

**A Study Of Prerequisites For Successful ERP
Implementations From The Project Management
Perspective**

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Abstract

For

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Difficulties with implementations of Enterprise Resource Planning (ERP) software are widely documented. A review of selected literature published between January 1995 and May 2001 identifies fifteen prerequisite elements that can facilitate successful ERP implementations. These elements are related to specific project management problem areas, using grounded theory coding analysis and constant comparison. Results of the analysis are presented for project managers as a list of recommendations related to project scope, quality, time, cost and expectations.

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Introduction and Brief Purpose

According to O’Leary, Enterprise Resource Planning (ERP) systems are “computer-based systems designed to process an organization’s transactions and facilitate integrated and real-time planning, production, and customer response” (O’Leary, 2000).

ERP serves as an information backbone for a company’s core business processes (Forger, 2000; Campbell, 2000). Given the importance of such a system, more and more companies have been implementing ERP software products of one kind or another, making them one of the fastest growing segments of the business-software industry (Plotkin, 1999). ERP software now makes up the largest portion of corporate information technology (IT) budgets (Cissna, 1998; Artner, 1999; Somers & Nelson, 2001).¹ Looking ahead, AMR Research anticipates compound annual growth rate of 32% for ERP software suites, with annual sales topping \$66 billion by 2003 (Forger, 2000).

Based on 1999 revenues, top providers of ERP software include Oracle, SAP, BAAN, J.D. Edwards, PeopleSoft, etc. (Planet-Wide Research as cited in MSI, 2000; O’Leary,

¹ All sources claimed that ERP applications were the largest component of corporate IT budgets, by citing other research media statistics. While attempting to verify these statements, this researcher discovered that the statistics came from research firms, which would not release the original research without a fee. Therefore the researcher was unable to verify the statistics. However, since three separate sources cited similar claims, this researcher decided to include the citation because it indicates the significance of ERP in the corporate IT arena.

Cissna cited from Allen Davis & Associates, AMR Research Inc., the MERIT Project, Grocery Manufacturers of America. Artner cited from AMR Research. Somers and Nelson cited from AMR Research as well.

2000). Unlike many other types of software, purchasing ERP is only the very beginning of putting it in place (Turbide, 1999). ERP systems are very complex, often built on thousands of database tables (Koch, Slater and Baatz, 1999). There are often dozens of modules containing hundreds, if not more, configuration decisions that need to be made before an ERP program can be used. Its implementation can be a long and painful process (Macvittie, 2001).

The purpose of this study is to examine prerequisites for successful implementations of Enterprise Resource Planning (ERP) system from the project management perspective. A literature review resulted in identification of selected research papers, books, journal articles and surveys published from January 1995 to May 2001, each of which examines the factors critical for success in ERP implementations. Literature is analyzed using grounded theory analysis, accompanied by constant comparison, as defined by Strauss and Corbin (1994). Data analysis results in tables and analysis of fifteen prerequisite elements identified by the literature and their categorization into specific project management problem areas. Conclusions are presented for project managers as a list of recommendations related to project scope, quality, time, cost and expectations.

Full Purpose

The success of an ERP implementation can be defined in two ways. First, an implementation is considered successful if it meets the initial project requirements for going live, such as meeting deadlines, staying within budget and achieving system performance as expected (Robey, Ross and Boudreau, 2000).

The second and ultimate definition of a successful ERP implementation is the cost-effective integration of complete business processes (Macvittie, 2001) using information technologies. Companies satisfied with their ERP software often list dozens of productivity enhancements, including process automation, improved efficiency, tighter integration, as well as elimination of bottlenecks and duplicative procedures (Plotkin, 1999).

However, the reality is that most ERP projects do not appear to be delivering their promises. One survey of over 50 European companies revealed that an overwhelming 92% were dissatisfied with results achieved to date from their ERP implementations (PA Consulting, 2000). Other statistics show that more than 70% of ERP implementations fail to meet stated objectives (Brown, 2001; Buckhout, Frey and Nemec, 1999).

To make things worse, the cost of implementing an ERP system is very high (Jeffrey, 2001; O'Leary, 2000). And unfortunately, money is not all that is lost when an implementation fails. A company's well-being is often adversely affected by a failed

ERP implementation. One \$5 billion pharmaceutical went bankrupt, pointing to its failed ERP implementation as the primary cause because the ERP system had crippled the business (Brown, 2001).

One of the most commonly-cited reasons for failure is poor project management during implementation. The British Computer Society reports that in a survey of the 1027 IT projects, including ERP, only 130 (12.7%) were successful. Main causes of failure reported in order of importance include poor management scope, poor project management and poor change management (The British Computer Society, 2000).

Specifically, the symptoms of ERP implementation problems include falling short of expectation, over budget and behind schedule (Forger, 2000). These parallel the problem areas that project management principles address.

In order to address these problems, the purpose of this research paper is to relate aspects of project management to selected prerequisites for ERP implementation success.

According to Kulik, an attempt to understand why projects succeed is a worthwhile effort because it will help increase the chance of success of future projects (Kulik, 1997).

To accomplish this goal, this researcher employs literature review as the research method to identify existing publications in areas “collateral to” the area of this study (Leedy, 1997, p. 71). Selected research papers, book, journal articles and survey results published from January 1995 to May 2001 are analyzed using grounded theory analysis. Most

resources selected are located online because 1) they are timelier and much more accessible, as well as the fact that 2) very few books and academic research papers are available on the topic of ERP implementations.

Databases searched include University of Oregon library electronic resources such as Business Source Elite. This researcher also searched Association of Computing Machinery (ACM) library and www.elibrary.com. Internet search engines such as www.google.com are used to find other related material. In addition, specialized ERP resource web sites such as ERPSupersite, ERPAssist, ERPCentral and ERPWorld serve as portals to many published reference articles. Books are found using University of Oregon library catalog and online bookseller www.amazon.com. During the data collection process, terms such as enterprise resource planning, ERP implementation, ERP project management, ERP implementation and project management and software implementation are used as key words to search for relevant publications.

The initial search produced over 60 sources. A closer review identified around 20 that directly discuss the relationship between ERP implementations and project management. Data collected are subjected to analysis as part of grounded theory research design defined by Strauss & Corbin (as cited in Leedy, 1997). Using grounded theory, literature is initially reviewed to identify a list of prerequisites for successful ERP implementations. Afterwards, this list is grouped into specific project management problems areas – scope, time, cost, quality and expectations according to the definition of project management by the Project Management Institute, Inc. (1996). Finally, the results of categorization are

summarized and the role of project management behind these success factors is analyzed. Data collection and analysis are discussed in detail in the **Method** section of the study.

The result of the study includes: (1) a table listing fifteen prerequisites elements for successful ERP implementations identified by the literature, which are then (2) categorized into project management problem areas, and (3) an annotated list of recommendations to ERP implementation project managers.

The general audience for this research paper includes IT managers, project managers and business managers. The specific audience is managers of ERP implementation projects. These managers can be from both inside the organization, and outside, such as consultants hired to implement the ERP system. The recommendations produced as a result of this study are expected to provide guidance to these managers as they plan to implement an ERP system and to help them succeed in the implementations.

Limitations to the Research

Since ERP systems are cross-functional by nature (O’Leary, 2000), their impacts on the organizations implementing them can be quite extensive (Boudreau, 1999). Many studies are available on the topic of ERP software and its implementation. Perspectives include project management, change management, knowledge management, communication, risk management, training, data conversion, etc. (Kræmmergaard and Møller, 2000; Welti, 1999). This study focuses on the perspective of project management, because of its important role in achieving overall success in an ERP project (O’Leary, 2000; Welti, 1999; Desai, 1997).

Before discussing project management theories, it’s necessary to define the term **project**. Gray and Larson state in *Project Management – The Managerial Process* that a project is “a complex, nonroutine, one-time effort limited by time, budget, resources and performance specifications designed to meet customer needs” (Gray and Larson, 2000, p. 4). This definition of project is important because it helps to identify the part of an ERP implementation that is the focus of the study.

Project management is defined in *A Guide to Project Management Body of Language* (Project Management Institute Inc., 1996, p. 6) as the “application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project. Meeting or exceeding stakeholder needs and expectations invariably involves balancing competing demands among:

- Scope, time, cost, and quality.
- Stakeholders with differing needs and expectations.
- Identified requirements (needs) and unidentified requirements (expectations).”

The perspective of this entire study is based on this particular definition of project management, which serves as the theoretical framework for this researcher’s analysis of ERP implementation success factors.

Success of ERP implementations can be defined in two ways. According to Plotkin, the ultimate measure of success for an ERP implementation is the value that the system adds to the organization (Plotkin, 1999). However, before this ultimate success can be achieved, the ERP system has to be operational. Therefore, another definition of ERP implementation success is the satisfaction of the initial project requirements for going live, such as meeting deadlines, staying within budget and achieving system performance as expected (Robey, Ross and Boudreau, 2000). This researcher adopts the second definition for the purpose of this study. The reason for this limitation is two-fold:

1. It’s arguable when an ERP implementation actually ends (Deloitte Consulting, 1998; PA Consulting Group, 2000), and, given this fact, whether or not it should be considered a project. However, since the implementation stage before the ERP system goes live *is* a finite period of time, it meets the definition of a project.

2. As revealed in the literature, project requirements in this stage more directly correlate to the problem areas that project management is set out to address, most notably, the triple constraint of projects – scope, resources and schedule (Gray and Larson, 2000).

Based on the above limitations on the scope of this study, the selection of literature cited or referenced is guided by its relevance to ERP implementation process with project management emphasis. Other perspectives are not discussed. Under this criterion, around 20 research papers, books and journal articles are selected.

Furthermore, this researcher limits the inclusion of literature to the time period from January 1995 to May 2001. This date range was chosen to provide the most up-to-date and relevant information concerning approaches to ERP implementation. Another reason for selecting this date range is the difficulty of locating ERP resources online prior to 1995 because of the frequency of web site updates.

Problem Area and Significance

Information Technology project failures have been widely documented in the press. Starting in 1995, The Standish Group has been conducting research studies on IT application development projects, titled “CHAOS”. Project success was defined as “completed on-time and on-budget, with all features and functions as initially specified”. The 1995 study of 8,380 projects showed that 83.7% of them failed one way or the other. In 1998, the study expanded to 23,000 projects, the failure rate was 74% (The Standish Group Inc., 1995; Kenagy, 2000).

A more recent study conducted by the British Computer Society in 2000 reported similar results. In this study, “success was defined as delivering to the sponsor everything specified to the quality agreed on or within the time and costs laid out at the start”. (The British Computer Society, 2000, online). Out of 1,023 projects, only 130 were successful according to survey respondents, which amounted to an 87.3% failure rate (The British Computer Society, 2000).

Although ERP projects were not the only focus of the studies cited above, they are susceptible to problems because they play a significant role in the corporate IT arena, according to these statistics:

- “ERP applications make up the largest portion of IT budgets: 39 percent of large companies and 60 percent of smaller companies are deploying ERP systems. (Cissna, 1998, online¹)
- “According to AMR Research, almost half (43%) of all application spending at corporate IT departments is for ERP implementations.” (Artner, 1999, online¹)

In fact, problems with initial implementation of ERP have been widely reported (Buckhout, Frey and Nemec, 1999). Since the goal of installing an ERP system is to transform and integrate a company’s overall business processes, complete successes are difficult to achieve, while failures are extremely costly (Macvittie, 2001). The following news report is an example of what can happen when an ERP implementation does not deliver as promised:

“Nike officials said an i2 supply-and-demand-planning application didn’t perform as expected, resulting in shortages of some footwear models and excess stock of others.

Executives at i2 (stock: ITWO), however, maintain that the problem was caused not by the software itself, but by Nike’s customized implementation.

Regardless of who’s to blame, the resulting inventory shortages will reduce Nike’s fiscal third-quarter sales by as much as \$100 million. Earnings estimates for the quarter, which ended this week, have been cut to 34 to 38 cents per share from 50 to 55 cents.” (Wilson, 2001, online)

Despite the challenges, IT projects, and in particular, ERP implementations, are moving forward. The situation helps to explain the high growth rate of the ERP software market. Many companies still see clear benefits of an ERP system. As mentioned in a Harvard Management Update article, “ERPs have near-magical effects when they work as promised”:

“Managers at other companies list dozens of productivity enhancements from ERPs, including the ability to calculate new prices instantly when a single component in a product is changed; more accurate manufacturing-cost comparisons among different facilities; better electronic data interchange (EDI) with vendors and suppliers; more detailed forecasting; rapid delivery of custom quotes for special orders; and the elimination of bottlenecks and duplicative procedures.” (Plotkin, 1999, online)

Such contrast between success and failure, as well as the high costs associated with ERP systems has prompted managers to search for factors contributing to ERP implementation success (Mendel, 1999). Meanwhile, people who have been through ERP implementations have been writing about their experiences and detailing the lessons learned. According to Willcocks and Sykes, “critical success factors, and reasons for failure in ERP implementations, have now been widely Researched”(Willcocks and Sykes, 2000, p.32).

Although a fair amount of literature is available on the topic of ERP implementations, very little research has been done to predict initial and ongoing ERP implementation success from any theoretical perspective (Brown, Carol and Vessey, 1999).

This researcher seeks to identify ERP implementation success factors from the project management perspective, subject to the limitations outlined in the **Limitation to the Research** section. Significant benefits can result from analyzing ERP implementation from this theoretical perspective because of the close alignment between symptoms of ERP implementation failures and the problem areas that project management discipline addresses. According to Gray and Larson, “Quality and ultimate success of a project are traditionally defined as meeting and/or exceeding the expectations of the customer and/or

upper management in terms of cost (budget), time (schedule), and performance (scope) of the project “(Gray and Larson, 2000, p. 63).

ERP implementation failures often demonstrate the inability to meet these expectations. Another study by The Standish Group on ERP projects implemented in companies with over \$500 million in annual revenue found that many of them had failed to achieve their goals. What was used to define failure coincides with the problems that project management is supposed to solve. Table 1-1 demonstrates this relationship as well as the outcome of The Standish Group study.

Table 1: Symptoms of ERP implementation failures

Stakeholder Expectations	Project management problem areas	Results of ERP implementations
Stay within budget	Cost	178% cost overrun
Finish on schedule	Time	230% longer
System performs well	Scope	59% less than expected

Source: Buckhout, S., Frey, E. and Nemeč J., 1999²

² The results of this Standish Group research as cited by Buckhout, S., Frey, E. and Nemeč J. have been confirmed by the researcher via e-mail correspondence on June 20, 2001 with:

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Method

The research method of literature review (Leedy, 1997) is employed to assist the researcher in addressing the purpose of this study, which is to relate prerequisites for a successful implementation of ERP system to project management problem areas. Since the purpose is to extract and examine existing points of view, a grounded theory analysis of literature on the subject is the most feasible approach.

Data Collection

Literature searches are conducted using the following channels:

- University of Oregon (UO) online catalogs
- UO electronic journal databases, such as Business Source Elite;
- Association of Computing Machinery (ACM) library (www.acm.org);
- Electric Library (www.elibrary.com);
- Internet search engine Google (www.google.com)
- ERP resource web sites (www.ERPSupersite.com, www.ERPAssist.com, www.ERPcentral.com and www.ERPWorld.com).
- Online bookstores (www.amazon.com and www.bn.com)

Data collection focuses on research papers, journal articles, books, surveys and white papers. To be included for review, items must pass the initial steps of content analysis,

which is a process to ensure that the data are related to the problem area of this research (Krippendorff, 1980).

Candidates of relevant materials are uncovered first by a search for key word and phrases, including the following list. These are used to produce a broader list of references. Several of these key words are added during the search process, by virtue of being the subjects or keywords of articles pertinent to the study.

- Software implementation
- Software projects
- ERP implementation
- Enterprise resource planning
- ERP projects
- ERP project management

In addition to key word searches, several pieces of literature have been identified because they are in the bibliography of other relevant articles.

After the initial search, the researcher reviews each candidate article to determine whether and how to use it in the paper, by testing it against the following criteria:

- Does the article discuss implementation of ERP systems and either the requirements for success or the factors that may lead to failure?

- Is the focus of the article on the project management aspect?

If the answers are affirmative to both questions, then the article is presented in the **Review of References** section of the research paper. Otherwise, either the relevant content is cited in the study to provide background or no content is used at all.

Data Analysis

Literature review is qualitative in nature. According to McMillan & Schumacher (1993), “qualitative data analysis tends to be primarily an inductive process to organizing data into categories and identifying patterns (relationships) among the categories” (Leedy, 1997, p. 165).

Within this qualitative research framework, this study uses a data analysis method based on grounded theory design, including the process known as constant comparison. In general, Strauss & Corbin describe grounded theory design as “a way of thinking about and conceptualizing data” (as cited in Leedy, 1997, p. 163). More specifically, Leedy defines grounded theory as “qualitative research studies aimed at deriving theory through the use of multiple stages of data collection and interpretation” (Leedy, 1997, p. 111). However, it is not the goal of this paper to derive theory. In fact, this researcher utilizes only the coding types, which are the preliminary steps, of grounded theory method to analyze data collected.

According to Struss & Corbin (as cited in Leedy, 1997, p. 164), grounded theory analysis consists of three major coding steps:

1. **Open Coding** – “. . .breaking down, examining, comparing, conceptualizing, and categorizing data”. In this study, this is the step of combing through the data and compiling an emergent list of prerequisites for successful ERP implementations.
2. **Axial Coding** – Putting data back “in new ways after open coding by making connections between categories”. Once compiled, the list of prerequisites is grouped into specific project management problems areas – scope, time, cost, quality and expectations. In this study, this step also includes summarizing the results of categorization and analyzing the role of project management principles behind the success factors. However, since much of the axial coding process is rather speculative, this study presents only the initial phase of this step.
3. **Selective Coding** – “. . .selecting the core category, systematically relating it to other categories, validating those relationships, and filling in categories that need further refinement and development”. Since this step leads toward the goal of building theory, this researcher adopts only the very beginning of this coding in the form of the development of recommendations.

While going through these coding steps, a constant comparative approach to analysis is used. According to Leedy, this method is the “continual process of comparing data segments and data codes within and across categories” (Leedy, 1997, p. 164). This researcher constantly compares each piece of literature read with a piece that has been previously reviewed to attempt to find the common ground between the ERP success prerequisites mentioned.

Data Presentation

Results of the analysis are presented in two tables. The first lists the prerequisite elements and their sources identified in the selected literature. The second shows the categorizations of these identified prerequisites into project management problem areas of scope, quality, schedule, cost and expectations. As a summary of data analysis, this study explains the role of project management in each of the prerequisite elements identified. Final conclusions of the study are presented as an annotated list of recommendations for ERP implementation project managers, grouped by project management problem areas.

Review of References

This section contains an annotated bibliography of the primary references examined during the research. Each entry below includes a discussion on:

- Key aspects of the reference related to the purpose and problem of this paper.
- The role that the reference plays in the content of the paper.
- The criteria used to select the reference.

References are published in various formats, including research papers, books, journal articles and surveys. Based on the content, these documents are presented as two categories listed below. Within each category, the entries are organized alphabetically.

- ERP Implementation and Project Management
- Research Methodology

ERP Implementation and Project Management

Bonerjee, Angshuman (2001). *10 Commandments of ERP implementation*. ZDNet India
[Online]

Available: <http://www.zdnetindia.com/biztech/resources/enterprise/features/stories/17623.html>

This article contains two parts, 1) a review of ERP software industry and the trends in the web-based economy, and 2) factors for a successful ERP implementation.

The 10 commandments suggested by the author cover the entire ERP implementation life cycle, which is beyond the limited scope of this study.

However, several points are still applicable, including:

- Start with clear objectives
- Link business strategy with software selection and implementation
- Plan and time process changes carefully

This article presents a clear list of factors for successful ERP implementations from a high level. It is cited in the **Analysis of Data** section of this paper.

The British Computer Society (2000). *IT Projects: sink or swim?* Computer Bulletin.

[Online]

Available: <http://www.bcs.org.uk/publicat/ebull/jan2000/article1.htm>

This purpose of this survey is to “identify whether these (IT project) successes are just exceptions, to understand where failure can occur, to examine whether a single issue repeatedly causes failure, and to discover what skills a project manager needs to give a project the best chance of success”.

Out of the 1027 IT projects surveyed, only 130, or 12.7% were completed successfully.

The top 3 reasons cited for failure with respect to management activities are poor scope management, poor project management and poor change management. As to where the failures occur, the most problematic stages are requirements definition and implementation. Among the critical success factors cited, survey respondents list clear and detailed requirements, clear project change control and strong business commitment at the top.

This survey was selected because it serves as an importance reference for the larger problem area surrounding ERP implementations. It's cited in the Full Purpose and Problem Area of this study.

Brown, Carol and Vessey, Iris. (1999) *ERP implementation approaches: toward a contingency framework*. Proceeding of the 20th international conference on Information Systems, 1999, Pages 411 – 416 [Online].

Available: ACM Digital Library www.acm.org (June 23, 2001)

This research paper identifies variables critical to ERP implementation success. A contingency framework based on these variables is proposed. Using a case study research method, the researchers tested the framework using data from six companies.

This contingency framework first assumes that organizational characteristics determine ERP package capabilities sought. Subsequently, these two factors influence the ERP package choice and project scope. In the end, “some subsets of variables of all three factors are then expected to influence the key ERP implementation choices” (p. 413).

When this paper was published, data had only been gathered on a pair of case studies. Despite the preliminary nature of the study, this paper was selected because it provides collateral evidence to the lack of theoretical research in the area of ERP implementation. In addition, the authors’ analysis of organizational variables to successful ERP implementations, especially in the project management area, contributes the list of recommendations made by this study.

Brown, Jennifer (2001). ERP Doomed By Poor Planning. Computing Canada, 02/09/2001, Vol. 27 Issue 3, p11, 1/2p [Online]

Available: UO Library online database - Business Source Elite

This short article is based on an interview with an ERP implementation consultant. The main focus is on working with ERP vendors before and during the implementation. The key points and their relationship to project management problem areas are as follows:

- Companies should plan carefully before searching for ERP systems. This is equivalent to establishing a scope of project before getting started.

- A vendor should be selected only after a thorough review process and their promises must be documented in writing. As the article points out, implementation consulting can cost as much as or more than the software licenses. Therefore it's important to know exactly what will be delivered before entering into a contract with the vendor. Building on the principle of managing scope, this point also deals with the relationship between quality and cost of an ERP implementation project.

This article is reviewed here because of its emphasis on planning and vendor selection, which are both crucial foundations to ERP implementation success. It is cited in the **Analysis of Data** section of this paper.

Buckhout, S., Frey, E. and Nemeč J. (1999). *Making ERP Succeed: Turning Fear Into Promise*. Strategy and Business, 2nd Quarter, 1999. [Online]

Available: <http://www.strategy-business.com/technology/99208/> (July1, 2001)

The authors argue in this article that ERP difficulties stem from two issues: 1) lack of strategic choices to configure the system, 2) implementation process spinning out of control. For each issue, they suggest ways to solve the problem. Since the second issue is more related to the topic of this study, this researcher chooses to analyze only the recommendations for it.

To keep the ERP implementation process in control, the authors suggest putting the CEO in charge. This is not simply “getting support from the top” (p.67), but a much different level of involvement from the top executive, specifically:

1. Outline and link business strategic priorities to the ERP system.
2. Get the organization involved in the ERP implementation.
3. Link performance measures and incentives to ERP project success.

This article is relevant to this study because an emphasis on strategic alignment of ERP projects translates into having the expectations clearly defined, which is a key in successful project management. This article is cited in **Full Purpose, Problem Area and Significance** sections of this study.

Campbell, Doug (2000). *Successful ERP Implementation Strategies*. Integrated Solutions, March 2000, Corry Publishing Inc. [Online]

Available: www.corrypub.com

In this article, the author points out two important factors to a successful ERP implementation project, from the organizational perspective.

The first is gaining top-down project support. This includes the CEO and the most important managers of the company. The author argues that the critical nature and broad potential impact of the ERP system demand the attention from the highest levels of the organization. Anything less simply will not do.

The second is being cautious about choosing an ERP system based on IT decisions alone. An ERP system is much more than just another IT project. Selection of ERP systems must be based primarily on business needs.

Project management does not operate in a vacuum. Working closely with the CEO and key managers of the company helps the implementation team understand the scope, needs and expectations of stakeholders, and is therefore critical to ERP project success. Meanwhile, ERP system is a piece of computer software after all. As a result, the involvement of the organization's IT department is necessary. However, a balance must be stricken to avoid placing too much emphasis on ERP's IT aspect. This article is cited in the **Introduction and Brief Purpose** and the **Analysis of Data** sections of this study.

Mousseau, Patrick (1998). *ERP Projects Call For Multi-Talented Managers*. Computing Canada, 11/09/98, Vol. 24 Issue 42, p30, 1/3p, [Online]

Available: UO Library online database - Business Source Elite

This article identifies characteristics of good project managers in ERP implementation projects. The author is an experienced ERP consultant at Ernst & Young. According to him, ERP project managers can be effective if they are able to do the following:

- Be credible in technical and business knowledge;
- Stay calm under stress and make quick and effective decisions;
- Compromise flexibly when appropriate to accomplish project goals;
- Manage expectations of managers and end-users properly, i.e., balancing the need to stimulate project team members and keep project manageable and within scope;

- Demonstrate good people skills in dealing with various factions and coaching own team members;
- Market the project's benefits to the entire organization and create positive perceptions of the project.

Project management can stay only a theory without capable project managers. That's why the article is significant to this study. On the same token, the practices of effective project managers often equate good project management techniques. In this article, these techniques primarily relate to expectations, scope, as well as the environment surrounding an ERP project. This article is cited in the **Analysis of Data** section of this paper.

O'Leary, Daniel (2000). Enterprise Resource Planning Systems – Systems, Life Cycle, Electronic Commerce and Risk. Cambridge, United Kingdom: The Cambridge University Press.

This book is separated into four sections as suggested by the title. The systems section discusses background, ERP data input and output. The life cycle section covers the entire ERP implementation process, from making a decision, choosing a system to going live and training. The last two sections address ERP's role in electronic commerce and the success and failure factors of ERP, i.e., risk. The credibility of O'Leary's points is reinforced throughout the book by case examples, surveys and citations.

The part of this book that has the most direct implications to the purpose of this study is the chapter on ERP risk. According to O’Leary, there are three categories of risk in ERP systems. These categories and their definitions as shown on pages 213 and 214 of the book are summarized in table 3-1:

Table 2: Three ERP risk categories

Risk	Definition
Technical	“arise largely because of information processing technology”
Business	“derived from models, artifacts, and processes that are chosen and adopted as part of the ERP implementation”
Organizational	“derived from the environment – including personnel and organizational structure – in which the system is chosen and implemented”

Source: O’Leary, 2000

Within each risk category, O’Leary proceeds to explain its effects on the ERP life cycle. With the purpose of this study in mind, this researcher focuses on the implementation stage of the life cycle. Table 3-2 summarizes his explanations of risk effects on this stage, as well as this researcher’s categorization of these risks into project management problem areas.

Table 3: ERP risk categories and project management problem areas

Risk	Effects on ERP implementation	Project Management problem areas
Technical	What’s the limit of the ERP system in the current IT environment? And does it meet performance expectations?	Needs and Expectations
Business	Will the implementation take longer and cost more than expected?	Schedule and Costs
Organizational	Should the ERP system be changed to fit the organizational needs or vice versa?	Needs, schedule and costs

Source: O’Leary, 2000

These analyses of ERP risks and the effects on implementation lay a foundation for the recommendations presented in the **Conclusion and Recommendations** section of this study. In addition, the resources cited in the book help to triangulate and reinforce the claims by online sources previously found by this researcher. This book is cited in **Introduction and Brief Purpose, Full Purpose, Limitation** and **Analysis of Data** sections of this research paper.

PA Consulting Group (2000). *Unlocking the Value in ERP*. London, United Kingdoms

Available: <http://www.pa-consulting.com/publications/index.html>

This survey was conducted over a 9-month period with over 50 senior managers at multi-site, multi-national European companies which had implemented complex ERP systems. The instrument of the survey is face-to-face interviews. The purpose is two-fold: 1) “to explore the business case and rationale for ERP”, 2) “to examine experiences of implementation” (p. 4).

The survey found that “92% of companies were dissatisfied with results achieved to date and only 8% had achieved a positive improvement in performance” (p. 6).

Some of the reasons for such poor results were identified as:

- Many implementations did not end up with an integrated system, but “a series of loosely related initiatives within functional silos” (p. 7).
- A surprising 90% of the projects finished on time and on budget.

However, this was not necessarily a good thing. As the survey reported,

over 70% of these projects were initiated because of Y2K compliance requirements. Consequently, speed prevailed over quality.

- ERP systems have not been aligned with business processes. Part of this problem reflects in inadequate training, resulting in lack of understanding for the new system.

This survey is chosen because it offers important insights from the perspectives of the managers who have gone through ERP implementations. The problems and lessons identified help this researcher formulate the results of this study. This survey is cited in the **Full Purpose** and **Limitation** sections of this study.

Plotkin, Hal(1999) *ERPs: How to make them work*. Harvard Management Update.

[Online]

Available: UO Library online database - Business Source Elite
This article presents a list of practical advices for ERP implementers, based on the experience of an ERP project manager at a company that has realized 25% revenue growth attributable to the new ERP system. The recommendations in the article represent antecedents to ERP implementation success in the case of this particular company.

The ideas that directly relate to project management include:

1. Create a critical path document for the implementation plan and keep track of progress.

2. Manage the expectations of internal “super users” to ensure their satisfaction with the technology and training.
3. Get involved in understanding how the software works and how it’s going to change the operations. This is an important requirement for being able to balance end-user needs and expectations.
4. Carefully manage transitions. Keep the goal of process re-engineering in mind, while avoid alienating the users by forcing them to change daily routine too drastically all the sudden.

This article contributes to the list of recommendations from this study. In addition, its content is cited in **Introduction and Brief Purpose, Full Purpose, Limitations, Problem Area and Significance** and **Analysis of Data** sections of this study.

Robey D. and Ross J. and Boudreau M. (2000). *Learning to Implement Enterprise Systems: An Exploratory Study of the Dialectics of Change*. Georgia State University.
[Online]

Available: <http://citeseer.nj.nec.com/robey00learning.html> (June 23, 2001)

Using a comparative case study approach, the researchers observed 13 industrial firms’ ERP implementation process. The study focuses on the dialectical learning process that occurs to overcome knowledge barriers at various stages during ERP implementations. The dialectic motor that drives organization change, as the authors cited from Van de Ven and Poole, emphasizes a “pluralistic world of

colliding events, forces, or contradictory values that compete with each other, for domination or control”. Realizing the dynamic nature of the factors involved in ERP implementations, these authors chose not to specify an *a priori* approach, and instead, decided to allow the case data identify the forces of change.

The conclusion of the paper points out that firms are likely to encounter two categories of knowledge barriers while implementing an ERP system: configuration and assimilation. The former has to do with the initial “go live” process. The latter barrier is related to integration of the business processes. Moreover, the authors conclude that different implementation approaches, piecemeal or concerted, influence the dynamic of learning.

This particular research paper is useful for this researcher in three ways:

1. How the organizations in the case study overcame or dealt with the knowledge barriers has direct implications to the results of this study.
2. The discussion about existing research on ERP implementations provides a concise overview for this researcher.
3. References cited by the study are relevant to this researcher’s work.

This paper is cited in the **Full Purpose** and **Limitation** sections of this study.

Sarker, S. and Lee, A. (2000). *Using a case study to test the role of three key social enablers in ERP implementation*; Proceedings of the twenty first international conference on Information systems, 2000, Pages 414 – 425 [Online]

Available: ACM Digital Library www.acm.org (June 23, 2001)

The authors identify three key social enablers in ERP implementation noted in literature as necessary precursors for successful ERP implementation. These enablers include: strong and committed leadership, open and honest communication, and a balanced and empowered implementation team. A single-case case study research method is used to test whether these enablers are necessarily required for an ERP implementing to be successful. The result shows that while “strong and committed leadership at the top management level, at the project management level, and of the IS function” is a necessary condition for successful ERP implementation, the other two enablers, “while possibly helpful”, cannot be generalized as necessary conditions in every case.

This paper serves as an important reminder for this researcher, as well as the readers of this study, that any recommendation suggested by any literature, including this study, cannot be applied to an implementation without considering the specific situation and culture. In addition, the three enablers tested in this paper are basis for select recommendations as a result of this study. This paper is cited in the **Analysis of Data** section.

Somers T. and Nelson, K. (2001). *The Impacts of Critical Success Factors across the Stages of Enterprise Resource Planning Implementations*. Proceedings of the 34th Hawaii International Conference of System Sciences – 2001. [Online] (July 8, 2001)

Available: <http://www.computer.org/proceedings/hicss/0981/volume%208/09818011.pdf>

This article identifies a list of 22 critical success factors in ERP implementations based on the literature reviewed by the authors. Using a survey approach, the importance of each factor is assessed. Factors are coupled with various implementation stages. The criticality of these factors is ranked based on survey responses by stage.

The authors conclude that the most important part of an ERP implementation project is the beginning. These factors include conducting a detailed software selection process and securing commitment from all levels. Throughout the implementation, training, education and communication are key.

The ERP success factors outlined by Somers and Nelson help this researcher formulate the list of prerequisites in the **Analysis of Data** section of this paper. In addition, this article is cited in the **Introduction and Brief Purpose** section.

Welti, Norbert (1999). Successful SAP R/3 Implementation – Practical Management of ERP Projects. Harlow, Essex, England: Addison Wesley Longman Limited.

Using the case study method, Welti thoroughly documents the entire project management process of an ERP implementation that he managed. Project management approaches, such as scope definition, work breakdown structures, resource and risk management, as well as reporting are strictly followed from the beginning to the end. The project is broken down into phases, including:

- **Planning:** “In this phase, the project scope is defined, the organization enrolled, the resources allocated, the implementation schedule created, the as-is and to-be concepts established, and the technical environment set up” (p. 17).
- **Realization:** The project team sets up and customizes the ERP system according to business requirements, resulting in a prototype system.
- **Preparation:** The project team converts data, completes system setup, tests processes and integration, trains users and finishes documentation.
- **Productive:** End users process live data on the system. Project team adjusts and fine-tunes the system.

Underlying these distinct phases, “training, project control, risk management, and change management are issues that affect all phases of the project” (p. 102).

As a conclusion for the book, Welti lists 13 factors for a successful ERP implementation, many of which are incorporated in the **Analysis of Data** section of this study.

Research Methodology

Krippendorff, Klaus (1980). Content Analysis: An Introduction to Its Methodology.

Beverly Hills, CA: Sage Publications.

In addition to providing a theoretical framework on the content analysis research methodology, Krippendorff’s book contains a practical guide to content analysis

procedures. This book has helped this researcher maintain the approach and focus of the research process. This work is cited in the **Method** section of this study.

Leedy, Paul (1997). Practical Research Planning and Design. Upper Saddle River, NJ: Prentice Hall.

This book presents a general guide to research, including discussions of various research methodologies. Leedy's discussions of literature review and qualitative research are cited in the **Full Purpose** and **Method** sections of this study. In addition, this researcher's data analysis approaches are based on the section on grounded theory research design from page 162 to 164.

Analysis of Data

This section documents the details of the data analysis process, especially the application of the selected coding steps of grounded theory research as outlined in the **Method** section. Results of this data analysis are presented in two tables and the accompanying narratives. Table 4-1 lists the prerequisites for successful ERP implementation identified by the literature reviewed. Table 4-2 categorizes these prerequisites into project management problem areas.

Step 1: Open Coding – Selecting prerequisites for successful ERP implementation and their categories

When reviewing the literature, the researcher scans each piece to look for particular terms and words, especially “factors”, “prerequisites”, “pitfalls” and “recommendations”.

These terms are usually associated with a list. Once found, the context surrounding these terms is analyzed to see if it is related to ERP implementation. If it is, then the items on the list are included in the data analysis process. Sometimes, a prerequisite may be mentioned in multiple sources, but different terms are used. At this point, the process of constant comparison is employed. In other words, prerequisites identified in each subsequent piece of literature are compared to those reviewed previously. For example, Welti mentions “ownership assumed by management” (Welti, 1999), while Campbell uses the term “top-down project support” (Campbell, 2000). Because the research

interprets these two phrases as having the same meaning, they are listed as one prerequisite element. Such constant comparative analysis underlies the entire process.

Table 4-1 presents a summary list of prerequisite elements selected from the literature by this researcher and their sources.

Table 4: Prerequisite elements to successful ERP implementation

Prerequisite Elements	Sources
Top management assumes project ownership	Somers and Nelson, 2001; Sarker and Lee, 2000; Bucker, Inc., n.d.; Bonerjee, 2001, Scavo, 1998; Gray and Larson, 2000; Mendel, 1999
Strong and multi-talented project management	Mousseau, 1998
Active risk management	Gray and Larson, 2000; O'Leary, 2000; Kulik, 1997
Tight project controls on schedule and scope	Gray and Larson, 2000; Somers and Nelson, 2001
Capable and committed project team members	Somers and Nelson, 2001; Willcocks and Sykes, 2000; Brown and Vessey, 1999
Good external consultants	Welti, 1999; Somers and Nelson, 2001
Smooth and tactful transition management	Sweat, 1999; O'Leary, 2000; Boudreau, 1999
Properly timed and managed process changes	Scavo, 1998; Bonerjee, 2001; Welti, 1999; O'Leary, 2000; Plotkin, 1999
Proper balance of IT and business emphasis	Campbell, 2000; Welti, 1999; Brown, 1999
Adequate project planning	Bucker, Inc., n.d.; Donovan, 1999
Flat and streamlined project organization	Welti, 1999; Mousseau, 1998
User involvement	Mendel, 1999; Brown, 2001
Appropriate and timely training	McAlary, 1999; O'Leary, 2000; Plotkin, 1999
Clear and measurable project objectives	Somers and Nelson, 2001; Scavo,

	1995; Gray and Larson, 2000; Welti, 1999
Open communication to the entire company	Bucker, Inc., n.d.; Scavo, 1995

Step 2: Axial Coding – Summary and analysis of categorization

In addition to identifying and combining prerequisites with the same meaning, the constant comparative method is used to identify the appropriate categories of project management problem areas for each prerequisite element. According to *A Guide to Project Management Body of Language*, the goal of project management is to balance competing demands among **scope**, **time**, **cost** and **quality** to meet or exceed stakeholder **expectations** (Project Management Institute Inc., 2000, p. 6). During the review of literature, this researcher marks each prerequisite element to indicate relevant categories by using the following codes:

- A. Scope – What does the project do exactly?
- B. Quality – How well should the resulting system perform?
- C. Time – Will the project reach all milestones on time?
- D. Cost – Will the project costs stay within budget?
- E. Expectations – What do the stakeholders expect from the project?

Table 4-2 lists the prerequisite elements coded in relation to the appropriate project management problem area categories. The prerequisites are listed in the order of the number of related categories, with the most on top.

Table 5: Prerequisite elements categorized by project management problem areas

Prerequisite Elements	Categories
Top management assumes project ownership	A, B, C, D, E
Strong and multi-talented project management	A, B, C, D, E
Active risk management	A, B, C, D
Tight project controls on schedule and scope	A, C, D
Capable and committed project team members	B, C, D
Good external consultants	B, C, D
Smooth and tactful transition management	B, C, D
Properly timed and managed process changes	B, C, D
Proper balance of IT and business emphasis	A, B
Adequate project planning	A, E
Flat and streamlined project organization	B, C
User involvement	B, E
Appropriate and timely training	B, E
Clear and measurable project objectives	A
Open communication to the entire company	E

Many sources consider project management critical in ERP implementations (O’Leary, 2000; Welti, 1999; Desai, 1997). Likewise, Table 4-2 demonstrates that each prerequisite to a successful ERP implementation identified in the literature can be related to one or more of the project management problem areas. The following is a detailed discussion of each prerequisite element identified, with the emphasis on the explication of the five project management problems areas: Scope, Quality, Schedule, Cost and Expectations. These discussions are based on this researcher’s interpretation of the contextual information surrounding each selected prerequisite as well as an understanding of the five

project management problem areas, derived from information provided in *A Guide to Project Management Body of Language* (Project Management Institute Inc., 2000).

Top management assumes project ownership

The role of top management in ERP projects as a prerequisite has been widely documented (Somers and Nelson, 2001). In study after study, this element was ranked among the most important factors for ERP project success (Sarker and Lee, 2000; Somers and Nelson, 2001). From the project management perspective, this prerequisite addresses **all five problem areas**.

- A. **Scope** – Top management’s participation in defining the ERP project scope ensures that the objectives are aligned with company strategic priorities (Bonerjee, 2001).
- B. **Quality** – By linking performance measures and incentives to ERP project success, top management can positively affect quality (Buckhout, Frey and Nemec, 1999).
- C. **Time** – Top management participation boosts perceived priority and inspires project teams to work harder (Scavo, 1998). In addition, having executives easily assessible speeds up decision-making processes for the project (Scavo, 1998).
- D. **Cost** – Project costs can be reduced as a result of effective control on scope and schedule (Gray and Larson, 2000).
- E. **Expectations** – By getting involved, top management, as some of the most important stakeholders, can ascertain that their expectations are clearly

communicated. Meanwhile, the presence of top management in the ERP project team invariably encourages employee involvement and cooperation (Mendel, 1999; Bucker, Inc., n.d.). As a result of participating in the project and communicating with their managers, employees can make their expectations known.

Strong and multi-talented project management

According to Mousseau, “the (ERP) project manager is the individual who acts as a leader to communicate and manage a clear vision of the goals and objectives, and manages the process so that that appropriate timing, resources and sequencing tasks produce agreed-on deliverables within scope and budget” (Mousseau, 1998, online).

From this description, it’s evident that a capable ERP project manager addresses **all of the five problem areas**:

- A. **Scope** – A clear vision and good communication ensure everyone on the team knows exactly what the project is to accomplish.
- B. **Quality** – Producing deliverables as agreed means a working ERP system.
- C. **Time** – Completing tasks with appropriate timing leads to finishing the entire project in time.
- D. **Cost** – Adhering to budget constraint is meeting the demand of cost.
- E. **Expectations** – Strong communication helps project team manage expectations and better understand stakeholder needs.

Active risk management

Risks are inherent in projects (Gray and Larson, 2000). According to O'Leary, ERP implementation risks can be categorized as technical, business or organizational.

Furthermore, risks from each category appear throughout the entire project, from making a decision to going live (O'Leary, 2000). Because of this, risk management really should cover **all five problem areas** of project management. Having a concrete action plans beforehand is important to mitigate risks (Kulik, 1997). Active risk management is also required because risks change constantly (Wolti, 1999).

Tight project controls on schedule and scope

Project controls are the heart of project management (Gray and Larson, 2000). A formal process is especially critical in a large project such as ERP implementation. Frequent updates of project status and progress allow for timely corrections and keep the project on track (Somers and Nelson, 2001). Tightly controlled project **scope** and **time** reduce ERP implementation **cost** (Gray and Larson, 2000).

Capable and committed project team members

Another key element of a project organization is competent project team members (Somers and Nelson, 2001). Capable project members can understand and explain new concepts and processes better, in addition to satisfying the technical requirements of the project (Willcocks and Sykes, 2000). Meanwhile, commitment from project members, especially insight and focus, will reduce implementation **time** and enhance project **quality** (Brown and Vessey, 1999).

Good external consultants

While they may seem expensive (Brown, 2001), external consultants possess a great deal of specialized knowledge about the ERP system (Welti, 1999). They also bring along a lot of implementation experience. Therefore, having good external consultants on the project team can help solve technical problems quickly, resulting in shortened implementation **time** and higher **quality** (Somers and Nelson, 2001).

Smooth and tactful transition management

A carefully planned transition, such as a phased implementation and parallel operations (simultaneous processing in the current and the new systems), increases the probability of success (Sweat, 1999; Martin and Sara, 2001). Change management in ERP implementations is a big subject that's not covered within the limited scope of this paper. However, it's important to bear in mind that organizational changes due to ERP implementations can be both evolutionary and revolutionary (Boudreau, 1999). The implication of change and transition to project management is the impact on project **quality, time and cost**.

Properly timed and managed process changes

In ERP implementations, changes can be made to either business processes or the software. Scavo points out that modifications to ERP software are not only costly, but also time-consuming (Scavo, 1998). On the other hand, Bonerjee cautioned against extensive business process re-engineering (BPR) before going live because of the same reasons (Bonerjee, 2001). Another argument for doing BPR after project implementation is that system users will have much better understanding of functionality and the potential

of the ERP software (Welti, 1999). A complete analysis by O'Leary asserts that the combination of process and software changes plays an important role in determining ERP implementation success, where the highest probability of success exists when there is minimal need to change the process and software (O'Leary, 2000). This conclusion is supported by the ERP implementations at IBM and Microsoft where the implementers discovered that the best approach involves striking the right balance between changing processes and customizing software (Plotkin, 1999; O'Leary, 2000). The extent and timing of process changes affect **time**, **cost** and **quality** of the project.

Proper balance of IT and business emphasis

Balancing IT and business emphasis in an ERP implementation helps to ensure the system meets business requirements, while adapting a sound, long-term technological platform (Campbell, 2000). To achieve this balance, both sides have to cooperate and have input into the ERP project (Sweat, 1999). Part of this cooperation reflects in both sides having a clear sense of responsibility in the ERP project, which helps to clarify **scope**. Meanwhile, the integration of IT and business efforts improves the **quality** of the ERP implementation (Brown, 1999).

Adequate project planning

A project plan serves as a guide for the implementation (Bucker, Inc., n.d.). In addition to the actual details of the plan, such as mission statement, scope, operating plan, critical path analysis, etc., the project plan establishes the expectations for how the project should be completed (Donovan, 1999). Consequently, ERP project planning impacts these two problem areas: **scope** and **expectations**.

Flat and streamlined project organization

The most visible benefits of a streamlined project organization reflect in short communication lines and lack of politics (Welti, 1999). In such organizations, ERP project team members can get a decision from senior management quickly, allowing them to work efficiently. Furthermore, the flat and simple reporting structure lessens the opportunities for political in-fights, freeing up time for productive work (Mousseau, 1998). Therefore, this prerequisite helps address the **quality** and **time** challenges.

User involvement

If the employees who are not on the project team are excluded from the entire ERP implementation process, they may resist or fear the new system (Mendel, 1999). On the other hand, involved users are not only more motivated to adopt the new system, but they can also help identify and resolve potential issues early, thereby improving implementation **quality** (Brown, 2001). As they try out the system, user **expectations** can be better gauged and met during implementation.

Appropriate and timely training

According to McAlary, “successful ERP implementation depends on successful training” (McAlary, 1999). Training teaches new skills, which makes employees feel more confident and more enthusiastic about the possibilities with the new system (Plotkin, 1999). Appropriate timing for training varies by company. The key is to balance the needs of current work and the new system (O’Leary, 2000). Like user involvement, training helps to improve **quality** of ERP project results and to meet user **expectations**.

Clear and measurable project objectives

Having clear project objectives is critical to the entire project, especially at the beginning (Somers and Nelson, 2001). These objectives are referred to as **scope** in project management (Gray and Larson, 2000). This prerequisite is listed in the following contexts:

- Helps the project team maintain focus by minimizing scope creep, which means going beyond the defined tasks of the project (Scavo, 1995).
- The measurable attribute of this clear project scope makes analyzing the level of success easier and employees more motivated because they know exactly how their work will be evaluated (Wolti, 1999).

Open communication to the entire company

In ERP projects, companies that pay particular attention to educating employees and communicating future changes to the entire company tend to have much better chance of achieving project success (Bucker, Inc., n.d.). For a cross-functional system such as ERP to work, users from all departments must feel that they know and own the system (Scavo, 1995). This prerequisite has a direct impact on the user **expectations** of the ERP system.

Although a number of these prerequisites can be categorized into other disciplines, such as change management, the above analysis reveals that project management concepts play an important role in the success of ERP implementations. In the following **Conclusion and Recommendations** section, this researcher suggests a list of recommendations for managers to address, relevant to each of the project management problem areas.

Conclusion and Recommendations

By using literature review as the general research methodology and grounded theory coding steps with constant comparison to conduct data analysis, this study has identified a list of fifteen prerequisites for successful ERP implementation. Further, this list is categorized into project management problem areas as defined by the Project Management Institute, Inc. (1996). The purpose of this research is to examine and analyze this list of prerequisites from the project management perspective and present recommendations aimed at helping project managers succeed in ERP implementations. The list of prerequisites and the analysis are completed in the **Analysis of Data** section. This section presents the recommendations resulting from the analysis.

Starting from each of the project management problem areas -- scope, quality, time, cost and expectations, this researcher presents the following recommendations to be used by managers in the process of planning for a successful ERP implementation. Each recommendation is elaborated with examples selected from the literature, which are presented as specific action items below each recommendation entry.

A. Scope – Recommendations to define objectives and maintain focus

A1. Make sure that the top management of the company takes the ownership of the project

- In addition to getting involved, lead the implementation and take responsibility for the results (Buckhout, Frey and Nemec, 1999; Donovan, 1999).

- Ensure that the objectives of the project are linked with company strategic priorities (Bonarjee, 2001; Forger, 2000).
- Be champions for the implementation at all times and motivate employees from all levels of the company to get involved (Mendel, 1999; Taylor, 2000).

A2. Develop a set of clear and measurable objectives for the ERP project

- Keep the following criteria in mind when defining ERP project objectives: clear, measurable, controllable and the savings quantifiable (Welti, 1999).
- Plan for the end of the project before the beginning, i.e., know exactly the boundaries or scope of the project (Donovan, 1999).

A3. Plan thoroughly before starting the project

- Define the exact business value to derive from the ERP project (Sweat, 1999; Jeffery, 2001).
- Plan to implement the ERP system in short, focus phases with many milestones (Forger, 2000; Mendel, 1999).
- “Create an ERP implementation road map or critical path document” that identifies milestones and task relationships (Plotkin, 1999, online).
- Know what to do every step of the way – make sure the plan covers mission, operations, system implementation and education (Bucker, Inc., n.d.).

B. Quality – Recommendations to achieve desired results

B1. Put capable people into the project team

- Include the best managers of the company in the project team if possible. If not, at least maintain close communication with them (Campbell, 2000).
- Recruit technologically competent people who understand the company business into the project team (Mendel, 1999).
- Use consultants strategically – don't focus just on costs and sacrifice quality and time (Macvittie, 2001). On the other hand, avoid over-reliance on the consultants - learn from them (Sweat, 1999).
- Foster teamwork and the culture that is oriented to solve problems (Savin and Silberg, 2001).

B2. Involve the end-users in the implementation

- Ask the end-users to perform daily functions on the new system and use feedback to improve the implementation (Martin and Sara, 2001).
- Organize a team of “super-users”, who will be the internal experts of the ERP system. They should learn the system thoroughly and actively participate in the implementation process (Plotkin, 1999)

B3. Emphasize employee education

- Integrate business process discussions into training and pilot testing, encourage them reflect on daily tasks (Schultz, 2000).

- Include managers in the training because they need to see first-hand the functionalities of the new system in addition to offering special insights (Plotkin, 1999).
- Train the top managers on the “big pictures” - concepts and applications of ERP (Bucker, Inc., n.d.).

B4. Properly balance IT and business requirements

- Involve IT early in the project to validate ERP sustainability and consult their expertise during implementation (Spangenberg, 1999).
- Make sure to reflect business needs in the application - avoid making decisions based on IT recommendations alone (Sweat, 1999; Savin and Silberg, 2001).

C. Time – Recommendations to complete the implementation on Schedule

C1. Maintain a simple project organizational structure

- Minimize levels of reporting within the project team (Bucker, Inc., n.d.).
- Empower project team and support rapid decision-making relating to ERP implementation (Forger, 2000).
- Streamline project team communications (Scavo, 1995).

C2. Implement and maintain project controls diligently

- Track project deliverables and milestones rigorously (Jeffery, 2001).
- Manage tasks along the critical path with top priority to prevent delays (Kulik, 1997).
- Create an efficient work culture that treats deadlines seriously (Forger, 2000).

C3. Manage transitions effectively

- Implement in phases if possible to avoid setbacks in both management support and time (Sweat, 1999).
- Test program and processes thoroughly to minimize problems when going live (Martin and Sara, 2001).
- If necessary, develop temporary solutions to bridge the old processes to the new system (Plotkin, 1999).
- Employ change management techniques to cope with rejections (Forger, 2000).
- Ensure sufficient implementation support from the vendors and consultants during the initial days of going live (McAlary, 1999).

D. Cost – Recommendations to stay within budget**D1. Plan and manage risks proactively**

- Identify potential ERP project risks, and come up with plans to prevent them from becoming problems (Kulik, 1997).
- Know how to respond to risk occurrences ahead of time (Welti, 1999).

D2. Stick to the project plan and minimize scope creeps

- Have proactive measures in place to deal with scope creeps (Desai, 1997).
- Obtain management support to minimize demands for unimportant functionality changes to the ERP system (Buckhout, Frey and Nemec, 1999; Wagle, 1998).
- Minimize customizations to the ERP software (Scavo, 1998; McAlary, 1999).

D3. Stay on top of the project budget

- Establish a realistic project budget with contingency reserves to cover unforeseeable costs (Bowen, 1998).
- Regularly monitor project implementation costs and schedule (Jeffery, 2001).
- Stick to the project schedule and planned resource usage (Welti, 1999).

E. Expectations – Recommendations to manage and meet stakeholder needs

E1. Communicate the project goals clearly

- Help employees understand the impact of ERP on their work and the critical nature of the project (Taylor, 2000; Plotkin, 1999).
- Sell the project to all employees using various marketing activities involving project team members and top management (Welti, 1999).

E2. Include the employees in the implementation process

- Gain user buy-in early on by reviewing business processes before starting the project (Savin and Silberg, 2001).
- Turn the ownership of the project over to the end users (Scavo, 1995)
- Make them feel like they are part of the ERP implementation process (Mendel, 1999).

E3. Get line managers to champion for the project

- Make the ERP project a management priority throughout the company (Welti, 1999).

- Tie manager performance evaluation and/or compensation to the success of ERP project (Buckhout, Frey and Nemec, 1999).

The prerequisites identified and recommendations presented in this study are not intended to be all-inclusive. Rather, they represent a way of addressing the challenges of implementing an ERP system - from the project management perspective. It is anticipated that future research can go in two directions: 1) horizontally - expanding the focus of research from project management to include change management, knowledge management, risk management and other disciplines; and 2) vertically - conducting more detailed research in the project management discipline, such as validating the recommendations presented in this study through case study of actual ERP implementation projects.

Appendix A - Terms and Definitions

ERP Systems

ERP is the abbreviation for Enterprise Resource Planning. ERP systems are “Computer-based systems designed to process an organization’s transactions and facilitate integrated and real-time planning, production, and customer response” (O’Leary, 2000). ERP is widely considered as an information backbone for a company (Forger, 2000; Campbell, 2000).

Going Live

Going live is the point in time in the ERP life cycle when the system is first used for actual production (O’Leary, 2000). For examples, real customer orders are processed, actual invoices are prepared, and genuine vendor checks are issued from the new ERP system.

Implementation

In the context of ERP systems, implementation often means putting the ERP system in place and start live production on it (Robey, Ross and Boudreau, 2000). However, it can also be extended to beyond the “go live” point (PA Consulting Group, 2000; Davenport, 1998). Typically such extended outlook includes the business process changes that accompany the new ERP system.

Prerequisite

According to www.dictionary.com, prerequisite means “Required or necessary as a prior condition”. In the case of ERP implementations, this refers to the conditions that exist before the outcome of an implementation is determined (Robey, Ross and Boudreau, 2000).

Project

A project is “a complex, nonroutine, one-time effort limited by time, budget, resources and performance specifications designed to meet customer needs” (Gray and Larson, 2000, p. 4).

Project Management

Project management is the “application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project. Meeting or exceeding stakeholder needs and expectations invariably involves balancing competing demands among:

- Scope, time, cost, and quality.
- Stakeholders with differing needs and expectations.
- Identified requirements (needs) and unidentified requirements (expectations).”

(Project Management Institute Inc., 1996, p. 6)

Scope Creep

Multiple minor changes to project scope which result in scope changes eventually deemed to have major impacts to project results (Gray and Larson, 2000).

Successful ERP implementation

Success of ERP implementations can be defined in two ways. According to Plotkin, the ultimate measure of success for an ERP implementation is the value that the system adds to the organization (Plotkin, 1999). Another definition of ERP implementation success is the satisfaction of the initial project requirements for going live, such as meeting deadlines, staying within budget and system performing as expected (Robey, Ross and Boudreau, 2000). The second definition applies to the shorter-term definition of implementation and is adopted for the purpose of this study.

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