

CIOs' perspectives of critical success factors in ERP upgrade projects

D. L. OLSON* and F. ZHAO

Department of Management, University of Nebraska, Lincoln, NE 68588-0491, USA

(Received July 2006)

Enterprise resource planning systems have required significant upgrades in the 21st century as many of the systems obtained prior to 2000 have become outdated due to vendor changes. SAP and Oracle have emerged as dominant vendors, and SAP has announced discontinuance of support in the future for its primary R/3 system. This study reports interviews with the chief information officers (CIOs) of 15 institutions that have undergone (or are undergoing) enterprise system upgrades, with focus on discussion of major critical success factors for ERP upgrade projects.

Keywords: Enterprise information systems; Upgrade projects; Critical success factors

1. Introduction

Enterprise resource planning (ERP) market size was \$47.88 billion in 2004 according to AMR (2005) research. Although ERP systems offer a great deal, implementation success is far from assured. Statistics show that more than 70% of ERP implementations fail to achieve their corporate goals (Standish Group 2004) and the number of horror stories about failed or out-of-control projects is large (Olson 2004). Previous research has shown that failure to understand the business implications of ERP systems is related to implementation failure (Mendel 1999, Kumar and Van Hillgersberg 2000). Despite great technical challenges, the biggest problems in ERP implementations are business problems (Davenport 1998).

Recent reviews (Esteves 2001, Dong *et al.* 2002, Jacobs and Bendoly 2003) suggest that most existing ERP research focuses on selection and implementation, not on ERP's post-implementation impacts. According to Staehr *et al.* (2002), the ultimate impacts of ERP on the organization—once the system has been implemented and has been 'shaken down'—are not as thoroughly researched. Therefore, understanding post-implementation of ERP will help organizations succeed longer after the ERP implementation. ERP upgrade is one of the major activities in the post-implementation stage of ERP implementation (Nah *et al.* 2001). Every 3 years, a major ERP upgrade and several small upgrades are typically needed to keep the system running smoothly. Organizations will spend a significant amount of money on each ERP upgrade project. Without comprehensive understanding of ERP upgrade concepts in the organizational environment this may lead to

*Corresponding author. Email: dolson3@unl.edu

terrible nightmares, and even result in irretrievable disaster. Therefore, the aim of this research focuses on what factors are associated with ERP upgrade success.

There are several reasons why this study is important. First, each ERP upgrade project costs a significant amount of money. For example, a Midwest university spent over \$2 million on a recent ERP upgrade project. While first time ERP implementation happens only once, ERP upgrades will happen many times after the first ERP implementation (probably once every three years). Therefore, the cost of ERP upgrade is continuous along with the usage of the ERP system in the organization.

Second, according to our literature review through over forty information systems journals over 10 years, relatively little research attention has been given to ERP software upgrade. One possible reason could be that upgrade is perceived to be a smaller project (compared to first time ERP implementation), and another reason could be that little theory has been developed regarding the topic of ERP upgrade. However, ERP upgrade is one of the important activities in the ERP software lifecycle, and an effective and efficient implementation of ERP upgrade has a tremendous impact on an organization's continuous business process improvement.

Third, little progress has been made in identifying relative importance of success factors in each ERP upgrade stage. Understanding the relative importance of success factors in each stage can help information technology (IT) managers emphasize on dominant issues during the ERP upgrade projects. Especially when there are needs to make decisions about trade-offs among different upgrade activities, IT managers can focus on the most important factors other than less important factors in each upgrade stage.

2. ERP upgrade

Enterprise resource planning upgrades are mainly intended to take advantage of new technologies and business strategies to ensure that the organization keeps up with the latest business development trends. Therefore, the decision to upgrade ERP is usually not driven by code deterioration or anticipated reduction in maintenance costs alone, but by different purposes. According to an AMR study (Swanton 2004), 55% of upgrades were voluntary business improvements triggered by the need for new functionality, expansion or consolidation of systems; 24% of upgrades were triggered by technology stack changes; 15% of upgrades were forced by de-support of the running version of software to avoid vendor support termination (Craig 1999); and 6% of upgrades were triggered by bug fixes or statutory changes.

The cost of ERP upgrades is high (Montgomery 2004). Swanton (2004) mentioned that the cost of each upgrade includes: 50% of the original software licence fee and 20% of the original implementation cost per user, which means over \$6 million for a 5000-user system. Typically, each ERP upgrade requires 8 to 9 months of effort with a team the equivalent of one full-time employee per 35 business users. The ERP-adopting organization does not have to develop and re-write the ERP system itself but rather it replaces (or upgrades) the old version with a readily available new version from the ERP vendor. However, a lack of experience may cause the costs and length of the upgrade project to approach or even exceed those of

the original ERP implementation effort. Collins (1999) listed some general benefits for organizations from ERP upgrades:

- *Eligibility for help desk support.* Most of ERP software vendors stop providing technical support 12 to 18 months after the next version becomes available. Therefore, keeping pace with the upgrade of ERP vendors will guarantee the support for the system from the vendors.
- *Solutions for outstanding 'bugs' or design weaknesses.* It is impossible to guarantee spotless and error-free ERP systems after the implementations even though vendors will conduct many different testing processes to eliminate the happenings of errors in the system before the leasing time. 'The majority of software bugs are resolved and delivered either fix-by-fix, or all-at-once as part of the next release version of the ERP package.' In this case, upgrades will be beneficial to the organizations in problem solving.
- *New, expanded, or improved features.* ERP software provides organizations the knowledge and strength (i.e. best practices) from the vendors. ERP upgrades provide organizations future enhancement from the vendors to give the organizations better opportunities to catch up with the current business development, improve their processes and build more efficient business models with new functions, new features and new processing styles provided in the upgraded ERP versions.

Carr *et al.* (1996) believe that a project can be identified as a four-step process which is designed to assess the present position, decide on an appropriate change process, establish a sound theoretical framework for the change and ensure that aims are shared and personnel are involved and committed. This is achieved through the stages of:

- *Assessment.* Justification, objectives and broad characteristics.
- *Planning.* The entire change process is laid down.
- *Implementation.* Commitment, dissemination, training, change.
- *Renewal.* Monitoring, feedback and evaluation.

In this study, we adopted the Carr *et al.* (1996) model to present ERP upgrade process because this model is useful to help us distinguish between the 'phases' of change which the organization passes through as it implements ERP upgrade, and the 'processes' of change, i.e. the methods applied to get the organization to the desired state. The model progresses as follows.

2.1 Assessment phase

For the manager, the change process begins when questions are asked about what the originators of the proposal actually want to do. It begins with a general review of the organization, and it is relevant to organizational health, which is itself to do with motivation. By examining motives, managers should find out both positive and negative reasons for introducing change by asking all kinds of questions related to the change, such as what are the desired outcomes? What are the problems? How does the project fit with the strategy of the organization? What is the likely effect on the organization? What is to be the role of the manager? Outcomes of the assessment

phase include:

- Identification of what changes are required.
- Justification of changes.
- Identification of resources required.

2.2 Planning phase

The organization should make a detailed plan regarding all aspects of the resources of the organization. This includes staffing and personnel implications, structural implications, technical features and requirements, hardware and software arrangement, training plans, communication plans, etc. Outcomes of the planning phase include:

- Clarification of goals and objectives for each milestone.
- Identification of specific activities required to undertake desired change.
- Commitment obtained from stakeholders.
- Identification of support required to enable change to occur.
- Identification of staff development needs.
- Design of feedback mechanism.
- Review of general organizational implications.

2.3 Implementation phase

Changes identified are agreed upon and implemented. Actions and outcomes of the action phase can include:

- Putting the personnel in place.
- Communicating with the entire organization regarding activity results.
- Adjusting and refining changes where necessary.
- Reviewing the general organization implications.
- Putting the change into operation.

2.4 Renewal phase

The initial activity in this phase is to place the new system into operation. That tends to be very short in duration. But the renewal phase also offers the prospect of assessing the success and impact of the change; it also helps make changes permanently effective within the organization. Activities can include:

- Monitoring and evaluating changes.
- Results and outcomes from change communicated throughout the organization.
- Continuous development of employees through training, education.
- Ongoing monitoring and evaluation.

3. Critical success factors in general information systems projects

Critical success factors (CSFs) in ERP implementation has been studied fairly extensively, with recent studies by Akkermans and Van Helden (2002), Gefen (2002),

Hong and Kim (2002) and Robey *et al.* (2002). Some of these CSFs are expected to be less important in ERP upgrade projects, due to experience gained with the systems by organizations adopting these systems. Based on the literature review (Al-Mashari *et al.* 2003, Mabert and Soni 2003, Mandal and Gunasekaran 2003, He 2004, Huang *et al.* 2004, Loh and Koh 2004, Ehie and Madsen 2005, Ettl *et al.* 2005, Sun *et al.* 2005, Xue *et al.* 2005, Zhang *et al.* 2005), critical success factors which lead to a successful information systems projects were selected for this study shown, as the following:

- Business process re-engineering.
- Business vision.
- Communication.
- External support.
- Internal support.
- Organizational culture and change.
- Project champion.
- Project management.
- Top management support.
- Training and education.
- User involvement.

3.1 Method and analysis

This study uses an in-depth semi-structured interview technique to examine the success factors in ERP upgrade. This method allows a more spontaneous, informal and broader examination into the specific experiences of the interviewees in relation to the topic.

To ensure better results, we used only those companies who reported that their organization's ERP upgrade was completed the previous year or this year. By excluding organizations who completed ERP upgrade over two years, 15 IT managers were interviewed. A wide variety of industries were represented in the responses. Characteristics of the organizations are shown in table 2. In addition to the questions about ERP upgrade projects, IT managers were asked to rank the relative importance of critical success factors in each project phase. The purpose of this study is to gain an initial understanding of key factors in ERP upgrades.

Semi-structured interviews were audio-taped and later transcribed *verbatim* in preparation for analysis. In analysing the data, two researchers coded data independently. In the first phase, each coder read the transcripts to identify the key factors using qualitative classification. In the second phase, subcategories were identified to further the understanding of the layers of factors within each category. In the last phase, each factor was weighed by counting the number of respondents who provided the same or similar answers or emphasized similar themes.

Several strategies were used to ensure the reliability and validity of the analyses. The use of two independent coders ensured convergence in interpretation. Member checks were used by sending research findings to all participants. All of the participants concurred with the interpretation of the data gathered from their own interview. Table 1 reviews characteristics of organizations interviewed.

Table 1. Sample demographics.

Organization	Industry sector	Annual gross revenue (\$)	Number of employees	ERP vendor
A	Industrial manufacturing	9 billion	60 000	JD Edwards
B	Public sector	1 billion	3000	JD Edwards
C	Consumer products	3 billion	6500	Oracle
D	High technology	1.1 billion	2000	Oracle
E	Agriculture	100 million	200	Oracle
F	Education	500 million	6000	PeopleSoft
G	Healthcare	850 million	6000	PeopleSoft
H	Education	800 million	11 000	SAP
I	Industrial manufacturing	2.6 billion	24 400	SAP
J	Industrial manufacturing	19 billion	84 000	SAP
K	High technology	200 million	200	SAP
L	Utilities	200 million	1100	SAP
M	Bank	1 billion	86 000	mySAP
N	Distillery	2.7 billion	3400	mySAP
O	Industrial manufacturing	100 million	100	Syspro

More details about these upgrade projects are given in table 2. The vendor for each organization is given, with the year of upgrade and the upgrade project's duration. The reasons given for the upgrade are provided as well, and problems encountered during the upgrade project.

4. Results

4.1 *Recapitulation of the upgrade process*

These upgrade projects took between 2.5 months (a local system, with no customization) to 11 months (a more complex organizational structure with heavy training requirements). Customization may be needed by organizations, but will incur a cost in time (and thus money). The assessment phase was often quite short, ranging from two weeks to a month typically, although larger organizations took longer because of the need to obtain corporate approval. Planning and action phases were relatively consistent. We would conclude that upgrade projects involve lower levels of risk and uncertainty (and thus variance) than initial installations because the organization is very familiar with what the system should do. The renewal phase (putting the system on-line) was very short, typically less than 2 weeks. With proper project management, overnight or a weekend was possible.

The reasons for upgrade included eleven cases where some new functionality was desired (to include things like supporting Web access). There were five cases among the 15 where the vendor had announced discontinuance of service. Two cases cited the desire to obtain better vendor support. Another case cited the need to fix a bug in the existing system, and another to integrate modules.

Table 2. Upgrade project reasons.

Vendor	Upgrade	Months	Why	Problems
A JDE	2004	5	End of service pending New functionality (Web)	Scalability, solved by JDE
B JDE One World	2005	9	End of service pending New functionality	Customization needed
C Oracle	2005	5	Web functionality	Customization for CRM, dropped project
D Oracle	2005	7	Web functionality	None
E Oracle to 11i	2004	6	Web functionality	Dropped unhelpful consultant
F PeopleSoft	2004	9	End of service pending	None New functionality
G PeopleSoft	2004	7	Integrate modules	None
H SAP	2004/5	11	End of service pending Better vendor support	Training scheduling (many users)
I SAP to 4.6B	2003	5	New functionality End of service pending	None
J SAP to 4.7	2004	4	Fix bug	Problems with TMS add-on
K SAP (mySAP)	2005	3	Web functionality	None
L SAP to 4.7	2004	3	Better vendor support	Testing (some repeats)
M mySAP	2005	5	New functionality	None
N mySAP	2004	8	e-business, currency	None
O Syspro Impact	2003	6	New functionality	Needed patch to FedEx, UPS

There were far fewer problems involved in upgrade projects than are typically reported in initial ERP installations. This is to be expected, due to the experience gained with the system by the organization. Customization was a problem in two cases, one where customization was needed to provide adequate service (case B), and another (case C) where customization to implement a customer relationship management (CRM) add-on led to dropping this additional desired functionality. A problematic consultant was a problem in case E. There were also problems with a transportation management system (TMS) add-on in case J, and needed links to delivery vendors was a problem overcome in case O. Scalability was initially a problem in case A, but was resolved by the vendor. Some repeated testing was reported in one case, and the difficulty of dealing with massive retraining reported in another. Thus a variety of different problems can be expected in ERP upgrade projects, but for the most part these challenges are easier to overcome than is the case in initial implementation projects.

4.2 ERP upgrade critical success factors by phase

Each organization was asked to select those factors that they found important by project phase. These results are given in table 3.

The 15 organizations were quite consistent in their selection of critical success factors by phase. Business vision was selected by most organizations in the assessment phase. Top management support was selected by 12 of the 15 organizations in this phase. Four organizations also selected communication.

In the planning phase, there was unanimity that project management was the most important success factor. Communication was selected as second in importance

Table 3. Critical factors by phase.

	Respondents	
Phase I: Assessment		
1. Business vision	3	87%
2. Top management support	12	80%
3. Communication	4	27%
Phase II: Planning		
1. Project management	5	100%
2. Communication	14	93%
3. External support	6	40%
Phase III: Action		
1. Project management	2	0%
2. User involvement	10	67%
3. External support	9	60%
4. Training	7	47%
5. Customization	3	20%
6. Organizational culture	2	13%
7. Project champion	1	7%
Phase IV: Renewal		
1. User involvement	5	100%
2. External support	5	33%
3. Communication	2	13%

by 14 of the organizations. Six selected external support, which would emphasize the need to work with vendors.

In the action phase, project management continued to be selected as important (12 of 15 organizations). User involvement was also usually cited as important in the action phase (12 out of 15 organizations). Two organizations identified the need for a positive organizational culture. They were the multinational organizations. The other organizations were smaller in geographical scope. In addition, seven organizations emphasized the need for training. Customization was tabbed by three organizations, and one included the value of a project champion.

The renewal phase was quite short in most of the cases. All organizations (even those currently undergoing their upgrade projects) cited the need (or expectation) that user involvement was important. Five also cited the need for external support (from vendors). Only two emphasized communication, which help users understand the new policies after the upgrades.

Of the expected list of upgrade critical success factors, business process re-engineering and internal support were not mentioned by any of the 15 organizations. Evidently, business process reengineering (BPR) is already accomplished in the original project, and was not as critical in the upgrade projects. Internal support was probably developed to the extent needed by the organization's prior experience.

5. Conclusions

ERP upgrade projects have grown in importance, as vendors are seeking to generate revenue through improved systems. The reticence of vendors to support old systems

was noted by multiple organizations in this study (the value of improved functionality was also noted).

Upgrade projects seem to be much more controllable than initial ERP installation projects. This should be expected due to the experience organizations gain with their original systems. All of the organizations seemed to do something that fitted the theoretical model of an upgrade project that we used. Assessment, planning, and action phases were present to at least some degree. The renewal phase noted by the 13 organizations involved very smooth turnover. A limitation of the study is that future implications were not yet available in all cases (problems may crop up later), although all organizations credited strong planning and project management as ways to assure smooth transitions.

ERP upgrade projects were shown to be less problematic than initial ERP installations, which in retrospect, may seem obvious. However, the 13 cases clearly show that some factors are more critical in different phases. And clearly careful planning is needed to attain success. It is recommended that future studies apply quantitative methods to evaluate the results from this qualitative study.

References

- Akkermans, H. and Van Helden, K., Vicious and virtuous cycles in ERP implementation: a case study of interrelations between critical success factors. *Eur. J. Inform. Syst.*, 2002, **11**, 35–46.
- Al-Mashari, M., Al-Mudimigh, A. and Zairi, M., Enterprise resource planning: a taxonomy of critical factors. *Eur. J. Oper. Res.*, 2003, **146**, 352–364.
- AMR report, 2005. Available online at: www.amrresearch.com (accessed 15 March 2006).
- Carr, D., Hard, K. and Trahan, W., *Managing the Change Process: A Field Book for Change Agents, Consultant, Team Leaders, and Reengineering Managers*, 1996 (McGraw-Hill: New York, NY; Coopers & Lybrand).
- Collins, K., Strategy and execution of ERP upgrades. *Gov. Finance Rev.*, 1999, **15**(4), 43–47.
- Craig, R., Laurier enterprise system upgrade, in *International Conference of Information Systems*, Charlotte, USA, 1999.
- Davenport, T., Putting the enterprise into the enterprise system. *Harv. Bus. Rev.*, 1998, **76**, 121–131.
- Dong, L., Neufield, D. and Higgins, C., The iceberg on the sea: what do you see, in *Proceedings of the 8th Americas Conference on Information Systems*, Dallas, TX, edited by R. Ramsower and J. Windsor, 2002, pp. 857–864.
- Ehie, I. and Madsen, M., Identifying critical issues in enterprise resource planning (ERP) implementation. *Comput. Indus.*, 2005, **56**, 545–557.
- Esteves, J., Enterprise resource planning systems research: an annotated bibliography. *Comm. of the AIS*, 2001, **7**(8).
- Ettlie, J., Perotti, V., Joseph, D. and Cotteleer, M., Strategic predictors of successful enterprise system deployment. *Int. J. Oper. Prod. Manage.*, 2005, **25**(10), 953–972.
- Gefen, D., Nurturing clients' trust to encourage engagement success during the customization of ERP systems. *OMEGA—Int. J. Manage. Sci.*, 2002, **30**, 287–299.
- He, X., The ERP challenge in China: a resource-based perspective. *Inform. Syst. J.*, 2004, **14**, 153–167.
- Hong, K.-K. and Kim, Y.-G., The critical success factors for ERP implementation: an organizational fit perspective. *Inform. Manage.*, 2002, **40**(1), 25–40.
- Huang, S., Chen, H., Hung, Y. and Ku, C., Transplanting the best practice for implementation of an ERP system: a structured inductive study of an international company. *J. Comput. Inform. Syst.*, 2004, **44**(4)(Summer), 101–110.

- Jacobs, F.R. and Bendoly, E., Enterprise resource planning: Developments and directions for operations management research. *Eur. J. Oper. Res.*, 2003, **146**(2), 233–240.
- Kumar, K. and Van Hillgersberg, J., ERP experience and evolution. *Comm. of the ACM*, 2000, **43**(4), 23–26.
- Loh, T. and Koh, S., Critical elements for a successful enterprise resource planning implementation in small and medium-sized enterprises. *Int. J. Prod. Res.*, 2004, **42**(17), 3433–3455.
- Mabert, V., Soni, A. and Venkataramanan, M., The impact of organization size on enterprise resource planning (ERP) implementations in the US manufacturing sector. *Omega*, 2003, **31**(3), 235–246.
- Mandal, P. and Gunasekaran, A., Issues in implementing ERP: a case study. *Eur. J. Oper. Res.*, 2003, **146**, 274–283.
- Mendel, B., Overcoming ERP project hurdles. *InfoWorld*, 1999, **21**(29).
- Montgomery, N., Build your business case for upgrades by adding functionality. *Computer Weekly*, 2004, (10 February).
- Nah, F., Faja, S. and Cata, T., Characteristics of ERP software maintenance: a multiple case study. *J. Software Mainten. & Evol.: Res. & Prac.*, 2001, **13**, 399–414.
- Olson, D., *Managerial Issues of Enterprise Resource Planning Systems*, 2004 (McGraw-Hill: New York, NY).
- Robey, D., Ross, J.W. and Boudreau, M.C., Learning to implement enterprise systems: an exploratory study of the dialectics of change. *J. Manage. Infor. Syst.*, 2002, **19**(1), 17–46.
- Staeher, L., Shanks, G. and Seddon, P., Understanding the Business Benefits of Enterprise Resource Planning Systems, in *Proceedings of the 8th Americas Conference on Information Systems*, Dallas, TX, edited by R. Ramsower and J. Windsor, 2002, pp. 899–905.
- Standish Group. Third Quarter Research Report, 2004. Available online at: <http://www.standishgroup.com/index.php> (accessed 15 March 2006).
- Sun, A., Yazdani, A. and Overend, J., Achievement assessment for enterprise resource planning (ERP) system implementations based on critical success factors (CSFs). *Int. J. Prod. Econ.*, 2005, **98**, 189–203.
- Swanton, B., Build ERP upgrade costs into the business change program – not the IT budget. *Computer Weekly*, 2004, (21 September).
- Xue, Y., Liang, H., Boulton, W. and Snyder, C., ERP implementation failures in China: case studies with implications for ERP vendors. *Int. J. Prod. Econ.*, 2005, **97**, 279–295.
- Zhang, Z., Lee, M., Huang, P., Zhang, L. and Huang, X., A framework of ERP systems implementation success in China: An empirical study. *Int. J. Prod. Econ.*, 2005, **98**(1), 56–80.