The Road to ERP Success: Understanding End-User Perceptions

Asli Yagmur Akbulut
Grand Valley State University

Jaideep Motwani
Grand Valley State University

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ABSTRACT

Even though there is a growing body of literature that focuses on improving the success rate of enterprise resource planning (ERP) projects, there is a lack of research aimed at understanding end-users perceptions of ERP systems. Given that employee expectations and attitudes play an important role in the success of ERP projects, the purpose of this study is to gain a deeper understanding of end-user perceptions of ERP systems. In order to achieve this objective, we provide empirical evidence from two companies that have recently implemented ERP systems. We also offer strategies that could be utilized by managers, project leaders, and vendor companies to enhance user satisfaction with ERP systems.

INTRODUCTION

For over a decade, companies have been investing substantial amounts of organizational resources to implement enterprise resource planning (ERP) systems. Even though ERP systems can provide important benefits to organizations, it is well-known that the history of ERP implementations is not without its failures (Cliffe, 1999; Salopek, 2001). In fact, research has reported that more than 90% of ERP projects have suffered time and cost overruns and 70% of the ERP projects have failed to provide the expected benefits (Al-Mashari and Zairi, 2000; Martin, 1998).

Research suggests that many ERP projects fail to achieve their anticipated objectives because managers tend to underestimate the efforts involved in managing change (Somers et al., 2003). ERP systems affect all functional areas within a company, resulting in fundamental cultural and structural changes (Al-Mashari et al., 2003; Brown and Vessey, 2003). If employees are unprepared for these changes, the implementation can result in denial, resistance, and chaos (Umble et al., 2003), which ultimately hinder the successful utilization of the system. In this respect, end-user satisfaction with ERP systems is an important issue that requires careful attention by management.

A review of the pertinent literature indicates that even though numerous studies have been conducted in the ERP domain, little research has focused on end-user satisfaction with ERP systems, which represents an important dimension of system success (Esteves and Pastor, 2001; Somers et al., 2003). Consequently, the objective of this study is to gain a deeper understanding of end-user perceptions of ERP systems. In order to achieve this objective, we collect and analyze qualitative and quantitative data from two companies located in the Midwest region of United States that have recently implemented ERP systems. The reminder of the paper is organized as follows. In the next section we review the relevant literature. Then, we outline the research methodology. In the succeeding sections, the findings are presented. The final section summarizes the conclusions and insights gained from the study, and offers strategies to enhance end-users experiences with ERP systems.

LITERATURE REVIEW

ERP systems are comprehensive, packaged software applications that integrate key business processes and functions across departmental boundaries (Klaus et al., 2000). ERP systems continue to constitute the largest portion of organizations' information technology (IT) budgets (Somers et al., 2003). However, despite the substantial investments of time, money and other resources, the success of ERP systems cannot be guaranteed. Unfortunately, ERP system implementations have gained a reputation for providing meager results and causing considerable problems for organizations (Motwani et al., 2002; Parr and Shanks, 2000).

There is a growing body of literature in the information systems domain that investigates potential methods for improving the success rate of ERP implementations. These studies utilize the critical success factors approach

(Rockart, 1979), which aims to identify the prerequisites for successful ERP implementations. For example, Parr and Shanks (2000) recommend utilizing a phased model approach to investigate ERP implementations. They build a phased project model consisting of planning, set-up, and enhancement phases and then identify the critical success factors that are important within each phase. Based on a case study, Umble et al. (2003) identify success factors, software selection steps, and implementation procedures critical to a successful ERP implementation. Somers and Nelson (2004) categorize the critical success factors into key players and activities across the ERP project life cycle. They subsequently test the relative importance of each activity/player to determine when particular activities/players need to be given higher priority than others to ensure success.

Defining success in ERP implementations is not an easy task. Markus and Tannis (2000) state that the success outcome in ERP implementations represents a multidimensional, dynamic, and relative concept. Hence, no one measure of ERP success is sufficient for all the concerns that an organization might have about the ERP experience. Along these lines, Al-Mashari et al. (2003) draw attention to four dimensions of ERP project success – project, correspondence, expectation, and interaction. An ERP project is considered successful if it meets its time, budget and scope goals (*project success*) and delivers its pre-determined business benefits (*correspondence success*). *Expectation success* is achieved when the ERP system matches user expectations and, finally, *interaction success* is achieved when the users attitudes toward the ERP system is positive. Most of the studies in the ERP critical success literature focus on either project success or correspondence success (Robey et al., 2002), yet neglect the other dimensions that focus on the end-users. Since resistance to change by end-users lie "at the root of most ERP implementation challenges" (Salopek, 2001; p. 28), employee expectations and attitudes play an important role in ERP success (Sower et al., 2001). Therefore, they should be specifically addressed during the implementation process.

As such, this study focuses on the end-user perceptions in the contexts of ERP systems. More specifically, we examine end-user perceptions of the usefulness and ease of use of the system, and their satisfaction with it. *End-user satisfaction* can be defined as the "affective attitude towards a specific computer application by someone who interacts with the application directly" (Doll and Torkzadeh, 1988; p.261). End-user satisfaction represents the satisfaction of an employee with the content, accuracy, format, timeliness, and ease of use of a computer application. Employee satisfaction is considered one of the most important measures of information systems success (DeLone and McLean, 1992; Lin and Shao, 2000) because it plays a central role in determining the final acceptance and utilization of a new information system (Bhattacherjee, 2001; Ginzberg, 1981). Research suggests that the degree of user satisfaction positively affects system usage; and usage is a necessary condition for ensuring productivity payoffs from IT investments (Igbaria and Tan, 1997). Therefore, before the benefits of an ERP system can be achieved, end-user satisfaction represents a necessary precondition to facilitate system acceptance and use.

Research has also shown that two distinct mechanisms determine end-user satisfaction with a particular system. More specifically, perceived usefulness and perceived ease of use play a key role in fostering end-user satisfaction (Igbaria et al., 1995; 1996). *Perceived usefulness* can be defined as "the degree to which a person believes that using a particular system would enhance his/her job performance" (Davis, 1989; p. 320) and it directly affects satisfaction with the information system (Igbaria et al., 1996). *Perceived ease of use* can be defined as "the degree to which a person believes that using a particular system would be of physical and mental effort" (Davis, 1989; p. 320). Information systems that are easier to use are perceived as more useful by the end-users (Davis et al., 1989; Taylor and Todd, 1995). Moreover, information systems that are easier to use induce higher levels of end-user satisfaction, as users can accomplish their goals with minimal effort (Davis et al., 1989; Igbaria et al., 1995).

METHODOLOGY

The case study methodology was chosen to address the research question. In recent years, case study research has become a popular methodology in the information systems domain and has been widely used by researchers. Case study data were collected from two companies that had recently implemented ERP systems from the same vendor (SAP). Both qualitative and quantitative data were collected using multiple data collection methods.

Qualitative data was collected to gain an understanding of the company backgrounds, the reasons behind moving to an ERP system, and the implementation processes at the companies, as well as the approach utilized by

management and project teams throughout the process. Multiple data collection methods including interviews, observations, and archival sources were utilized for this purpose.

An interview guide was developed based on the literature review. Prior to conducting interviews, the interview guide was examined by academicians and practitioners and revised based on their feedback. Semi-structured interviews were conducted with the managers, end-users, consultants, and information systems personnel from both companies who were involved in the ERP implementation process. The length of the interviews ranged from 45 minutes to 2.5 hours.

As an observer, one of the researchers attended several of the project meetings at both companies throughout the study. At each meeting, notes were taken and informal conversations with knowledgeable informants were conducted. The researchers were also provided access to the archival resources including feasibility studies, meeting minutes, memos, and proposals.

During the data collection and analysis, guidelines in the literature on the enhancement of validity and reliability were followed (Dubé and Paré, 2003; Miles and Huberman, 1994; Yin 2002). After all the data was collected and reviewed by the researchers, two separate narratives describing the history of the projects were prepared. These narratives were reviewed and validated by the key informants in the case study companies.

Quantitative data was also collected from the case study companies to examine end-user perceptions of the ERP system. More specifically, a survey was prepared to measure end-users' perceptions about the usefulness, ease of use, and satisfaction with the new ERP system. The items in the survey were derived from previously tested survey instruments to take advantage of well-tested psychometric measures (Straub, 1989). Each construct was measured by using multiple indicators to capture the underlying theoretical dimensions effectively (Premkumar and Ramamurthy, 1995).

Perceived usefulness and perceived ease of use constructs were each measured using 6 items, which were adapted from Davis et al. (1989). End-user satisfaction with the ERP system was measured using the end-user computing satisfaction (EUCS) instrument developed by Doll and Torkzadeh (1988). The EUCS instrument is a psychometrically sound instrument that has been widely used in the information systems area to assess end-user satisfaction with various information systems including voice mail and e-mail applications, decision support systems, data warehouses etc. More recently, psychometric properties of the instrument were confirmed in the ERP domain by Somers et al (2003).

Survey data were collected from the same companies approximately six months after the "go live" date of the ERP system. Surveys were sent to the employees in the accounting and human resources departments within Company A, and to the employees in the accounting department within Company B. None of these employees had been part of the ERP implementation team. These departments were selected because they were directly affected by having their legacy systems entirely replaced by the ERP system.

Surveys were mailed to a total of 215 employees across companies. In order to ensure the highest achievable response rate, Dillman's (2000) Tailored Design Method was adopted in the design and implementation of the survey questionnaire. Personalized cover letters were included with each survey. The letter described the purpose and importance of the study, assured confidentiality of the responses, and stated that participation was voluntary. Employees were instructed to send their responses directly to the researchers. The response rate in company A was 48 %, whereas the response rate in company B was 22%.

In order to evaluate whether any statistical differences between the two companies regarding perceived usefulness, perceived ease of use, and end-user satisfaction with the ERP system, we compared the two groups of respondents using independent samples t-tests to check for equality of means. Before conducting the t-tests, Levene's statistic was calculated to ensure comparable variances between groups. Levene's statistic revealed no significant error variance differences. As such, we assumed equal variances for both groups. SPSS was used as the statistical analysis tool.

FINDINGS

In this section, we first describe the ERP implementation at the case study companies. A brief background of the companies, the need for the ERP implementation, and details about the implementation processes are

provided. Subsequently, the findings from the survey data obtained at both companies are discussed.

ERP Implementation at Company A

Company A is a large energy company, which is engaged in the exploration, production, refining, marketing, and distribution of energy products and technologies. The company has numerous manufacturing facilities located across multiple states in the United States.

The company's ERP initiative emerged from both top and mid-level management. Prior to the implementation of ERP, the company used a number of standalone, legacy information systems. Due to the lack of integration and increased complexity caused by rapid growth, these systems became inadequate to facilitate the timely and effective management of company operations. The company was facing a number of problems including difficulties in scheduling the manufacturing lines. Time and cost overruns were also occurring frequently. Equipment problems, such as maintenance delays and material shortages, were also common, adversely affecting customer relationships. Customer complaints about delayed and incorrect deliveries were inevitable, adding to the frustration faced by management and employees.

Recognizing the need for an integrated system, the management devised a strategic plan to implement an ERP system. The company opted to replace a set of selected legacy systems with an ERP system and cutover to the new system all-at-once.

The management was ready for the change process and committed to providing the necessary leadership and organizational resources for the project. The goals and the expected deliverables of the ERP initiative were well-defined and clearly communicated to the employees. A cross-functional team comprised of representatives of all functional areas within the company was assembled. Consultants from a leading consulting firm were also hired to join the project team. The team was charged with the task of implementing the system and interfacing it with the legacy systems that would be retained. In order to achieve these objectives, the team was granted significant decision-making authority.

With the approval of the management, the project team set forth an implementation timetable of one year and estimated the project budget to be around $100 million. A formal, phased project management approach was used to manage the project. Project management tools and techniques were utilized during the course of the implementation. The company also used process mapping and analysis techniques to study the "as-is" processes, as well as measure the process performance improvements.

Management also placed a heavy emphasis on end-users training. Employees were not only trained on the new system, but also received cross-functional training in different functional areas. For example, IT professionals were trained in parts of the accounting function. Cross-training employees provided them with a better appreciation of an integrated system, and proved helpful in creating a collective knowledge base for the company.

The company extensively relied on the internal IT staff during the implementation process, but also utilized the expertise of the external consultants when needed. The external consultants were assigned to the team as boundary spanners, as well as to assist in correcting on-site problems. Internal technology gatekeepers were also assigned to the project team from the project's inception. The company was knowledgeable about the experiences of other companies that had implemented ERP systems and incorporated this knowledge into their implementation plan.

The project was completed on schedule, yet substantial overtime was required to achieve this objective. Before going alive, the new system was tested extensively according the overall test plan that was developed earlier. Relatively few problems arose after implementation and the company considered the project to have been a great success.

ERP Implementation at Company B

Company B is a global automotive supplier, which is engaged in the design, engineering, and manufacture of a wide variety of components and sub-assemblies for automotive, commercial, and off-highway vehicle

manufacturers around the world. The company operates facilities in 15 countries and employs approximately 10,000 employees worldwide.

Prior to the implementation of the ERP system, the procurement, sales, marketing and operations functions of the company ran on more than 30 different legacy systems. This fragmented, function-based structure led to excess inventory, lack of responsiveness to customers' requests, higher operating costs, and duplication of efforts across different departments. For example, the procurement department was experiencing problems interpreting the production schedules to determine the required materials. Furthermore, obtaining even basic information from operations was taking at least several hours, if not days. Inventory reports were not up-to-date, creating additional problems for the procurement and productions. Moreover, since the inventory levels were not determined correctly, excess inventory on-hand was not being disposed gradually. In order to overcome these problems, top management decided to replace the legacy systems with an integrated information system that would provide a common IT platform throughout the company.

Top management formed an eight-member evaluation task force comprised of senior individuals from different functional areas to select and implement an ERP system. The task force carefully evaluated different ERP packages and recommended that SAP R/3 be adopted for all its facilities globally. Top management accepted this recommendation and formulated a strategy of revolutionary change from the start. Similar to Company A, they decided to implement selected ERP modules all at once and adopted the ASAP (AcceleratedSAP) methodology to streamline the implementation process.

Top management devoted substantial amount of time and money to ensure the project's success. The project scope was defined by the top management. The project schedule and budget were determined collaboratively between the top management and the task force. At the time of the implementation, the task force was modified to include key individuals from each functional area. The project team was charged with the responsibility of identifying, examining, and rethinking existing processes. The team was given the authority to reengineer or develop new business processes to support organizational and ERP goals.

The company brought in external consultants to help the project team throughout the implementation process. These consultants had extensive experience in implementing ERP systems in the automotive industry. Therefore, leveraging the consultants' expertise, the company was able to learn from other organizations that had successfully implemented ERP systems. The company also worked closely with consultants from the ERP vendor prior to and during the implementation process to take advantage of their technological expertise and ensure timely responses to technical issues that arose. When any problems were discovered, managers would meet to discuss the problem and contact vendor consultants for fixes.

The management of the Company B clearly communicated the importance of the project to the organization and followed a structured methodology to effectively manage the change process. In addition to the implementation team, change agents were appointed within each division. The role of these change agents was to raise employee awareness, remove obstacles, and ensure follow-up. Even though several organizational units at Company B were independent and differed culturally, there was limited local resistance to migrating to the new system and the implementation approaches specified by the central project team.

A business analysts group was formed to pilot test the system and to provide additional feedback to the project team. When the business analysts were comfortable that the system was performing as expected, 85 trainers were brought on board from each division's different functional areas. Team leaders who were responsible for coordinating training sessions were assigned to each functional area. Detailed, easy to use user manuals were prepared and these manuals were published in different languages for employee convenience. Many hours were spent bringing all employees up to speed with the ERP system. Moreover, resident experts were assigned to ERP technical support activities after the cutover date, thereby providing a significant resource for users.

The company utilized formal techniques and process metrics successfully for process measurement. Project team members regularly measured changed processes and articulated their value to management and functional groups. Data flow diagrams, CASE tools, and simulation were used for process analysis and redesign. Communications technology such as e-mail enabled effective communication and teamwork throughout the implementation process.

Implementation of the SAP R/3 system without major customizations reduced the complexity of the project and ensured the completion of the project on schedule and within budget.

Survey Results

All the respondents from Company A were from the accounting area, whereas the 72% of the employees in Company B were from accounting, while the remaining 28% were from human resources. 92% of the respondents in Company A, and 90% of the respondents in Company B had at least a 4-year college degree. Demographic information about the respondents is represented in Table 1.

Table 1: Demographics of Respondents.

	Company A (%)	Company B (%)
Education		
Some college	7	10
Four-year college graduate	71	78
Some postgraduate school or postgraduate degree	21	12
Areas of Work		
Accounting	100	72
Human resources	0	28

Usefulness of the ERP system: Respondents in both companies were generally positive about the usefulness of the ERP system (See Table 2). End-users generally believed that the ERP system enabled them to accomplish their tasks more quickly, and increased their effectiveness and productivity, while improving their job performance. For all items, Company A respondents rated the usefulness of the system higher (range 3.86 to 4.21) than Company B respondents (range 3.15 to 3.90). Further analysis was conducted to evaluate whether there were any statistical differences between the two companies regarding the end-users' perceptions about the usefulness of the ERP system. With the exception of item number 1, significant differences surfaced between Company A and Company B respondents at the .05 level.

Table 2: End-user Perceptions: Usefulness of the ERP System.

Items	Company A Mean	Company B Mean	Sig.
Using the ERP system in my job enables me to accomplish tasks more quickly.	4.21	3.90	.092
Using the ERP system improves my job performance.	4.14	3.74	.015*
Using the ERP system in my job increases my productivity.	4.07	3.67	.011*
Using the ERP system enhances my effectiveness on the job.	4.00	3.51	.005*
Using the ERP system makes it easier to do my job.	3.86	3.25	.001*
I find the ERP system useful in my job.	4.14	3.15	.000*

Note: The response format for each item consisted of a 5-place scale ranging from "Strongly Disagree" (1) to "Strongly Agree" (5)
* Significance levels less than .05 indicate that the two companies are statistically different

Ease of use of the ERP system: Users in both companies moderately agreed on the ease of use of the ERP system (See Table 3). Surprisingly, the mean scores of respondents in Company B (range 3.25 to 3.75) were a little higher than Company A (range 3.15 to 3.55), in spite of receiving less training and time for implementation.

Statistical differences between the two companies regarding the end-user's perceptions about the ease of use of the ERP system were analyzed. No significant differences emerged between Company A and Company B respondents at the .05 level.

Table 3: End-user Perceptions: Ease of Use of the ERP System.

Items	Company A Mean	Company B Mean	Sig.
Learning to use the ERP system is easy for me	3.71	3.75	.832
I find it easy to get the ERP system to do what I want it to do.	3.36	3.60	.185
My interaction with the ERP system is clear and understandable	3.43	3.25	.289
I find the ERP system to be flexible to interact with	3.36	3.31	.782
It is easy for me to become skillful at using the ERP system	3.79	3.51	.162
I find the ERP system easy to use	3.36	3.67	.071

Note: The response format for each item consisted of a 5-place scale ranging from "Strongly Disagree" (1) to "Strongly Agree" (5)

* Significance levels less than .05 indicate that the two companies are statistically different

User satisfaction with the ERP system: End-user satisfaction with the ERP system was measured along 4 dimensions including the satisfaction of the employees with the content, timeliness, accuracy, format, and ease of use of the ERP system (See Table 4). The mean scores of the respondents in Company A ranged from 3.43 to 4.50, whereas the mean scores of the respondents in Company B ranged from 3.23 to 4.58. In general, end-users in both companies were satisfied with their ERP experience. Each of the sub-dimensions of satisfaction is discussed below.

Table 4: End-user Perceptions: End-user Satisfaction with ERP System.

With regards to the ERP system used at work, please answer the following questions related to your satisfaction with the system:	Company A Mean	Company B Mean	Sig.
C1: Does the system provide the precise information you need?	3.86	4.15	.069
C2: Does the information content meet your needs?	3.79	3.97	.267
C3: Does the system provide reports that seem to be exactly what you need?	3.43	3.25	.350
C4: Does the system provide sufficient information?	3.79	3.74	.779
A1: Is the system accurate?	4.29	4.29	.994
A2: Are you satisfied with the accuracy of the system?	4.21	3.97	.118
F1: Do you think the output is presented in a useful format?	3.79	3.90	.525
F2: Is the information clear?	3.86	3.75	.522
E1: Is the system user friendly?	3.64	3.47	.424
E2: Is the system easy to use?	3.64	3.23	.040*
T1: Do you get the information you need in time?	3.93	3.81	.528
T2: Does the system provide up-to-date information?	4.50	4.58	.526

Note: The response format for each item consisted of a 5-place scale ranging from "Almost Never" (1) to "Almost Always" (5)

* Significance levels less than .05 indicate that the two companies are statistically different.

Content: The end-users in both companies believed that the ERP system provided precise and sufficient information and the content of the information met their needs. Regarding the reports provided by the system, users were less convinced with the system's ability in providing the exact reports that they needed. This item received the lowest rating from the end-users in both companies.

Timeliness: The end-users in both companies were in agreement that the information provided by the ERP system was timely. They were particularly satisfied with the systems' information being up-to-date and gave the highest ratings to the question which asked them whether the system provided up-to-date information.

Accuracy: Another dimension of the end-user satisfaction deals with the accuracy of the ERP system. In our study, end-users indicated that the system was accurate and they were satisfied with the accuracy of the system.

Format: Regarding the format, the end-users believed that the information was clear and the outputs were presented in a format that is useful to them.

Ease of use: Finally, even though the end-users were generally positive about the ease of use of the system, their self-reported satisfaction levels with the system were lower compared to the other dimensions. For example, the ease of use item received the lowest ratings from the Company B respondents.

We conducted further analysis to evaluate whether there were any statistical differences between the two companies regarding each sub-dimensions of end-user satisfaction. With the exception of the ease of use item number 2, no significant differences surfaced between Company A and Company B respondents at the .05 level.

DISCUSSION

In this study, we discussed the successful implementation of ERP systems at two global companies and then examined the perceptions of the end-users with the ERP system six months after the implementation.

Both of the companies in our study followed a revolutionary all-at-once approach to implementing the ERP system rather than following a phased approach. In both companies, top management played an important role throughout the implementation process by effectively communicating the importance of the new system and providing the necessary support and leadership. Cross-functional teams were delegated responsibility to implement the system and were empowered to make the necessary structural changes. The teams in both companies worked well with consultants and vendors throughout the entire process. In each company, the progress of the project was monitored actively through pre-determined milestones and targets. The implementation process was backed with careful change management, which provided the necessary environment for a smooth transition from the old system to the new one.

In terms of end-user perceptions of the ERP system, we examined the end-users perceptions of the usefulness and ease of the system, as well as their satisfaction with it. Regarding the usefulness of the ERP system, end-users in both companies found ERP system to be useful in accomplishing their tasks faster, improving their job performance, increasing their productivity, and enhancing their effectiveness. It was observed that the users in Company A found the system to be more useful compared to the end-users in Company B. Statistical comparison of the two company respondents' provided support for our findings. This may be attributed to the fact that the management of Company A had a clear vision and definition of the goals and expectations regarding the ERP system, and its potential impact on the day-to-day activities of the end-users. These issues were clearly communicated to the end-users. Moreover, end-users were not only trained on using the new system but also cross-trained on different functional areas. This provided the employees a better understanding of how the new system functioned and how an integrated system would improve their daily activities.

In terms of the ease of use of the ERP system, end-users found the system to be less accommodating. This result is not surprising because ERP systems are complex information systems and there is a learning curve when employees are introduced to new technologies. It is reasonable to expect that, in time, end-users will become more proficient in using the system, finding it more user-friendly and easy to use. Our finding is consistent with that of Somers et al. (2003). Somers et al. (2003) conducted a large scale survey to confirm the EUCS instrument in the

ERP domain and observed that ease of use and user friendliness of the ERP system received the lowest ratings from the end-users.
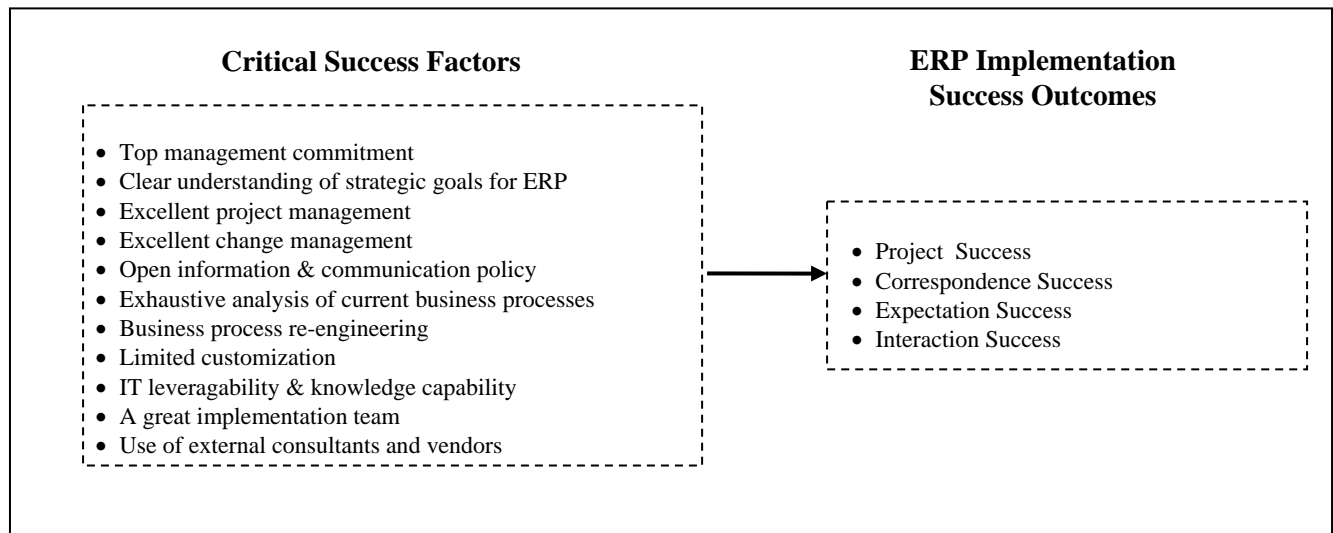
Even though there were no statistical differences between the end-users in the case study companies, Company B respondents rated the ease of use of the system higher than Company A respondents, in spite of getting less training and time for implementation. The reason for higher scores in Company B can be attributed to the fact that Company B developed and designed their own easy to understand manuals which were published in different languages for convenience. Also, after the system went live, Company B assigned resident experts to help the employees with the questions they might have in using the system.

Finally, in terms of user satisfaction with the ERP system, end-users in both companies were generally satisfied with the content, timeliness, format, and accuracy of the system. Statistical comparison of the two company respondents' provided support for our findings. The end-users were most satisfied with the accuracy of the ERP system and timeliness of the information provided by it. However, parallel to our earlier discussion, end-users were concerned about the friendliness and ease of use of the ERP system.

Based on the experiences of case study companies, several factors were identified as being critical to ERP implementation success. These factors, discussed below, can provide explicit guidelines to companies that are in the process of deploying ERP systems:

- Top management must be committed to the implementation project (Rao et al., 2004) and provide on-going support (identifying the ERP project as a priority, providing the necessary direction and resources for the project, etc.)

- The organization must have a clear understanding of why the ERP system will be implemented, and a detailed business plan to guide the implementation of the ERP system.

- The organization must apply project management tools and techniques in order to manage project activities (e.g. scope, time, cost, and quality management, focus on deliverables and performance measures etc.)

- The change process must be carefully managed. The organization must be prepared for the structural and cultural changes that will occur as a result of the implementation of the ERP system (e.g. cultural readiness, commitment to change, change management plan, etc.)

- Open information sharing and communication among the management, project implementation team, end-users, and external vendors and consultants must be encouraged.

- Current business processes must be carefully analyzed for inefficiencies and re-engineered to incorporate the best practices. The customizations to the ERP package must be kept at a minimal.

- The organization must rely on the IT department as the enabler (Rao et al., 2004) and facilitator of ERP implementation process. Communication technologies must be used effectively to share the accumulated knowledge.

- A great implementation team with business and technical knowledge (including representatives from functional departments, IT experts, consultants) must be assembled. This team must be empowered to make critical decisions and resolve disputes.

- The organization must effectively use external vendors and consultants throughout the project life cycle (package selection, testing, installation, troubleshooting, etc.)

- The organization must carefully consider the end-user needs and expectations and provide them with the necessary tools (e.g. end-user training on the new system, cross functional training and re-skilling of employees, sound technical services, end-user involvement through out the implementation process, easy to use and user friendly interfaces, etc).

Figure 1 summarizes the critical success factors identified in our study and links them to ERP implementation success outcomes.

Figure 1: ERP Critical Success Factors and Implementation Success Outcomes.

Critical Success Factors

- Top management commitment
- Clear understanding of strategic goals for ERP
- Excellent project management
- Excellent change management
- Open information & communication policy
- Exhaustive analysis of current business processes
- Business process re-engineering
- Limited customization
- IT leveragability & knowledge capability
- A great implementation team
- Use of external consultants and vendors

**ERP Implementation
Success Outcomes**

- Project Success
- Correspondence Success
- Expectation Success
- Interaction Success

LIMITATIONS

Like every research effort, our study is limited in certain respects. One limitation of our study is that it does not include any pre-implementation data, such as end-user satisfaction levels with the legacy system or expectation data for the new ERP system. By the time we began studying the case study companies, both of them had already started using the ERP system. As such, we did not have the opportunity to survey the end-users about their experiences and perceptions about systems that were used prior to the implementation or about their expectations from the ERP system before it was implemented. Including this type of pre-implementation data would have helped us gain a better understanding of the justification for the ERP system and could have been used as a baseline for measuring the changes that occurred as a result of the implementation.

It should be also noted that although reliance on end-user perceptions in measuring information system success is common among information systems researchers and practitioners, the use of end-user perceptions as a sole measure of success has certain limitations. For example, end user satisfaction measures rely on the affective/cognitive dimensions of user satisfaction without accounting for the objective performance related dimensions. Therefore, no one measure of success is sufficient to fully assess the success outcome of ERP implementation projects. As such, it is imperative that researchers and practitioners also consider the other dimensions of ERP project success (e.g., project success, correspondence success) and the interrelationships among them to gain a more comprehensive understanding of the phenomena.

Moreover, understanding end-user perceptions of ERP systems serves as an important supplement to traditional critical success factors identified in the literature. However, they are not a replacement for them. As such, the critical factors for successful ERP implementations must be identified and linked to the ERP implementation outcomes. Figure 1 in the previous section constitutes an initial step towards achieving this goal.

CONCLUSION

End-users play a key role in achieving ERP system success and utilizing the potential benefits that the system can offer. Therefore, findings of this study are important and relevant to the managers and project leaders who are in the process of implementing ERP systems. In addition, ERP vendors and consulting companies can utilize the findings of this study to improve their products and enhance client service by focusing on the areas that are important to end-users.

It is extremely important for management to understand the perceptions of the end-users with the ERP system, and the areas that produce satisfaction or dissatisfaction. By this way, management can more easily develop

and employ appropriate strategies that are necessary to improve end-user satisfaction with the system. Potential areas of resistance can be identified in advance and specific actions can be taken to avoid resistance and increase acceptance rate of the new ERP System.

Consistent with past research (e.g. Stebel, 1992), our findings suggest that corporate transformation requires a vision of the future, and a well-managed change process to effectively balance forces in favor of change over forces of resistance. Open communication and information sharing, cross-functional training, and personnel movement within the organization can promote a common culture and innovative behavior in the organization (Guha et al., 1997). Clearly communicating the benefits of the ERP system to the end-users, increasing end-user involvement in the implementation process, enhancing training activities, providing technical support facilities, and designing user interfaces that are easy to use and more user friendly might prove helpful in influencing end-users perceptions of the system and enhancing their satisfaction with it.

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