

Learning from adopters' experiences with ERP: problems encountered and success achieved

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Enterprise resource planning (ERP) packages touch many aspects of a company's internal and external operations. Consequently, successful deployment and use of ERP systems are critical to organizational performance and survival. This paper presents the results of a study of the problems and outcomes in ERP projects which was conducted under the sponsorship of an ERP systems vendor. Two basic research questions were addressed. First, how successful are companies at different points in time in their ERP experiences and how are different measures of success related? (That is, can early success be followed by failure and vice versa?) Second, what problems do ERP adopters encounter as they implement and deploy ERP and how are these problems related to outcomes? The findings showed that the success of ERP systems depends on when it is measured and that success at one point in time may only be loosely related to success at another point in time. Companies experience problems at all phases of the ERP system life cycle and many of the problems experienced in later phases originated earlier but remained unnoticed or uncorrected. These findings suggest that researchers and companies will do well to adopt broad definitions and multiple measures of success and pay particular attention to the early identification and correction of problems.

Introduction

One of the most enduring research topics in the field of information systems (IS) is that of system success (Lyytinen and Hirschheim, 1987; deLone and McLean, 1992; Ballantine *et al.*, 1996). Prior research has addressed the measurement of success, the antecedents of success and explanations of success or failure. Yet for each new type of information technology (IT) or application the question of success comes up again. In the case of enterprise resource planning (ERP) systems success takes on a special urgency, since the costs and risks of these massive technology investments rival their potential pay-offs. Failures of ERP system implementation projects have been known to lead to organizational bankruptcy (Bulkeley, 1996; Davenport, 1998; Markus and Tanis, 2000).

Briefly, ERP systems are commercial software packages that enable the integration of transactions-oriented data and business processes throughout an organization. From a base in manufacturing and financial systems, ERP systems may eventually allow for integration of interorganizational supply chains (Davenport, 1998; Markus and Tanis, 2000). Because these systems touch so many aspects of a company's

internal and external operations, their successful deployment and use are critical to organizational performance and survival.

This paper describes the results of a study of problems and outcomes in ERP projects. The study was conducted under the sponsorship of an ERP vendor who was interested in helping its customers be more successful in ERP implementation. Two basic research questions are addressed: First, how successful are companies at different points in time in their ERP experiences, and how are different measures of success related? (That is, can early success be followed by failure and vice versa?) Second, what problems do ERP adopters encounter as they implement and deploy ERP, and how are these problems related to outcomes?

Success with ERP and how it happens

The definition and measurement of success are thorny matters. First, success depends on the point of view from which you measure it. It became clear early on in our research that people often mean different things when talking about ERP success. For example, people whose job it was to implement ERP systems (e.g. project managers and implementation consultants)

often defined success in terms of completing the project plan on time and within budget. However, people whose job it was to adopt ERP systems and use them in achieving business results tended to emphasize having a smooth transition to stable operations with the new system, thereby achieving intended business improvements such as inventory reductions and gaining improved decision support capabilities.

In this paper we adopt an inclusive perspective that focuses on the organizations that adopt ERP systems and the individuals within these organizations (rather than on ERP vendors and external implementation consultants). We recognize that our 'etic' perspective (non-interpretive, outside looking in) may not have corresponded with that of any particular actor(s) in the organizations we studied, but it allowed us to include many different dimensions in our assessment of success, including the following.

- (1) Success viewed in technical terms.
- (2) Success viewed in economic, financial or strategic business terms.
- (3) Success viewed in terms of the smooth running of business operations.
- (4) Success as viewed by the ERP-adopting organization's managers and employees.
- (5) Success as viewed by the ERP-adopting organization's customers, suppliers, and investors.

A second important issue in the measurement of success concerns when one measures it. Some years ago, Peters and Waterman (1982) attracted much attention with their study of 'excellent companies'. A few years later, a sizeable number of their excellent companies were no longer star performers. Project managers and implementers can afford to declare success in the short run, but executives and investors are in it for the long haul. The organizations that adopt ERP systems need to be concerned with success, not just at the point of adoption but also further down the road. The importance of considering ERP success at multiple points in time was made clear in a case study by Larsen and Myers (1997) in which a successfully installed ERP system was later terminated when the company merged with another.

In this study we were concerned with the assessment of success at three different points in time during the adopting organization's experience with an ERP system. We can conceptually differentiate three distinct phases in the 'ERP experience cycle' (Markus and Tanis, 2000): (1) the project phase during which ERP software is configured and rolled out to the organization, (2) the shakedown phase during which the company makes the transition from 'go live' to 'normal operations' and (3) the onward and upward phase during which the company captures the majority of

business benefits (if any) from the ERP system and plans the next steps for technology implementation and business improvement. A number of success metrics can be defined for each of these phases.

Success in the project phase

- (1) Project cost relative to budget.
- (2) Project completion time relative to schedule.
- (3) Completed and installed system functionality relative to original project scope.

Success in the shakedown phase

- (1) Short-term changes occurring after system 'go-live' in key business performance indicators such as operating labour costs.
- (2) Length of time before key performance indicators achieve 'normal' or expected levels.
- (3) Short-term impacts on the organization's adopters, suppliers and customers such as average time on hold when placing a telephone order.

Success in the onward and upward phase

- (1) Achievement of business results expected for the ERP project, such as reduced IT operating costs and reduced inventory carrying costs.
- (2) Ongoing improvements in business results after the expected results have been achieved.
- (3) Ease in adopting new ERP releases, other new ITs, improved business practices, improved decision making, etc., after the ERP system has achieved stable operations.

These success metrics include indicators of human and organizational learning. It is important not just how well the ERP system itself performs (e.g. accuracy, reliability and response time), but how well people in the organization know how to use, maintain and upgrade the ERP system and how well the business improves its performance with the ERP system.

An unresolved question is the relationship between the measures of success at different points in time. Larsen and Myers (1997) found that an ERP experience could be an early success and a later failure. But can an ERP experience be an early failure yet a later success? How important is it for organizations to be successful at all three phases of the ERP experience cycle? And how often do organizations push through initial failure to achieve an ultimate measure of success? These are empirical questions.

A third important issue in the measurement of success is the yardstick or criterion against which to compare an actual level of achievement. It is quite common in systems evaluation, technology assessment and impact studies to use the adopters' objectives, expectations and perceptions as the standard for defining and measuring success. Naturally, these subjective judgements of success can be quite important in understanding how organizations behave. If a company stops using an ERP system because corporate objectives have not been met, it does not matter that an outside observer might have assessed the implementation project and system operation as successful.

However, there are serious disadvantages to using perceptions, objectives and expectations as the sole measures of success. In the first place, it is hard to normalize them across individuals and organizations, thus making comparisons difficult. Second, their relationship with so-called 'objective' measures of success (such as whether or not a project is terminated prior to completion), (cf. Sauer, 1993) is unclear. People's objectives for and expectations of ERP systems may be overly ambitious so that they are unrealizable no matter what people do. Alternatively, or they may be insufficiently ambitious so that people do not take full advantage of the capabilities 'in' the technology which are available for them to use (Markus and Tanis, 2000).

If one wants to compare the outcomes achieved by the organizations that have adopted ERP systems, it is useful to have an external yardstick of success in addition to internal perceptual measures and local objectives and expectations. For this purpose, we proposed using optimal success, as defined by (Markus and Tanis, 2000), as our criterion as follows:

Optimal success refers to the best outcomes the organization *could* achieve with enterprise systems, given its business situation, measured against a portfolio of project, early operational, and longer term business results metrics. Optimal success can be *far more or less* than the organization's goals for an enterprise system. Further, optimal success can be *dynamic*; what is possible for an organization to achieve may *change over time* as business conditions change (p. 186–7).

Naturally, the concept of optimal success defined thus is difficult to operationalize. However, the advantage of attempting to assess outcomes by using such an external, non-interpretive yardstick is that it helps us compare the results achieved in different organizations and explore the interesting relationships between 'objective' outcomes and people's perceptions of results.

The phrase optimal success suggests that most organizations experience outcomes that fall somewhat short of what a 'best in class' organization might achieve. This observation directs attention at the problems companies experience when they adopt, deploy and use ERP systems and how they respond when problems arise. This is not a focus on 'success factors' *per se*, but on aspects of the 'lived experience' of organizations' ERP journeys. One wants to know how (the process by which) some companies realize better or worse outcomes than other companies do and what they do that makes the difference. Put differently, one wants to know whether all companies experience the same types of problems with ERP systems, whether they respond similarly to the problems and whether the problems and responses are related to the outcomes they experience.

It should be clear that we believe that the outcomes companies achieve with ERP systems (varying degrees of suboptimality, relative to what they could achieve, if all went perfectly well) are non-deterministic. Problems such as a lack of resources or turnover of personnel can arise in each phase of the ERP experience cycle. They may or may not be perceived as problems by the people in the organization and, even when people perceive the problems as problems, they may or may not take appropriate actions for resolving them. As a result, the outcomes in a particular phase may be optimal or less than optimal and the problems may or may not remain unresolved, thereby affecting outcomes later. See Markus and Tanis (2000) for a more detailed treatment of this 'theory' of ERP success.

In practice, it can be extremely difficult to differentiate between problems, symptoms of problems and outcomes (that is, the consequences of problems). Nevertheless, the importance and complexity of the ERP experience suggests the need to try. Therefore, this study addresses two related questions about the ERP experience. First, how successful are companies at different points in time in their ERP experiences and how are different measures of success related? (That is, can early success be followed by failure and vice versa?) Second, what problems do ERP adopters encounter as they implement and deploy ERP and how are these problems related to outcomes?

Table 1 helps to frame the findings of this research by providing a more complete description of the issues involved in assessing the success of ERP projects. Table 1 outlines (1) the activities that characterize each phase of the ERP life-cycle, (2) how and why the activities in each phase may affect the outcomes an adopter achieves, not just in the phase but also downstream, (3) some of the problems an ERP adopter may experience during the phase (which can also be understood

Table 1 Assessing achieved success in the ERP experience

Major activities of the phase	Implications of phase activities for success in phase and later	Common problems	Phase success measures
Project phase			
Project team formation and training Develop enterprise model for configuration and develop and validate kernel in multiple implementations	The majority of ERP expenditure plans are made during this phase Few benefits are experienced during this phase unless the organization pursues a	Inability to acquire/retain employees and external advisers with requisite expertise in ERP, project management and supporting technologies	Project cost relative to budget
Configure ERP software to reflect either current operations or planned new business processes Design and execute changes (if any are planned) in the organization's business processes and related organizational elements (organization structure, jobs, compensation, etc.) Implement add-ons, modifications and interfaces with other enterprise systems and legacy systems	'quick wins' or 'low hanging fruit' strategy of identifying and implementing business process improvements while ERP planning and configuration is under way The longer the project phase, the lower the overall financial benefits from the system on a discounted cash flow basis If the project goes very badly, decision makers may terminate it When the schedule gets tight, team may decide to cut scope, so that strategically essential processes are not supported	Turnover of project sponsor or project manager Excessive turnover (and/or stress-related health problems) on project team Unwillingness of business managers and key users to make time for project activities Major changes in project scope after start of project Poor quality software, documentation and training materials Modifications that do not work and delays in development of modifications and interfaces Conflicts with implementation consultants over project plans and management Cutting testing and/or training when schedule gets tight Pressure to terminate project if cost and schedule overruns occur	Project completion time relative to schedule Completed system functionality relative to original project scope
Acquire IT infrastructure resources and integrate ERP system with infrastructure and legacy systems (if any) Document configuration decisions and rationale			
Decide how to satisfy decision support/reporting needs			
Communication and change management Clean up data and convert data to new ERP system			
Test the new system Train users			

Table 1 continued

Major activities of the phase	Implications of phase activities for success in phase and later	Common problems	Phase success measures
Shakedown phase			
<p>Make the transition to 'normal operation' of the new system and the new business processes</p> <p>'Rework' (mistake correcting) activities may include changing configuration settings, upgrading IT infrastructure, revising business practices and procedures and retraining users</p>	<p>The organization may not be able to realize planned improvements in IT costs and/or business process efficiency until (1) the new system stabilizes, (2) the old systems are interfaced or turned off and older IT resources are removed from maintenance agreements and (3) users achieve full proficiency with the new system</p> <p>In addition, the organization may have to make significant new expenditures for temporary and overtime labour, consulting help and additional IT resources in order to complete the transition from 'go live' to 'normal operations'</p> <p>The longer the shake down phase, the lower the overall business benefits on a discounted cash flow basis</p> <p>If shake down goes very badly, the system may be removed or the organization may become unwilling to undertake future system improvements (e.g., upgrades)</p>	<p>Extremely poor system performance</p> <p>Excessive stress and/or turnover of key users and/or key system support personnel</p> <p>Excessive dependence on 'key users' (project team members) and/or IT specialists</p> <p>Maintenance of old procedures or manual workarounds in lieu of learning the relevant system capabilities</p> <p>Data input errors</p> <p>Inability to diagnose and remedy system and/or business process performance problems</p> <p>Extremely negative reactions from customers and suppliers (e.g. large losses of business)</p> <p>Absence of sharp and fast improvements during shake down</p> <p>Absence of satisfactory management information/analysis and reporting</p> <p>Pressure to de-install system</p>	<p>Short-term deterioration in key (business) performance indicators (KPIs) (e.g. process cycle times, inventory levels and operating labour costs)</p> <p>Length of time before KPIs and business impacts return to normal</p> <p>Short-term negative impacts on organization's suppliers and customers (e.g. average time on hold, lost calls, lost sales and customer satisfaction levels)</p>

Table 1 continued

Major activities of the phase	Implications of phase activities for success in phase and later	Common problems	Phase success measures
<p>Onward and upward phase</p>			
<p>Ongoing operation and use of system and business process after the shakedown phase</p>	<p>The majority of business benefits (if any) are achieved after shake down</p>	<p>'Normal operation' never materializes</p>	<p>Achievement of planned business results (e.g. IT operating costs, inventory carrying costs, business process cost and cycle time)</p>
<p>Planning for upgrades and migration to later releases/versions of hardware and ERP software</p>	<p>Many desired business benefits may not be possible with the current release, but may require the organization to undertake a series of upgrades (e.g. reductions in an organization's IT personnel expenditures may not be realizable during the initial ERP experience cycle and achieving business process 'visibility' across sites occurs after all sites have been implemented)</p>	<p>Non-improvement in users' ERP skill levels (e.g. many potential users remain untrained and users routinely rely on project team members and technical support personnel to perform 'normal' job activities)</p>	<p>Use of data and decision analyses produced by the system</p>
<p>Adoption of additional modules/packages and integration with ERP</p>	<p>ERP experience cycle and achieving business process 'visibility' across sites occurs after all sites have been implemented)</p>	<p>Failure to retain people who understand the implementation and use of ERP systems</p>	<p>Use of data and decision analyses produced by the system</p>
<p>Business decision making based on data provided by the ERP system</p>	<p>Many benefits cannot occur until: (1) users have learned how to use the system well, (2) managers have used the data collected by the system in order to make business decisions and plan improvements in business processes and (3) additional changes are made in business processes, practices, software configuration, etc.</p>	<p>No documentation of rationale for business rules and configuration decisions</p>	<p>Ongoing improvements in business results (after planned results have been achieved)</p>
<p>Continuous improvement of users' IT skills</p>	<p>Many benefits cannot occur until: (1) users have learned how to use the system well, (2) managers have used the data collected by the system in order to make business decisions and plan improvements in business processes and (3) additional changes are made in business processes, practices, software configuration, etc.</p>	<p>Difficulty in optimizing system performance and in reconfiguring the system to support business innovations</p>	<p>Planned results have been achieved</p>
<p>Continuous business process improvement in order to achieve better business results</p>	<p>Many benefits cannot occur until: (1) users have learned how to use the system well, (2) managers have used the data collected by the system in order to make business decisions and plan improvements in business processes and (3) additional changes are made in business processes, practices, software configuration, etc.</p>	<p>Unwillingness of organization to adopt additional changes in business processes, system configurations or IT infrastructure</p>	<p>Ease in developing/adopting/implementing additional innovations in technology, business practices and managerial decision making</p>
<p>Reconfiguration of current release/version</p>	<p>Many benefits cannot occur until: (1) users have learned how to use the system well, (2) managers have used the data collected by the system in order to make business decisions and plan improvements in business processes and (3) additional changes are made in business processes, practices, software configuration, etc.</p>	<p>Pressure to de-install system</p>	<p>Original decision to implement ERP still makes sense in light of subsequent business decisions and events (e.g. mergers and acquisition)</p>
<p>Continuous business process improvement in order to achieve better business results</p>	<p>Many benefits cannot occur until: (1) users have learned how to use the system well, (2) managers have used the data collected by the system in order to make business decisions and plan improvements in business processes and (3) additional changes are made in business processes, practices, software configuration, etc.</p>	<p>Pressure to de-install system</p>	<p>(Over time) decreases in length of project planning and shake down phases for subsequent ERP implementations</p>

as indicators that the experience may be heading for suboptimal success) and (4) the success measures relevant to the phase.

Approach

This research study combined several methods: (1) reviews of published and in-process research studies and teaching cases of ERP implementations, (2) in-depth case studies of the ERP experience in five ERP-adopting organizations following the procedures prescribed by Yin (1994), (3) interviews with 11 additional ERP-adopting organizations and (4) approximately 20 interviews with ERP implementation consultants and members of the ERP vendor company sponsoring this study. Table 2 describes each of the 16 ERP-adopting organizations that directly participated in this research. At the same time, the analysis and interpretation of the results presented in this report reflect the experiences of a much larger number of companies (approximately 40 in total), including those described in teaching cases, other research reports and the trade press.

The 11 ERP adopter interviews were conducted by phone or in person: one or more members of the research team discussed the ERP experience with one or more members of the adopting organization. The interviews ranged from 1 to 3 h in length. The case studies involved a much more significant level of effort. Two to four members of the research team visited the case site for 2–4 days, interviewing 12–25 people. Documents describing the company and its implementation effort were collected and analysed. Notes were transcribed and reviewed by project team members and summaries were written. The detail and thoroughness of the case study method meant that it was not necessary to examine a large number of cases in order to gain the benefits of this research strategy in analysing 'how and why' research questions (Yin, 1994). For such scientific purposes, four to 12 case studies are considered perfectly adequate.

Several criteria were used in selecting the companies for this study. First, we selected companies that were interested in learning about how to improve their ERP experiences from the research. These companies were recruited at public presentations where we described our research project.

Second, we studied companies at different stages of the ERP experience. Studying projects in process provides useful knowledge about how the ERP experience unfolds over time. This is particularly useful in identifying why companies act the way they do. After the project is over, people forget many details and reconstruct the past in order to be consistent with

known outcomes. Studying completed projects allows researchers to identify the key causal factors in success or failure. Thus, we aimed for a mix of both completed and in-process projects. Table 3 shows the stage of completion reached by each company at the time we collected data. Because some of the cases we studied were in process at the time of data collection, we do not have complete outcome data for all companies.

Third, we went out of our way to select projects that had experienced problems rather than projects that were unqualified successes. A major goal of the study was understanding the problems adopters experience with ERP systems, why these problems occur and what could be done about them. Therefore, we skewed our sample towards companies with problems and suboptimal success. This means that the companies examined in this study may not be a representative sample of all companies using ERP systems. It would not be valid to draw conclusions from this study about how frequently ERP adopters experience certain problems or how frequently they achieve success (or lack of it) on different measures.

Two additional factors may limit the potential statistical generalizability (Yin, 1994) of the results. First, all 16 of the adopter companies we studied were based in North America or Europe. Second, all 16 companies used the ERP products of a single software vendor. However, we do not believe that these factors materially affected our findings about the kinds of problems and outcomes companies experience with ERP systems. Our findings closely tracked reports by other academics and journalists. Further, these factors were not likely to affect the analytical generalizability (Yin, 1994) of our results. Although the current study design did not provide reliable data about frequencies, it could provide reliable insights into how and why problems and outcomes occur when they do occur.

Findings

Table 4 presents a summary of the problems and outcomes reported by the companies participating in this research. Immediately below, we present some interesting generalizations about the nature of success across the ERP life-cycle. In a subsequent section, we discuss the problems companies experienced.

Findings about adopters' achieved success with ERP systems

First, none of the ERP adopters we studied was an unqualified success at all of the stages of the experience cycle completed at the time of our data collection. This is to be expected given the nature of our

Table 2 Overview of companies in the study

Company identifier	Company description	ERP implementation description – status at time of data collection	Data sources
Company A	<p>\$250 million US company</p> <p>Company had grown through past mergers that were never fully integrated</p> <p>Single manufacturing location, functionally organized</p> <p>Assemble to order manufacturing plus some custom business processes</p> <p>Industry details omitted at company request</p>	<p>Project was justified to and approved by company board</p> <p>Single-site implementation with approximately 400 users</p> <p>All major business functions included in project, including manufacturing, finance and distribution (but excluding human resources).</p> <p>System went live June 1997</p> <p>Total project cost approximately \$17 million including hardware and consulting services</p>	<p>Four researchers performing approximately 12 h of interviews with one key informant plus 3 h interview with chief information officer (CIO) (one researcher)</p> <p>Data collected in US in March through to September 1998</p>
Company B	<p>\$1.2 billion global North American-based manufacturing company with 7000 employees and 170 sites all over the world</p> <p>Fifth or sixth in their industry.</p> <p>Make-to-stock, assemble-to-order and a small proportion of engineer-to-order processes</p> <p>Company formed through 1997 merger of two companies roughly equal in size and previously competed in distinct, industrial equipment niches; little integration of the companies has occurred</p>	<p>Company was having difficulty deciding which software release to implement</p> <p>Approximately 500 concurrent users world-wide were expected</p> <p>Project budget approximately \$133.5 million and planned schedule 30 months</p> <p>The ERP project was cancelled in 1999 after an expenditure of \$70 million</p>	<p>Three researchers performing approximately 24 h of interviews with 16 members of implementation team, including CIO and consultants</p> <p>Reviewed internal documentation and videotapes of ERP project introduction at leadership meeting January 1998</p> <p>Data collected in US in June 1998</p>
Company C	<p>European subsidiary of US multinational apparel company</p> <p>Make to stock manufacturing</p> <p>Facing declining market demand for core product</p>	<p>Multisite, pan-European roll-out in process (eight sites over 4 years)</p> <p>Headquarters went live with finance modules December 1997 (on time) and raw materials management in June 1998 (6 months delay)</p> <p>First affiliate and sales office live in July 1998 (6 months delay)</p> <p>Multisite configuration: eight (logistical and financial) companies were set up</p> <p>Distributed architecture – separate server at each site</p> <p>\$5.5 million worth of modifications and interfaces (includes consulting)</p>	<p>Two interviews with five key informants in summer 1998</p> <p>Two researchers performing approximately 27 h of on-site interviews with 19 informants in September 1998</p> <p>Reviewed key internal documentation</p> <p>Data collected in Belgium and The Netherlands</p>
Company D	<p>\$330 million arm of global energy and engineering firm located in Scandinavia</p> <p>One thousand five hundred employees</p> <p>Company is the result of a 1996 merger of three companies preserved in 1998 as three divisions</p> <p>Manufactures components and systems that serve the entire supply chain of the electrical power industry</p>	<p>Three divisions each with separate single-site instance of same ERP package</p> <p>First division went live in January 1996, on time and within budget</p> <p>Second division went live May 1998 6 months behind schedule and 25% over budget due to buggy software and more customizations than planned</p> <p>Third division was in the process of implementing</p>	<p>Two researchers performing approximately 30 h of on-site interviews with 17 informants from operations, finance and IS and one external IT consultant in September 1998</p> <p>Reviewed key internal documentation</p> <p>Data collected data in Scandinavia</p>

Table 2 continued

Company identifier	Company description	ERP implementation description – status at time of data collection	Data sources
Company E	Multinational conglomerate based in the UK	Implementation began autumn 1997 Thirty ERP projects planned over 5 year period	Three researchers performing approximately 20 h of on-site interviews with 13 informants in October 1998 plus 3 h of interviews prior to site visit
Company N	Small private US company manufacturing health care equipment and supplies	Single-site implementation Initial implementation in 1993 and reimplementa- tion in 1997	One hour telephone interview with company president in March 1998
Company O	\$1 billion electronics company based in the US Manufacturing locations in five countries Six thousand employees	Multiple implementations in different international sites First implementation of early ERP package in Germany then company-wide roll-out In the process of reimplementa- tion and worldwide roll-out, starting with manufacturing	One hour telephone interview with member of worldwide roll-out team in March 1998
Company P	Japanese-owned automotive supplier operating in North America One thousand employees in North America Regional offices in five sites Experiencing rapid growth	Planned live dates in May 1998 for Canadian operations and August 1998 for main office All modules to go live at once	One hour telephone interview with manager of corporate services and corporate production planning in March 1998
Company Q	\$40 million Canadian electronics semiconductor manufacturer Growing at 20+ % per year High-tech company with strong IT experience Company culture tolerates change reasonably well	Beta test site for early ERP package In the process of reimplementing ERP with new software	One hour telephone interview with CIO/IT project manager in April 1998
Company R	Small private company with plants in the US, Canada and the UK Combination of assemble to order and repetitive manufacturing	Used ERP since 1993 Currently implementing ERP upgrade	One hour telephone interview with CIO in April 1998
Company S	\$1 billion and growing US-based industrial equipment manufacturer with 5200 employees worldwide Fifty years old; a wholly owned subsidiary of a major industrial equipment company	Enterprise rollout planned for 1999 Description of ‘unit A’, the first division to go live with ERP: Single-site implementation with ten licences Went live in November 1997 Project budget of \$1.2 million First release implemented was ‘very buggy’ and now reimplementing later release Still have three major interfaces to homegrown systems Plan to replace with ERP in the future	One hour telephone interview with manufacturing systems manager of unit A in April 1998

Table 2 continued

Company identifier	Company description	ERP implementation description – status at time of data collection	Data sources
Company T	Small North American-based producer of security systems Approximately 600 direct labour manufacturing employees Fifteen to twenty per cent annual growth rate over previous 5 years	\$1.5 million project Server upgraded numerous times due to undersizing by ERP vendor Due to company's performance problems, vendor performed special modifications in order to enable special software release	Electronic interview in April 1998
Company U	Small European electronics assembler Twenty-five to thirty per cent annual growth rate Five hundred employees	First ERP implementation in 1990; logistics Reimplemented current release	One hour telephone interview in June 1998
Company V	\$175 million US-based manufacturer Products sold in 100+ countries through distributors and dealers Nine hundred employees, most of which are at headquarters/manufacturing facilities Many of the products are engineered to order	Went live on ERP early 1997 Elapsed time from initial project concept to go-live approximately 2.5 years One hundred and fifty or more users of the system	One and a half hour telephone interview with IS director in March 1998
Company X	Large manufacturing firm Details omitted at company request	Roll-out completed December 1997	One hour telephone interview in June 1998
Company Y	Large US manufacturing firm in the aerospace industry	Two US locations and three phase roll-out First phase went live May 1997 Other two planned to be complete by September 1998	One hour telephone interview in June 1998 Reviewed internal documentation

Table 3 Companies studied by stage of ERP experience cycle

Stage of experience cycle reached at time of data collection	Company identifier
Project phase	Company B Company O Company P
Shakedown phase	Company C Company E Company X Company Y
Onward and upward phase	Company A Company D Company N Company Q Company R Company S Company T Company U Company V

sampling (overselection of companies that had experienced or were experiencing difficulties) and it may not be a representative finding. We do believe that some companies are successful on all three categories of success measures.

However, Ross and Vitale (2000) found that a performance dip after initial implementation of an ERP system is very common. Many of our companies similarly experienced moderate to severe business disruption when their ERP systems 'went live'. They had difficulty diagnosing problems (which had many possible causes) and they had difficulty recovering from them. They sometimes achieved 'normal' operations only by permanently increasing staffing levels and reducing expectations about labour efficiency. In general, ERP adopters seemed both physically and psychologically unprepared for shakedown phase difficulties.

Further, extreme difficulties in the shakedown phase appeared to have strong negative influences on companies' willingness to continue with the ERP experience. Several companies with shakedown phase problems reported strong pressure to de-install their ERP system. Even when the ERP system was retained, there was great unwillingness to upgrade to 'enhanced' versions of the software. In essence, these companies implemented 'legacy' ERP systems.

Second, mixed 'success' results were observed even with a single phase. For example, a number of companies achieved their budget and schedule targets, but had to cut scope, often substantially (companies S, A and T). In the case of company T, these scope reductions led to failure later on: the company did not achieve the business results it had hoped for. However,

company S did achieve its desired business results, despite a massive cut in scope. While company S implemented only 15% of the ERP functionality it had originally planned to implement, the company claimed to have achieved substantial inventory reductions, as intended. This result shows that it is possible for 'failed' projects to achieve eventual business success.

We found that companies differed substantially in how they defined success in the project phase because they differed in their definitions of the project itself. Some companies defined the project as 'implementing ERP as quickly and cheaply as possible'. Others defined the project as 'adopting best practices enabled by ERP' (which entails business process re-engineering). Still another defined the project as 'achieving commonality of systems and business practices in a decentralized organization' (which entails a process of organizational development and consensus building). In general, the larger the organization's definition of the project the more willing the organization was to expand the project's budget and schedule. These companies were less likely to judge the overall ERP experience as unsuccessful when the project budget and schedule were not met.

We found that larger organizations tended to define the ERP experience in much more expansive terms than smaller ones. They often demanded business results from 'IT' projects. In many cases, these organizations were planning for multiple (perhaps dozens of) ERP installations and realized the importance of learning how to implement and upgrade ERP systems better each time. They were more likely than smaller organizations to start planning for the onward and upward phase during the project phase.

Third, as Larsen and Myers (1997) observed, some companies that achieved 'success' in the project phase could be classified as failures later on. Either they experienced substantial difficulties during the shakedown phase (companies E and N) or they reported a lack of business benefits during the onward and upward phase (company Q). Similarly, one of the companies studied by Dolmetsch *et al.* (1998) successfully implemented SAP R/3 (a particular ERP system) within 4 months but was later disappointed not to have achieved business performance improvements because it had not re-engineered its processes.

We were surprised that several companies in the onward and upward phase could not say whether they had achieved business benefits from using ERP with any confidence. They gave a variety of related reasons for their inability to assess their results.

- (1) The ERP system had been adopted for technical reasons (e.g. Year 2000, cost or lack of capacity in their current system) and not for business reasons.

Table 4 Problems and outcomes experienced by phase

Companies by phase of experience cycle at time of study	Project phase problems and outcomes	Shakedown phase problems and outcomes	Onward and upward phase problems and outcomes
Companies in project phase			
Company B	In-process ERP project halted and rechartered when company merged ERP system faced huge organizational integration issues The ERP project was cancelled in 1999 after an expenditure of \$70 million	N/A	N/A
Company O	Had to modify ERP software for essential functionality despite policy against it First implementation partner replaced for lack of relevant experience ERP project combined with company-wide standardization and re-engineering; big change in management issues	N/A	N/A
Company P	Had to modify ERP software for essential functionality despite policy against it Project team had difficulty getting involvement from local sites	N/A	N/A
Companies in shakedown phase			
Company C	Project team communicated well with management and sites Management centralized formerly decentralized IS units for ERP implementation; local sites resisted Experienced cost and schedule overruns	Experienced system performance problems KPIs deteriorated in short term Customers and suppliers experienced negative effects Managers not happy with reporting capabilities	N/A
Company E	On time and within budget Expected scope achieved Project team did excellent job of building consensus around need for common systems in this decentralized company	KPIs deteriorated in short term	N/A
Company X	Not discussed	Experienced difficulties with data conversion Experienced system performance problems KPIs deteriorated in short term	N/A
Company Y	Budget and schedule overruns Experienced software bugs	Experienced system performance problems KPIs deteriorated in short term Customers and suppliers experienced negative effects	N/A

Table 4 continued

Companies by phase of experience cycle at time of study	Project phase problems and outcomes	Shakedown phase problems and outcomes	Onward and upward phase problems and outcomes
Companies in onward and upward phase			
Company A	On schedule and within budget Scope cuts	KPIs deteriorated in short term	Turnover of experienced users and support personnel User skill with system is low Some improvements in key business measures Other planned improvements not achieved (owing to scope cuts) System may be partially de-installed (owing to unanticipated merger)
Company D	One division on time and within budget A second division experienced schedule delays due to software modifications	Experienced heavy data entry errors by users Had to increase staff to cope with errors KPIs deteriorated in short term	User skill with system remains low and errors remain high System not used in managerial decision making Insufficient plans for ongoing system support and business improvement
Company N	Acceptable project outcomes despite heavy customizations	Disastrous performance problems Severe business disruption Severe negative impact on customers and suppliers	Never achieved normal operations Experienced permanent loss of business
Company Q	Acceptable despite entirely in-house implementation with no prior experience	Users challenged by conversion to client-server environment Severe system performance problems	Business improvements were not sought as part of ERP implementation
Company R	Experienced poor consulting advice Made excessive software modifications	Experienced many software errors due to lack of integrated system testing Experienced difficulty recovering from errors	Business improvements were not sought as part of ERP implementation
Company S	Within budget Greatly behind schedule Greatly reduced scope	Not discussed	Planned business benefits achieved

Table 4 continued

Companies by phase of experience cycle at time of study	Project phase problems and outcomes	Shakedown phase problems and outcomes	Onward and upward phase problems and outcomes
Companies in onward and upward phase			
Company T	Within budget Schedule overruns Scope cuts	Not discussed	Head count increased instead of decreased as planned Improved reporting and data access Some planned business improvements not achieved
Company U	Project team took excessively functional approach to implementation Management support gained quite late in process	Extensive reconfiguration occurred as a result of learning about integrated operations KPIs improved after reconfiguration	Poor data quality continues to hamper business Company has gained improved awareness of benefits of cross-functional integration Management is extremely satisfied with system Upgrade to new release is planned
Company V	Ignored advice of experienced implementation consultants Did not follow conventional implementation methodology Excessive project manager turnover (five times)	Extreme business disruption owing to configuration errors, system integration problems and incomplete/inaccurate data KPIs deteriorated in short term Customers and suppliers experienced negative effects	Permanent loss of customers Business processes streamlined Company is now ready to undertake process re-engineering

- (2) No business goals had been set for the ERP project.
- (3) The company did not manage by metrics.
- (4) Existing systems did not allow the company to measure where it was on key business metrics prior to the implementation of the ERP system.
- (5) The company did not perform a post-implementation audit of the ERP project in order to assess whether projected benefits were achieved.

In general, companies that do not deliberately set out to achieve measurable business results do not obtain them (or do not realize that they have obtained them). Further, the inability to document measured benefits from an ERP implementation appears to discourage organizations from undertaking future upgrades and/or migrations.

In conclusion, success in the ERP experience is multi-dimensional and often hard to measure. Early success (or success on project measures) is not closely linked with later success (success on business measures) and early failure (failure on project measures) is not tightly linked with later failure (failure of business measures). Clearly then, success in an ERP experience is not pre-determined by a set of success factors in place at the start of the project and continuing unchanged throughout. Either conditions change over the course of the experience or different types of actions are required at different phases and the ways in which a company responds to conditions at each phase influence the subsequent progress and ultimate success of the ERP experience. This observation suggests one obvious normative recommendation: companies should be concerned with success in all phases of the ERP experience and should not concern themselves exclusively with what happens during the project phase. In addition, this observation suggests one obvious research issue: In order to understand the success of an ERP experience, one needs to look at what goes on (e.g. problems experienced and attempts at problem resolution) at each phase of the experience cycle. In the next section, we focus more deeply on why the companies we studied achieved suboptimal success.

Findings about adopters' problems with ERP

We asked adopters what problems they experienced with ERP systems, how they had dealt successfully with these problems (if they had) and what they had learned as a result of their experience. We also formed our own impressions of their experiences based on what we observed when we visited their companies. We came away with a deep respect for the challenges they faced. If what they were trying to do was easy, more of them would have been successful on all measures. However, many of the problems they

experienced were 'wicked', that is hard to recognize and diagnose due to multiple interacting causes and varying symptoms and effects. In this section, we describe what we believe to be the most difficult problems adopters experienced and why the problems occurred.

Project phase problems

The most challenging project phase problems reported by our respondents involved software modifications, system integration, product and implementation consultants and turnover of project personnel.

Software modifications Almost every analyst of the ERP experience strongly advises companies to avoid modifying the software. Companies are advised to live with existing ERP functionality and to change their procedures to adapt to it. However, we found the following.

- (1) Many adopters could not avoid some degree of ERP software modification. In some cases, ERP packages are selected on a centralized basis in order to fit the majority of corporate needs. Often, there are a few sites that cannot operate effectively with the software's functionality, even if people there are in principle willing to modify their business processes. For example, one company reported having an order of magnitude more entities (e.g. sales representatives) than were allowed by the relevant field size in the software package. Other companies explained that the software simply did not fit business rules around commissions and royalties and that these rules could not be changed without serious negative business implications.
- (2) Many adopters had difficulty in getting modifications to work well. They complained about implementation consultants who did not deliver well-tested and working modifications in a timely manner.
- (3) Most distressingly, several adopters reported that, after wrestling with modifications (and sometimes failing to make them work well), they eventually learned that their modifications were unnecessary after all. They had usually made plans for software modifications early in the project phase when they did not understand the software thoroughly (in particular the integrations across modules). Later on when they understood the software better, they discovered ways of implementing the needed capabilities without modifications.

For a more general treatment of the issues involved in tailoring ERP software to a company's specific needs see L. Brehm, A. Heinzl and M. L. Markus (forthcoming).

Problems with system integration ERP systems are sold as ‘integrated packages’, implying that they contain everything one needs and that ERP software configuration (plus tailoring) is the major activity of the project phase. However, there are a number of respects in which this is not so.

- (1) First, an ERP system needs to be integrated with the computing platform on which it will run. We found that companies had great difficulty integrating their enterprise software with a package of hardware, operating systems, database management systems software and telecommunications systems suited to their particular organization size, structure and geographic dispersion. They reported having difficulty finding experts who could advise them on the precise operating requirements of their ERP configuration. They described having made unplanned upgrades of processors and memory to support their systems. One company reported making several changes of database management system before finding one that ‘worked’.
- (2) Second, for all that ERP systems are said to be comprehensive packages that cover every organizational function, most of the companies we studied (large and small) reported needing to retain some legacy systems that performed specialized functions not available in ERP packages. (Alternatively, they acquired specialized software from third parties.) These systems needed to be interfaced with ERP systems – a process, that is both challenging and expensive.
- (3) A particular area in which many organizations found ERP systems deficient was that of data reporting. ERP systems are essentially transaction processing systems that do not (without expensive add ons) solve companies’ needs for decision support. For descriptions of the measures companies must often take to solve their ERP-related data reporting problems, see the cases of Microsoft (Bashein *et al.*, 1997) and MSC Software (Bashein and Markus, 2000).

Problems with product and implementation consultants ERP implementations are socially complex activities. As many as a dozen or more external companies – including the ERP vendor, vendors of ERP product extensions, vendors of supporting hardware, software and telecommunications capabilities, implementation consultants and so forth – may be involved in different aspects of an organization’s ERP experience. Coordinating the efforts of all these firms is, to put it mildly, a challenge. We found the following.

- (1) Few IT products and services firms were willing to take end-to-end responsibility for coordinating all parties. In addition, adopters were often rightly reluctant to cede authority for project management to an outside party, even when they were willing to pay the steep fees for outside assistance.
- (2) IT products and services firms generally seem to resent taking subordinate roles to other such firms. They do not cooperate well. There is much finger pointing when problems occur.
- (3) Despite representations during the sales cycle, there was widespread lack of knowledge about the details of ERP products, particularly where integrations, tools and interfaces with ‘partner’ products were concerned.
- (4) Because IT products and services firms are growing rapidly, they find it difficult to provide continuity in personnel assigned to adopter projects and adopters strongly value continuity in personnel.
- (5) Several adopters reported having had conflicts (sometimes severe) with IT products and services vendors over contractual provisions (e.g. pricing and billing arrangements) and project direction (e.g. project management).

Turnover of project personnel An all too common complaint was the frequency with which adopters lose key personnel experienced with ERP or supporting technologies. As already noted, external service providers themselves are unable to maintain continuity of customer support personnel. In addition, adopters frequently reported the following.

- (1) Losing key IT specialists and user representatives working on the project while the project was going on, often despite handsome retention bonuses.
- (2) Losing experienced people after the project was complete. Many IT specialists thrive on project work and view assignment to a ‘competence centre’ (support unit) as unpleasant maintenance work.

In short, the project phase of the ERP life-cycle posed severe challenges for the adopters we studied and not all companies resolved these problems well. In some cases, unresolved issues ‘left over’ from the project phase became the source of problematic outcomes later in the shakedown phase.

Unfortunately, it was also the case that companies experienced problems that had originated in the project phase, but which were not perceived as problems or rectified at that time, during the shakedown phase. Although these problems are more rightly classified by

their origins as project phase problems, we list them below as shakedown phase problems because that is where their symptoms show up.

Shakedown phase problems

As mentioned earlier during the discussion on 'success', many of our companies experienced negative outcomes during the shakedown phase. Among the outcomes experienced were the following.

- (1) Performance problems with the ERP system (and underlying IT infrastructure).
- (2) A slow down in business processes.
- (3) Errors made by users entering data into the system.
- (4) Increased staffing required to cope with slow downs and errors.
- (5) A drop in the company's key performance indicators.
- (6) Negative impacts on customers and suppliers from an inability to answer their queries and from delayed shipments and payments.
- (7) A need for manual procedures for addressing lack of functionality in ERP software.
- (8) Data quality problems.
- (9) Inadequate management reporting.

This list is an uncomfortable *mélange* of symptoms of leftover problems (e.g. performance problems with the system and slow down in processes), attempts to resolve problems (e.g. manual processes, workarounds and increased staffing) that create new problems in their turn and true outcomes – consequences of problems (e.g. negative impacts on customers). These elements are difficult to disentangle analytically. However, after detailed examination, we concluded that many shakedown phase difficulties were caused by problems that occurred during the project phase but were not recognized as problems or successfully resolved at the time they occurred. The most important of these problems were approaching ERP implementations from an excessively functional perspective, inappropriately cutting project scope, cutting end-user training, inadequate testing, not first improving business processes and underestimating data quality problems and reporting needs.

Approaching ERP implementations from an excessively functional perspective Cross-functional integration is still a new concept to many organizations. It is far more natural for them to approach implementing ERP on a module-by-module basis and to assume that ERP modules correspond to traditional functional departments in the organization (e.g. accounting, manufacturing and sales). Configuration errors often follow when adopters set up project teams without

appropriate cross-functional representation. For an example, see Koh *et al.* (2000).

Inappropriately cutting project scope Knowledgeable project managers know that exceeding the project schedule is the major threat to project success (more so even than budget overruns). Therefore, cutting scope is a common tactic when the project shows signs of missing key milestones. Project managers are often tempted to cut scope according to what looks hardest to do; those who stay focused on 'what is the minimum functionality we can implement in order to obtain the desired business benefits?' are more successful. As mentioned earlier, several of the companies we studied cut scope when the schedule and budget ran short. These deletions often made it necessary for users to adopt inefficient manual processes in the shakedown phase.

Cutting end-user training Schedule pressures affect training as well as scope because end-user training is typically one of the last activities to occur in the project. Adopters frequently reported having underestimated the needs for end-user training. In particular, they told us that users needed additional training and education in non-ERP areas.

- (1) Making the transition from 'green screen' (mainframe software) to 'client-server' (PC-based software). Surprisingly, this was a major hurdle in several adopter organizations.
- (2) Understanding ERP and MRP (material requirements planning) concepts. Some adopters believed it necessary to conduct extensive APICS (a professional institution) education to accompany ERP training.
- (3) Understanding cross-functional business processes. In many organizations, people understand what they do, but not how their work affects others. In the ERP setting, such a limited world view leads to errors and misunderstandings.
- (4) Recovering from data entry mistakes. Because ERP systems are integrated, data entry errors have many more ramifications than do errors in traditional systems and they are much harder to correct. Adopters reported suffering from lack of training activities that addressed recovery from data entry problems.

In some companies, training was not budgeted as part of the ERP project itself, but was left to the budgets and discretion of operating managers. This management policy increased the likelihood of inadequate end-user training.

Inadequate testing, particularly of interfaces, modifications, integrations and exceptions Like scope and training,

testing is often cut when the project schedule gets tight. Further, because many adopters lack extensive experience with integrated software and with cross-functional teaming, they are likely to overlook the need for conducting system (as opposed to module) tests. Areas where testing is most likely to be deficient include ERP cross-module integrations, interfaces with legacy systems, modifications, particularly those performed by external firms (adopters often assume that external provider work is properly tested) and unusual business scenarios and scenarios involving the input of erroneous data. Several adopters told us that (they realized after the fact) they had not adequately tested their ERP software.

Not first improving business processes where this needs doing
 Adopters naturally want faster implementations and one of the best ways of shortening implementation schedules is to 'implement the software first and re-engineer the business processes later'. This is great advice when adopters have reasonably sound business processes to start with. However, some adopters do not. Some companies have found that failure to change their business processes leads to the following.

- (1) Inappropriate software modifications. One company we studied tried to implement ERP without changing either the software or its business practices. In the end, the company changed both unnecessarily. The software modifications could have been avoided through upfront business process improvements.
- (2) Severe disappointment with ERP when managers realized that getting business benefits from ERP required change in business practices (Dolmetsch *et al.*, 1998).

Underestimating data quality problems and reporting needs
 Our review of a few companies' detailed project plans revealed severe underestimation (even their implementation consultants missed this problem!) of the project tasks associated with data. In the early days of a project, it is of course hard to know how many and which legacy systems will have to be retained. However, even when the ERP system replaces all legacy systems, data problems can be severe.

- (1) Due to the nature of their businesses, adopters may need to retain legacy data for many years (e.g. for regulatory compliance or because their products remain in service for many years).
- (2) Adopters often underestimate the poor quality of the existing business records that will be input to ERP. Knowledgeable end-users often substitute for high-quality data in traditional systems:

they know what the numbers really are. However, because ERP systems are integrated, the data must be cleaner. Bad data may automatically trigger processes in distant areas where people lack the knowledge to override the system.

- (3) Most large adopter organizations have extensive and complex data reporting needs. While these needs are best addressed with technologies other than ERP, adopters often believe that ERP will satisfy them. Therefore, ERP project plans often neglect reporting issues and some adopters become very disappointed with ERP systems because their reporting needs were not well met.

In fact, our biggest surprise about the shakedown phase was that, in the adopter's eyes, high-quality data and good reporting are absolutely essential for ERP success. End-users and line managers are unwilling to trust and use systems if they do not trust the data and reports. Lack of user acceptance of data and reporting can lead to de-installation of the system or unwillingness to invest in further upgrades. Note that achieving acceptance of a common source of data is often a highly political process, particularly in large, complex organizations. However, if these politics are not well managed during the project phase the success of the entire experience is at risk.

In short, the shakedown phase reveals the unresolved or unrecognized problems of the project phase. Many negative shakedown experiences could be avoided by giving adequate attention to cross-functional configuration and testing of ERP software, end-user training, data conversion and management of legacy data, reporting needs and scenarios for recovering from data input errors during the project phase.

At the same time, steps taken during the shakedown phase for remedying these problems or their symptoms may fail to solve the problems and may actually make matters worse. For example, we found that, because end-user training was inadequate and users did not understand how to back out erroneous transactions, companies often began to rely heavily on 'key users' (project personnel) and IT staff to perform routine work that should have been done by users. As a result, the key users did not have time to conduct better end-user training and IT staff did not have time to work out platform problems and upgrades. These companies later found themselves extremely vulnerable when key users and IT staff began leaving for better paying jobs elsewhere. Similar observations about the persistence and negative consequences of 'workarounds' have been made by Tyre and Orlikowski (1994).

Onward and upward phase problems

Different problems characterized the onward and upward phase. As with the shakedown phase problems, problems appearing during the onward and upward phase often had much earlier roots. The most important problems we observed in the onward and upward phase are as given in the following subsections.

Unknown business results Many adopters who had been using ERP long enough to have business results did not know whether they had realized improvements. In most cases, these companies had viewed ERP strictly as a technology replacement decision and had not prepared business cases justifying ERP in terms of business benefits.

Disappointing business results Some adopters in the onward and upward phase reported that their business results had not been achieved. In some cases, the absence of business results could be traced to inappropriate scope-cutting decisions during the project phase. In other cases, the organization did not have a culture of managing the results, did not collect and use metrics, did not demand business improvements and so forth. The lesson is clear: ERP benefits are not automatic. They require human and organizational learning, both of which take time and require focused management attention.

Fragile human capital Many adopters were not in a strong position to go forward with ERP because of the fragile state of their ERP human capital. Many organizations had lost and had difficulty replacing ERP knowledgeable IT specialists and end-users. In some organizations, the only end-users who were ERP knowledgeable were those who participated on the project team. In addition, we saw IS specialists routinely doing work that belonged in end-user job responsibilities. This is a precarious situation for adopters. Not only may they fail to realize full business benefits from ERP, but they may also be unable to recover gracefully from future problems. Further, they may not be able to make future technology upgrades and business improvements without outside help.

Migration problems We spoke to several adopters who were on their second round of ERP implementation. Most reported having learned how poorly software modifications convert during implementation of later releases. In some cases, this was seen as a positive learning experience, because the organizations vowed never to modify the ERP software again but to make essential changes to their business processes. However, we suspect that most companies that have difficulties in upgrading will simply stop enhancing their ERP

systems. These organizations will in effect have implemented legacy ERP systems, obviating one of the major benefits of using packaged software – the ability to outsource the ongoing maintenance and enhancement of software to a vendor (Brehm and Markus, 2000).

In short, the onward and upward phase reveals the unresolved or unrecognized problems of earlier phases. In some cases, onward and upward phase problems could have been avoided by taking action during the project phase:

- (1) Doing a much better job of end-user training during the project phase.
- (2) Starting the project phase with plans for long-term maintenance and migration.
- (3) Documenting the reasons for configuration decisions, not just the parameters, so that people not involved in the project phase can get up to speed quickly.
- (4) Not disbanding the project team when the project goes live, but instead staffing a competence centre for managing future evolution and learning.

In other cases, however, preventing and resolving onward and upward phase problems must occur well before the project phase even begins. Markus and Tanis (2000) discussed the importance of what we call the chartering phase, which is often unacknowledged in less successful ERP adoptions, in which key business decisions related to the ERP system are made. In many cases, only senior executives (not project managers and team members) can address pre-existing organizational challenges that threaten ERP success. Among such challenges are the following, which were observed in several of our study companies.

- (1) Lack of results orientation in the business is a key factor in failure to achieve business results. This is not something that an ERP project team can fix.
- (2) A culture resistant to change is another big impediment to ERP success. Project teams can design and execute change management programmes, but senior executives must work to make these efforts a success.
- (3) When top managers do not buy in to the goals and plans of the ERP project team, the chances for success are weak. Good project managers can contribute to buy-in by good and frequent communication, but again success requires a concerted effort at the top, before and during the project.

Waiting to resolve these problems until the symptoms first appear – often as late as the onward and

upward phase – can be a recipe for failure. Remedial actions taken late in the experience often fail to solve the problems. The more likely outcome when problem resolution is delayed is termination of the system.

Conclusions and suggestions for future research

The implementation of ERP systems in organizations is an enormously complex undertaking. ERP systems can affect nearly every aspect of organizational performance and functioning and measures of ERP systems success must reflect this fact. Our findings show that different measures of success are appropriate at different points in the ERP experience cycle and that the outcomes measured at one point in time are only loosely related to outcomes measured later. This occurs because the experience cycle is a process (or really a set of processes) and not a mechanical connection between starting conditions and final results. Over the course of this process several things can happen to influence the final outcomes observed: starting conditions can change, problems can arise (which may or may not be recognized) and steps can be taken to address them (which may or may not be successful, possibly creating new problems in their wake).

In short, the connections between starting conditions, experienced problems and outcomes in the ERP experience are not deterministic. While this can be construed as bad news for academic theory, it is good news for both ERP adopters and for IS researchers. For ERP adopters it means that it is possible to succeed with ERP despite bad luck, some mistakes and even early failures. For researchers it means that there is much more work to be done in order to understand problem recognition and resolution behaviours and how they interact to result in successful and unsuccessful outcomes.

One particular area that deserves much future research is what we have called the chartering phase – this was often unacknowledged and unfulfilled in the organizations we studied. In this phase, which should occur before a ‘project’ is ‘chartered’ (hence the name), senior executives in consultation with others make important business decisions about the objectives of the project, the decomposition of the project into manageable chunks, the level of budget to be allocated to the project and shakedown phases of each chunk, an appropriate project leader and/or implementation partner and so forth. Further research is needed on how companies actually make or avoid making these decisions, what factors they consider and those that they do not, whom they consult and follow and the specific implications of these decisions for the problems and outcomes experienced later in the experience cycle.

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