid based on the software provider's proposed Statement of Work. Given our current state and future state process was discussed with vendor's sales team, both parties would be accountable for the project budget." Because SMEs sometimes lack organizational structure and ERP expertise, this approach may uncover too many unknowns for the SME, as well as the software vendor. Though this method may not be the proposed approach for some SMEs, Figure 8 outlines three budgeting approaches that have been successfully implemented by SME environments.

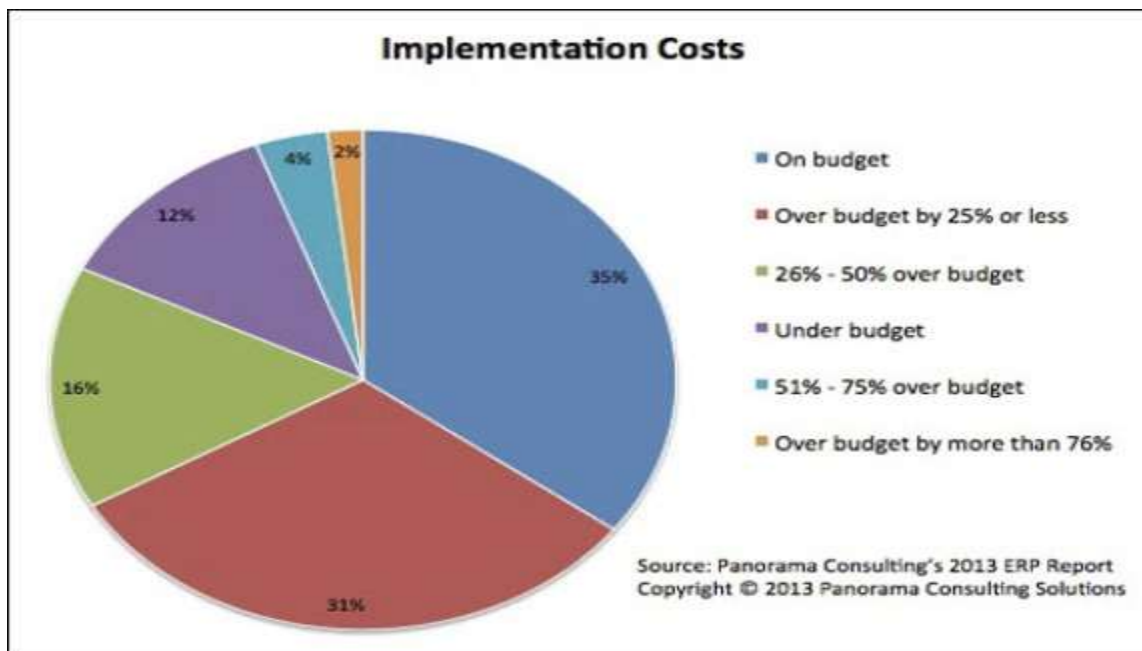


Figure 7: SME Implementation Costs (Source: Panorama Consulting)

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Type of Budget	Purpose	Time to Complete	Detail	Accuracy
Rough Order of Magnitude Budget (ROM)	To provide a general understanding of the range of costs of an ERP. Usually put together during initial strategic discussions of ERP feasibility.	A ROM budget can be assembled in a matter of days by an estimator experienced in ERP costs.	Rough approximations of costs for the major ERP budget categories; few details within the broad categories.	Depending on the experience and skill of the estimator, can be accurate within a range of 30 percent.
Planning Level Budget	To provide detailed ERP project costs and Annual Recurring Cost (ARC) prior to the selection of an ERP provider. Will often be the used as the basis for proceeding or not to the vendor selection phase.	A Planning Level budget will require from 2 to 5 weeks to complete. Much of this time is spent obtaining estimates from suppliers of various project resources.	Detailed estimates of the costs for all ERP budget categories. Will include all possible cost entries for each budget category.	Will be accurate to within 10 to 15 percent of the final budget used to manage the project.
Managing Level Budget	The final budget that will be used to manage the implementation. This budget is not completed until after contract negotiations with the selected ERP vendor(s).	The Managing Level budget may not be complete until the planning phase of the project is complete.	Will have exact figures for software licensing, maintenance, and ERP vendor consulting costs. Will also include cost adjustments for third party software and scope changes based on contract negotiations.	The Managing Level budget will be the most accurate, and should be within five percent of the final project costs, given no scope changes during the implementation.

Figure 8: Types of ERP Budgets Implemented by SMEs (Source: Jama, Ismail 2006)

3.2.2 Depending heavily on the software provider

With the larger, more established software vendors, there is a good probability that the Project Manager for the vendor is handling multiple ERP implementations at a given time. Because of this, the licensee’s Project Manager must be proactive to ensure the project is always on time and on budget. For SMEs, another potential risk in working with the larger ERP providers would be receiving a contractor, either in a Project Management or Consultant role. Though this may not pose a risk for some organizations, if the assigned contractors do not continue to stay current on the functionality of the software provider, this could cause a potential issue for the SME. Additionally, in most applications, the Consultants and Project Managers have worked together in the past, which improves the synergy throughout the life of the implementation.

3.3 The Execution Phase

All of the heavy lifting occurs during the Executive Phase of the ERP implementation. As outlined in section two, because the majority of resources and capital will be allocated during this phase, all parties involved in the implementation must be on the same accord to ensure the success of the project. Though a number of risks may contribute to a failed project, the following risks are the top factors that have attributed to failed ERP implementations based on the research in ERP implementation environments.

3.3.1 Failing to consider additional sites

In multi-site environments, the organization should ensure all sites are considered when setting up processes within the ERP application. In a study of implementations in SME environments, Williams and Pollock (2012) stated that over 50% of organizations implementing ERP software have multiple sites undergoing deployment. In one onsite interview, one consultant stated “in my experience, I have experienced “troubled” environments where the implementation is performed at corporate headquarters or the main facility. Because of this decision, most processes within the ERP application were configured based on that facility’s processes or executive management’s beliefs about the organization’s best practices. Even though outside sites should be following the same Standard Operating Procedures (SOPs), this is sometimes not feasible, as other facilities, primarily non-US sites, may incur different customer, legislative, or cultural requirements.”

3.3.2 Bringing over too much or too little data

When SMEs begin to discuss converting legacy information, most will state they want to convert all information from their legacy and disparate systems. In some cases, this may be feasible, but this situation may ultimately be based on the organization’s requirements, such as governmental and auditing regulations. Though this problem of conversion affects large enterprises more than SMEs, small enterprises could consult with their ERP vendor, outline their requirements, and look to the vendor to provide suggestions on the amount of data to convert into their new system.

An Execution Phase Case Study

During the go-live, the Service Repair department of an SME manufacturer incurred a large amount of new registrations for instruments coming in for repair. Based on the fact that they only converted registrations from 2004 to present, they expected a small percentage of new registrations to be created manually upon reception. After running a report because of repeated complaints by Customer Service, it was uncovered that 65% of new repairs received required a new registration. To quarantine the situation the organization referred to their legacy system and uncovered that all registrations that were being manually converted were sent into the field before 2004, some dating back to the early 90s. After further internal communications, the source of the situation was discovered to be that the Director of Sales released a program outside of their Preventative Maintenance program weeks before the go-live date to encourage customers to send in instruments older than ten years old so the organization could re-calibrate the instrument and replace parts. Because of this new program, the organization made the decision to convert five additional years of data, resulting in less than 5% manual registration creations moving forward.

3.3.3 Lack of End User Training

Based on studies that ranked factors for failed implementations, all studies included end user training within their list of factors (Joia et al., 2014; Mahdavian et al., 2016; Ravasan & Mansouri, 2015). In one article that reviewed the training of end users in an ERP implementation, the authors stated, “(in our study) 50% of the end user training was not carried out mainly due to the lack of computer literacy of the Super Users. This triggered a strong resistance to change for the new system being installed and caused a reduction in employee motivation” (Dixit & Prakash, 2011, p. 83).

3.4 The Deploy/Project Closure Phase

After the long days resolving issues uncovered in a live environment, organizations will close the Financials for the first month on the new system. After all of the numbers tie out, SMEs will look to close Phase I of the project. In SME environments, because implementations can span from six months to 24 months (Bansal & Agarwal, 2015), these organizations tend to believe this is the end. The risk factor outlined below is the key reason why end-users state an ERP implementation could be considered a failure.

3.4.1 Believing Phase I Closure is the end

Once the organization is live and fully operating in the new environment, the Steering Committee may believe the work is over on the overall implementation. On the topic of continuous improvement, the Director of IT for an OEM aerospace manufacturer, stated, “we have a slogan here that the work for improvement will never be done. As the company grows, new ‘opportunities’ will arise, and additional requirements will be gathered and acted upon. Because we support multiple sites, when I hire on a new analyst or programmer, I ensure that they know this job is a never-ending roller coaster because of all the employees we support. In addition to the daily support, we must also provide solutions to changes in processes from our Lean team, as well as the regulatory changes and audits.”

Mitigating Discovery Risk

The objective of this research was to compare risk factors affecting large enterprise and SME ERP implementations, with an emphasis on SMEs. Based on the research and outlined in previous sections of this document it can be seen that organizations large and small have experienced risks throughout the ERP Implementation Life Cycle. In the final part of this paper, the actions SMEs have taken to counter potential risks that may arise throughout the life of the implementation project will be outlined.

4.1 The Solution Discovery Phase

In this phase, it is important to ensure all requirements have been identified before the organization analyzes the application that is the best fit for the company. Because this step is essentially the project kickoff internally, a significant amount of planning must be involved to ensure a successful implementation. Below are steps that have contributed to successful implementations in SME environments.

4.1.1 Conduct a thorough Business Process Review

For the implementation to be successful, the Steering Committee must conduct a Business Process Review. Appendix C depicts an example implementation checklist used by Strategic Systems Group. As outlined in Figure 9, in a study conducted by Panorama Consulting, SMEs surveyed stated the largest sin during an ERP implementation is “insufficiently defining business processes.” With these findings, it can be seen that a large part of the success of the implementation is dependent upon the Business Process Review. During this step, subject matter experts from each department will discuss the current business processes or Standard Operating Procedures for their respective departments. During the business process review, departments will document their current state procedures, then outline future state processes for areas where increased efficiencies can be realized. Beyer and Holtzblatt (1998) developed a method called Contextual Design, which observes and interviews end users in their natural working environment. In performing this approach, an organization will be able to further confirm their current and future state processes, which will be integral throughout the life of the implementation.

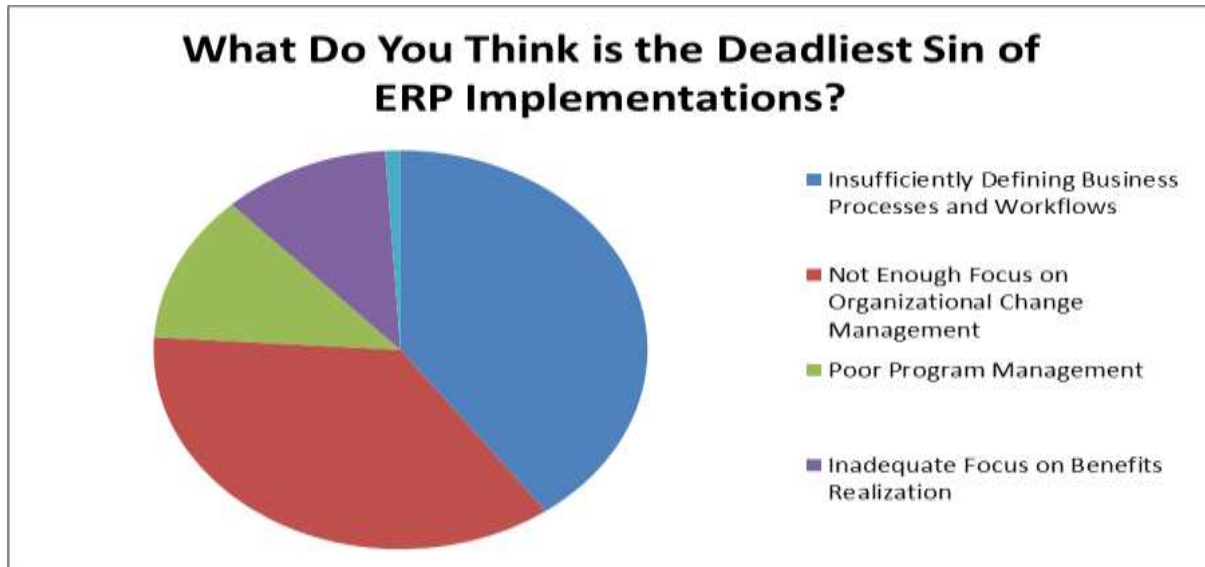


Figure 9: What Do You Think is the Deadliest Sin of ERP Implementations (Source: Panorama Consulting)

4.1.2 Hire an experienced consultant

Based on the fact that the typical life cycle of a business application in an organization is around fifteen years (Muscatello, Small, & Chen, 2003), there is a real possibility that individuals at SMEs do not have ERP-implementation experience. If an organization falls into this category, it is highly recommended that these organizations reach out to an independent ERP consultant to assist them in the software-selection process. In his Technology Diffusion Theory, Attewell (1992) emphasizes the role of external entities (e.g., consultants and IT vendors) as knowledge providers in lowering the knowledge barrier or knowledge deficiency on the part of potential ERP adopters. One thing to note when screening potential candidates is to ensure the selected consultant is impartial to the ERP vendors and has no ties to the vendors performing the demonstrations. Additionally, outside of the consultant having ERP-application experience, the consultant should also have industry experience to assist the organization in deciding how to apply their future state processes to the most viable application.

A Mitigation Case Study

As the pet food manufacturer based out of Connecticut began to grow out of their Sage Peachtree application, they began to look down the avenue of an ERP application. Having no experience with ERP implementations, Blue Buffalo's CFO embarked on a search to hire a consultant to assist them in their journey. After two months of interviews, the organization hired an Operations consultant that assisted Starter Inc. during their start-up days and stayed on board with the organization to ensure their SAP solution was deployed at all facilities. On the Financial side, Blue Buffalo hired a retired Partner from Deloitte – one of the big three consulting firms – to assist the company from an Accounting standpoint. When the CFO was interviewed regarding the decision to hire these outside resources, he stated “ERP software is a different animal compared to Peachtree. Given no one in our organization had experience with the process, we sought out for experts in the field. Once the software was installed, their assistance in our business process involvement and software implementation was a greater investment than the software itself.”

4.1.3 Provide business process scripts to ERP vendor

When organizations enter into the software review process with vendors, the ERP vendors normally have pre-defined scripts, which ensure the demonstration runs without a hitch. When companies are in the final supplier selection phase, companies should deliver demo scripts to these vendors based on their future state requirements – see an example in Appendix D. With these scripts, the SME should require the vendors perform the setup of these requirements during the demonstration and execute transactions in real-time. Using this approach companies have been able to identify the work effort involved in configuring the system to meet their requirements and recognize how many steps will be required to perform the transaction.

4.1.4 Request a proposed project plan from the vendor

In recent years, during the final supplier selection sub-phase, companies have requested the vendor to submit a high-level project plan. This request ensures that the vendor has sufficient resource availability from a consultant standpoint in the areas of Project Management, Technical Support, Operations, and Finance. This approach is a critical step in the process, as all ERP vendors normally have resource capacity limitations from a consultant resource standpoint. An additional mitigation technique that could lead to a successful ERP implementation would be to receive the resumes and request an interview from these proposed resources. Again, working in the consulting industry, an ERP provider's best consultants are generally booked out for months at a time. With this, even though the vendor may have a resource with capacity, the available resource may not be the best resource in that respective discipline.

4.1.5 Request references of customers currently using the application

Once organizations have pared the vendor list down to two or three vendors, the organization should request the vendor provide them with a list of references to contact. After receiving this list, the optimal solution is to ask the reference if the SME could review their operations and see the ERP application in a live environment. Given the vendor will only

provide customers that will praise their product (additionally, these customers normally receive some incentive from the vendor), the visiting organization should prepare a list of questions to ask during this visit to get an indication of the system's true capabilities and drawbacks. During this onsite engagement, the SME should ask the customer about the weaknesses of the application, the vendor's application support, and issues that arose during the implementation.

4.1.6 Rely on the vendor's expertise

During the pricing and licensing process, it is imperative to review the proposed contract submitted by the vendor's Sales Executive. In interviewing a Solution Architect from a big three ERP provider, he stated "this can be a double-edged sword where the customer may believe that the Sales Executive is proposing the purchase of too many licenses. Because of this, the customer would, for example, state that they will have 200 users on the system, but the Sales Executive wrote up the contract based on 225 users. This may, in fact, be a realistic estimate, based on the Sales Executive's experience writing up dozens of contracts annually. One thing I have heard when coming into a project after the sales cycle is a customer stating the Sales Executive pitched a 10% to 15% license discount if they increased their licenses by 10%. From the standpoint of SMEs with continuous growth, this would be a strategic approach to increase licenses at the beginning of the project to avoid additional costs and delays in the future."

4.1.7 Request infrastructure requirements during discovery phase

In interviewing many consultants and IT directors on the topic of why their project was deemed a failure, many responses stemmed back to the assumption that their current servers and infrastructure could handle the increased number of transactions that will occur within one application versus a number of disparate systems. Though potential issues may be uncovered early on in the implementation, when the large amounts of data are loaded into the system, other problems may be uncovered late in the process, potentially delaying the implementation.

The IT Director of a food distributor in New Jersey stated, "we provided the Sales Executive with our current server specifications and asked if this server could handle our application. After conferring with the technical consultants, the Sales Executive was certain our current server could handle the application without issue. After we loaded all of our master data, as well as piloted on the application with some of our modifications, no issues arose. Fast forward to the final pilot when we had all of our mods installed on the application. When each department was hitting the system, there was an increased amount of latency in the system to the point where it was unacceptable to the end users. When I reviewed the server's memory, the ERP application consuming almost 100% of the CPU, compared to 30%-40% in previous pilots. After research with a technical consultant, we were able to uncover that one of the modifications we created were referencing many tables within the system, causing the delay in transaction processing. The only solution to remedy the problem was to buy a bigger server, copy all information over and test to make sure everything is ready in three weeks' time. With that being said, if I would have requested detailed system requirements from the vendor and monitored server activity throughout the implementation, I would have been alerted to the potential issue earlier than three weeks before go-live."

A Mitigation Case Study

After a failed implementation of Oracle's BRM (Billing and Revenue Management) application, a Detroit-based manufacturer began the vendor application-review process once again. During the final review of an Infor product, the company paid for an ERP consultant to come on-site to review their current processes and perform these processes in the system they were reviewing. During this engagement, the consultant was able to refine the company's manufacturing and depot repair processes, which the SME was able to put into place immediately. Aside from the immediate process improvements, after running through all of the current and proposed future processes, the organization was confident that implementation would be successful. Because this organization outlined their processes in the initial phases, this SME was able to implement this new application successfully and slightly under budget.

4.2 The Planning Phase

4.2.1 Establish a "Change Manager"

An ERP implementation requires extensive risk and change management that must be monitored and controlled throughout the life of the project. Because of this, it is important that the Project Manager and/or other key members of the Steering Committee have previous risk-management and change-management experience before embarking on an ERP project. In the event none of the members of the Steering Committee have a risk or change-management experience, it would be feasible to look outside the Steering Committee for individuals with this experience. At a locomotive component manufacturer, the IT manager recounts that he reached out to the Program Manager of his organization to assist him in providing insight into an ERP implementation. The manager stated, "the information the Program Manager provided me was invaluable. Even though his team deals with large-scale deployments, he was able to provide guidance from an SME or divisional standpoint."

4.2.2 Ensure 100% buy-in from the Steering Committee

Based on the fact that the Steering Committee will be the voice of the ERP implementation to other members of the organization, it is imperative that each member be 100% on board with the project. When interviewing an ERP consultant with over 15 years' experience on the subject of member buy-in, the consultant stated that "you will always have a bad apple in the bunch. You will have those individuals who have a fear of the unknown, those who are the experts in their given field that do not want to give up their leverage or job security or those who are resistant to change. Because I can only provide suggestions on how to deal with these employees, I work with these SME to attempt to get them (the employees) on board." When it comes to large enterprises, these companies will usually implement an ERP solution at one site, and will then roll out the solution, processes, and procedures to the remaining sites. Though managers are generally involved in the initial implementation, end users normally do not have buy-in in these large-scale implementations. In these environments, attrition normally weeds out those individuals who are not on board with the change.

4.2.3 Get employees excited about the implementation

Because management may be the only members of the organization knowledgeable of the change within the organization, SMEs have experienced great success of employees embracing the new ERP implementation in various ways. Whether it is with a company picnic or a contest to name the project, making employees aware of what is on the horizon removes the “fear of the unknown” factor once an organization begins training the end users.

4.2.4 Identify high-risk tasks and develop a contingency plan for those tasks

When taking on an ERP implementation, all projects will come with potential risks. As outlined in a previous section, once the project plan has been created, the Steering Committee should meet to outline which tasks could be identified as high-risk tasks that could extend the project timeline or increase the budget. By outlining tasks such as data migration or end-user training as potentially high-risk tasks in the implementation, the project team could identify optimistic, pessimistic, and realistic durations to come up with a more accurate project plan. In doing this during the project plan review process, an organization can lessen the risk of going over budget or extending the implementation timeline.

A Mitigation Case Study

During the implementation planning phase at a northeastern OEM manufacturer, the Steering Committee developed a risk plan with the software vendor’s project manager. With this organization, they identified the following project tasks as high-risk topics:

- Data extraction, scrubbing, and conversion
- End-user training
- Cutover from legacy system to new ERP application

Given this customer added a time buffer and additional contingency plans to the data extraction and end-user training tasks, they were able to keep the project on schedule to the data cutover phase. Based on the project plan, when business ended on Friday, the Steering Committee began extracting data out of their legacy system and setting up tables and parameters in their new application. Once these tasks were completed, the initial plan was for their Business Consultant to arrive early Saturday morning, review the live system, and give a final sign-off before the organization began loading open purchase orders and sales orders. In preparation for his departure to the customer, the organization’s consultant became a part of a supply chain disruption when the tragedy at Los Angeles International Airport on November 2, 2013, caused his flight to be canceled. Because the organization’s IT staff initiated a contingency plan to create a VPN connection for each of their Consultants at the beginning of the project, the Consultant was able to connect to the company’s server to check all configurations, enabling the organization to have a successful cutover to their new application.

4.3 The Execution Phase

Because many tasks will be completed during the Execution Phase, the Project Manager must continually keep a close eye on all resources and duties to ensure implementation success. The factors below are measures I have seen Project Managers put into place to ensure the success of an implementation.

4.3.1 Continually review table setup and parameters

When interviewing one electronics SME on the subject of lessons learned during the implementation, the Project Manager stated, “system configuration is an on-going process, and we had to refer to the project plan to factor in three additional application configuration reviews. Because we were refining and improving our business processes throughout the life of the project, we were tweaking parameters here and there in our test system to provide the most optimal solution. With these changes, every two months, we would compare all tables and parameters in our test systems with those in our production environment, and would make changes accordingly.”

4.3.2 Conduct a project status call on a weekly basis

As organizations are working in a more global and remote environment, weekly status calls with all key team members, departments, and facilities are necessary. The smaller work environment for SMEs can cause these organizations to lose focus on including all key users from all sites in the decision-making process. Because the separate sites could have different processes and procedures, all decisions that have been made during the weekly workshops and discussions should be discussed during this weekly status call.

4.3.3 Institute a Manage By Walking Around Concept

The Management By Walking Around (MBWA) concept has been successfully used by operations for years to uncover operations’ inefficiencies (Goodman, 2014). During a recent ERP implementation, the President of a St. Louis, MO SME introduced the MBWA concept during the cutover and go-live phases. By doing this, each departmental manager observed processes that required further improvement and observed which shop floor employees required additional training during Phase II of the process.

4.3.4 Establish a Voice of the User Concept

For both SMEs and large enterprises, end-user input will be integral in the implementation. Because these employees will be the users performing the transactions within the system on a daily basis, it will be important to listen to their “pain points” to ensure they embrace the new system and do not revert to the old system or manual processes such as Excel spreadsheets. During the “re-implementation” kickoff with a surface material manufacturer, the customer stated that end-user training conducted by the previous project team was non-existent,

causing most of the system capabilities to be underutilized. Because of this, the project plan was composed to include training for the end users at a base level.

4.3.5 Audit, Audit, Audit

During the cut-over plan, most SMEs will have each respective department loading in their open Purchase Orders, Sales Orders, and Journal Entries. As the application is still very new to the end users, it is imperative to audit all open order transactions before cutting over to the new system. Once the organization is live on the new application, each department head should spend time auditing each transaction once created, as well as reviewing each transaction before it is received, invoiced, and posted. As for large enterprises, these enterprises normally have a team of IT personnel at each site which will be assigned to audit these transactions for accuracy instead of department heads, as at SMEs.

4.3.6 Perform Physical Inventory before loading On-Hand Quantities

There is a common saying in the ERP world of “garbage in, garbage out.” In this particular discipline, if inaccurate and corrupt data is loaded into the system, undesired results will arise. Outside of master data, which is loaded into the system, on-hand inventory balances will be loaded into the new ERP system. In some SME environments, organizations will go from a periodic inventory method to a perpetual inventory method. In this particular environment, performing a physical inventory before cutting over to the live environment will be one of the most important tasks to be performed before go-live. Though some SMEs may be moving from a perpetual inventory environment, it still may be integral to perform a physical inventory before loading inventory balances. When one consultant was asked about performing physical inventories before go-live, she explained “I always talk my customers into performing a full physical (inventory) before go-live because once you begin to load corrupt data into the system, it begins a domino effect which causes companies to start chasing their tail from day one. Another issue this causes is end users lose confidence in the data integrity of the system early on, which will cause them to continually refer to the legacy system for data.” When comparing SMEs to large enterprises, given large enterprises have requirements from banks and auditors to perform cycle counts and full physical inventories, if large enterprises can provide proof that the last physical inventory and cycle counts returned minor discrepancies, they may forego a full physical inventory and perform cycle counts on their fast-moving and high-value items.

4.4 The Deploy/Project Closure Phase

4.4.1 Plan for Phase II tasks before the Closure of Phase I

As stated above, even though the project was deemed a success does not mean the work is done. When one Project Manager was interviewed during the Project Closure meeting, she stated “because many requests and issues arose during the End-User Training, the Steering Committee was in agreement that we must decide which issues are go-live critical and which could be pushed to Phase II. Because the end users were and are still familiarizing themselves, many requests were pushed to Phase II to ensure they would still be an issue once the users become comfortable with the system. It is just like a new job, there will be many things you dislike about your new job once you start, but once you become familiar with them and perform those processes over and over, the steps become second nature.”

4.4.2 Perform a “Lessons Learned” Assessment during the Project Closure Meeting

As the project comes to a close, the Steering Committee should perform a “Lessons Learned” Assessment to outline things that were done successfully, as well as things that could be improved upon. Also during this meeting, the team will discuss next steps in the project such as implementing modules that were not implemented in the first phase, as well as potential modifications that could be performed during the second phase.



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Appendix A: Top Failure Factors in Large Enterprises and SMEs

Issues mentioned in the literature	Number of instances cited in the literature	Percentage contribution of each issue	Cumulative percentage of issues
1. Education & training	8	12.30%	12.30%
2. Top management support	7	10.76%	23.06%
3. Project management	5	7.69%	30.75%
4. IT maturity	4	6.15%	36.9%
5. BPR	4	6.15%	43.05%
6. Team composition	3	4.61%	47.66%
7. User involvement	3	4.61%	52.27%
8. Infrastructural facility	2	3.07%	55.34%
9. Economic status	2	3.07%	58.41%
10. Govt. regulation	2	3.07%	61.48%

Failure Factors in Large Enterprise Implementations (Source: Upadhyaty, Parijat, et al. 2010)

Issues mentioned in the literature	Number of instances cited in the literature	Percentage contribution of each issue	Cumulative percentage of issues
1. Education & training	7	10.76%	10.76%
2. Clearly defined goal and scope of implementation	6	9.23%	19.99%
3. Team composition	5	7.69%	27.68%
4. Top management support	4	6.15%	33.83%
5. Proper project planning	4	6.15%	39.98%
6. Minimal customization	3	4.61%	44.59%
7. Proper implementation strategy	3	4.61%	49.20%
8. Data accuracy	3	4.61%	53.81%
9. Role of external consultant	3	4.61%	58.42%
10. User involvement	3	4.61%	63.03%

Failure Factors in SME Implementations (Source: Upadhyaty, Parijat, et al. 2010)

Appendix B: Differences in Decision-Making Criteria

		Very important (percentage)	Important (percentage)	Rather unimportant (percentage)	Irrelevant (percentage)
Increased Customer Satisfaction	Small/medium companies	26.3	42.1	26.3	5.3
	Large companies	45.4	35.1	14.4	5.2
Process Improvement	Small/medium companies	31.6	47.4	21.1	0.0
	Large companies	52.0	40.8	6.1	1.0
Increased Organizational Flexibility	Small/medium companies	31.6	42.1	21.1	5.3
	Large companies	49.0	38.8	9.2	3.1
Improved Innovation Capabilities	Small/medium companies	11.8	29.4	52.9	5.9
	Large companies	20.6	40.2	29.9	9.3
Guidelines from a Controlling Company	Small/medium companies	10.5	21.1	10.5	57.9
	Large companies	24.2	18.9	15.8	41.1
Customer and Supplier Needs	Small/medium companies	5.3	10.5	26.3	57.9
	Large companies	12.4	20.6	27.6	39.2
Short Implementation Time	Small/medium companies	36.8	57.9	5.3	0.0
	Large companies	29.9	51.5	13.4	5.2
Adaptability and Flexibility of Software	Small/medium companies	68.4	26.3	5.3	0.0
	Large companies	49.5	44.3	5.2	1.0
Operating System Independency	Small/medium companies	15.8	26.3	52.6	5.3
	Large companies	30.9	39.2	23.7	6.2
Internationality of Software	Small/medium companies	31.6	10.5	26.3	31.6
	Large companies	37.8	30.6	19.4	12.2
Good Support	Small/medium companies	42.1	57.9	0.0	0.0
	Large companies	58.8	37.1	4.1	0.0
Market Position of Vendor	Small/medium companies	16.7	55.6	11.1	16.7
	Large companies	35.1	48.5	14.4	2.1

Sample Enterprise Decision Criteria (Source: Edward Bernroider and Stefan Koch 2000)

Appendix C: Implementation Checklist

Implementation Checklist

Has your organization made the decision to implement a new ERP application?

- ✓ *Why* are you implementing a new ERP application? What are the driving factors?
- ✓ Have you identified the most important business reasons for implementing a new application?
- ✓ Has an evaluation and/or analysis of various ERP applications been conducted?
- ✓ Have stumbling blocks to beginning an implementation project been identified?
- ✓ What are the deciding factors to move forward with the implementation?
- ✓ What are the final expectations of an implementation project (functionality, technology, performance)?
- ✓ Has sufficient time been allocated to the project during the implementation?
- ✓ How long do you expect the implementation project to take?
- ✓ Has a budget been drafted or approved for the project? What does that budget cover?

Who and what do you need for an implementation?

- ✓ Project Manager

This person must create and manage the project schedule, tasks and communication.

- ✓ Implementation/Core Team

The core team should consist of a cross functional group that understands your business, the project goals and knows the history of the organization.

- ✓ Systems

Determine what systems are required to support the new application. What interfaces are required to other applications?

- ✓ Business Processes

Verify that current processes are documented. These will be the baseline to determine how well the new application meets your business requirements and how the new application will impact current processes.

What will the project team do?

✓ **Scope Management**

The scope of the project should be defined before it begins (for example, will BOMs be changed as part of the implementation, will Service be implemented, etc).

✓ **Communication**

The project manager must coordinate communication between team members to ensure that all parties know what is expected of them and when tasks / assignments are due.

✓ **Risk Management**

If the scope of the project changes, determine the associated risk (will the timeline or budget be affected).

✓ **Business Process Impact Analysis**

Determine how business processes will change with the new application (tasks may no longer be required or work flows may changes)

✓ **Process Ownership**

The core team should take ownership of their functional areas. This ownership encompasses communication, coordination with subject matter experts (SME), and using their insights to identify how new functionality or processes will affect other departments and/or business processes.

How will the project team achieve a successful implementation?

✓ **Functional Overview Training**

This is the initial, guided tour through the application for the core team. It facilitates several activities – learning about the new application, identifying/documenting high-level gaps, identifying/documenting business process changes, and more. . .

✓ **Formal Training**

During this phase, each functional area receives formal training. It normally includes key users who are part of the implementation team and are subject matter experts (SME). Formal training should include hands-on workshops.

✓ **Pilot Testing**

This is one of the most significant areas of the implementation and is conducted at two levels: 1) functional area, 2) cross functional teams. It allows testing new functionality, identifying business processes changes, proposing solutions, validating proposed business processes changes, and more.

✓ **Documentation**

One of the most valuable tools that the implementation team can have is documentation that is customized to fit your business environment. Normally, this is accomplished by each functional team validating and documenting their business processes through the testing phase.

✓ **Data Migration**

'Clean' data is another of the more significant requirements to a successful data migration. The data migrations should be coordinated with pilot testing and user training.

✓ **User Training**

This step is generally at the end of the implementation process, shortly before go-live. This training should be conducted by the implementation team using the documentation created by the implementation teams. User training is best conducted after all business processes have been tested and validated, and after all customizations are in place. ⁶

Implementation Checklist (Source: Strategic Systems Group, Inc.)

