An effective IT infrastructure can support a business vision and strategy; a poor, decentralized one can break a company. More and more companies are turning to off-the-shelf ERP solutions for IT planning and legacy systems management. The authors have developed a framework to help managers successfully plan and implement an ERP project.

A Critical Success Factors Model For ERP Implementation

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Companies are radically changing their information technology strategies by purchasing prepackaged software instead of developing IT systems in-house. Price Waterhouse predicts that by 2000, two-thirds of all business software will be bought off the shelf. More specifically, Deloitte and Touche states that businesses prefer to replace legacy systems with enterprise resource planning systems. According to AMR Research, the ERP systems market was $15.68 billion in 1997 and is likely to increase at a compound rate of 36 percent, to $72.63 billion, by 2002. The associated consultancy market is approximately $30 billion. These statistics clearly indicate a shift in the ERP market.

There are mixed reports concerning the outcome of ERP projects. Successful ERP implementations are certainly publicized, such as Pioneer New Media Technologies (see http://Datamation.com/PlugIn/erp/index.htm) and Monsanto,[1] but less successful projects have led to bankruptcy proceedings and litigation against IT suppliers.[2] Approximately 90 percent of ERP implementations are late or over budget,[3] which may be due to poor cost and schedule estimations or changes in project scope rather than project management failure.[4]

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ERP software automates core corporate activities, such as manufacturing, human resource, finance, and supply chain management, by incorporating best practices to facilitate rapid decision-making, cost reductions, and greater managerial control. These factors make ERP software integration complex, because consensus is required from an entire enterprise to reengineer a core business process and take advantage of the software.[5]

ERP implementation can reap enormous benefits for successful companies—or it can be disastrous for organizations that fail to manage the implementation process. We must ask ourselves two critical questions, "How can ERP systems be implemented successfully?" and "What are the critical success factors for ERP implementation?"

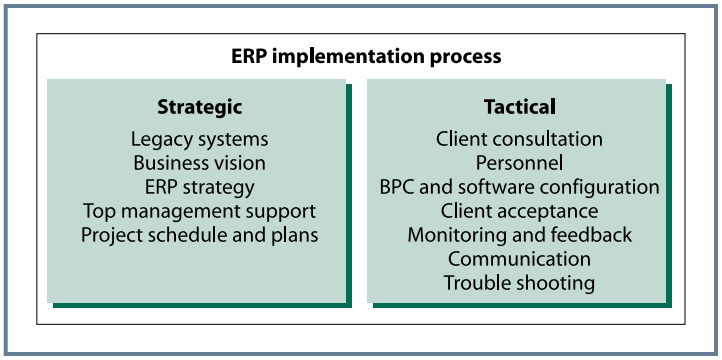

Figure 1. A critical success factors model with strategic and tactical factors.

Critical Success Factors Framework

There are different strategic approaches to ERP software implementation. The two main technical options are the implementation of a standard package with minimum deviation from the standard settings, and the customization of a system to suit local requirements. From a management perspective, the nature of the ERP implementation problem includes strategic, organization, and technical dimensions. Therefore, ERP implementation involves a mix of business process change, or BPC, and software configuration to align the software with the business processes.

We developed a CSF research framework based on a review of literature[6-9] and the experiences of the organizations in the study. The model, shown in Figure 1, groups the CSFs into strategic and tactical factors. Each has factors specific to ERP projects.

CSF models have been applied to general project management problems,[9] manufacturing system implementation,[10] and reengineering.[11] We have identified the factors needed to ensure a successful ERP project and to explain different project outcomes. Our approach is particularly suitable for the analysis of ERP projects because it includes the influence of tactical factors, such as technical software configuration and project management variables, together with broader strategic influences, such as the overall implementation strategy. Our framework will guide managers in the development of an implementation strategy and will help them make decisions by identifying the role and influence of individual factors on each other and on the project outcome. We illustrate our approach with two case examples from a research sample of eight companies. The case analysis highlights the critical impact of legacy systems upon the implementation process and the importance of selecting an appropriate ERP strategy.

Strategic Factors

We based our initial selection of strategic factors on Dennis P. Slevin and Jeffrey K. Pinto's list[7] and then added legacy systems and ERP strategy. This combined list is now customized for ERP implementation projects, because it balances the focus of an organization with specific ERP requirements. Slevin and Pinto describe business vision as the clarity of the business model behind the implementation of the project. Is there a clear model of how the organization should work? Are there goals or benefits that can be identified and tracked? They also define project schedules and plans as the formal definition of the project in terms of milestones, critical paths, and boundaries.

Legacy systems

Legacy systems encapsulate the existing business processes, organization structure, culture, and information technology.[12-14] Therefore, they cannot be controlled by a company in the same way as the other variables in the model. Inevitably, they determine the amount of organizational change required to successfully implement an ERP system and will dictate the starting point for implementation.

By evaluating existing legacy systems, you can define the nature and scale of problems that you will

likely encounter. This should then influence your choice of ERP strategy. For example, if your legacy systems are extremely complex, with multiple technology platforms and a variety of procedures to manage common business processes, then the amount of technical and organizational change required is high. If your organization already has common business processes and a simple technical architecture, change requirements are low. Legacy systems are not separate problems since their design and operation bind so many components of a business, such as work flow and processes.

ERP strategy

Your organization's propensity for change should influence your ERP strategy choice. For example, you can implement a skeleton version of a software package initially, and then gradually add extra functionality once the system is operating and the users are familiar with it. The main advantages of fast-track implementations are speed and simplicity. By adopting a skeleton approach, the roll-out of an ERP system across multiple sites can be achieved in a much shorter timeframe; this maintains the momentum of the project and also gives fewer opportunities for users to try and replicate their legacy systems onto the new ERP platform.

Most implementation models ignore legacy systems and underestimate their importance on the choice of ERP strategy.

A much more ambitious strategy is to implement a system with complete functionality in a single effort. There are also different approaches to linking the legacy system, ranging from implementing one ERP module at a time and interfacing with the legacy system to implementing an entire, customized system. The single-module approach can be done in parallel with the existing system or on its own. International projects are even more complex because of multiple country roll-outs and parallel teams operating in different regions.

You also need to decide whether to carry out custom development on the packaged software and how this will affect upgrading the system in the future. The amount of custom development depends on whether an organization is willing to change its business to fit the software, or whether it prefers to change the software to fit the business. Once you decide on an ERP strategy, you can consider the project management issues. Most implementation models ignore legacy systems (by assuming a greenfield site or by adopting a simplistic planning approach that ignores the existing situation) and therefore underestimate the importance of the existing situation on the choice of ERP strategy and the implementation process as a whole.

Tactical Factors

We also based our list of tactical factors—client consultation, personnel, client acceptance, monitoring and feedback, and communication—on Slevin and Pinto's work[9] and then added BPC and software configuration, which are unique to ERP implementation. These additional factors recognize the critical role of aligning business processes to ERP software during implementation. Although the standard project management factors are still important, they play a supporting role to BPC and software configuration. Organizations need to understand their current business structure and business processes associated with their existing IT systems, and relate this to the business processes contained within the ERP system.

Certain process modeling tools help organizations to align business processes with the standard package. For example, the ERP vendor Intentia has a tool, Movex Visual Enterprise, that models business processes and automatically configures the software. This tool has a repository of business processes that you can reference when you reengineer your current processes and design new ones. For every core and support process in the Intentia generic business process model there are several alternative processes relating to best practices in different types of operations and business environments that can be modified. For example, unwanted processes can be deleted online and others can be added. Therefore, business processes can be customized without making changes to the code. You can use this tool at any stage after the initial implementation process to enable continuous business process improvement.

ERP software configuration is different than building a customized system, because the focus of the development effort shifts from systems analysis and design to software configuration. The majority of the systems analysis and design effort has already been captured within the software and con-

sequently, much of the systems development effort focuses on enabling the required functionality embedded within the ERP system's business model.

Table 1
Case Sample

Company	Industry	ERP Project
Threads	Textile	Global SAP
Chemical	Chemical	Global SAP
Bell	Manufacturing – retail	Global SAP
Statco	Office supplies	European SAP
Compco	Information technology	National Masterpack
Pump	Manufacturing – industrial	Global SAP
Plasco	Plastics	National Movex
Pharmco	Pharmaceuticals	Global SAP

Research Method

We used a case study research method to build our theory about ERP implementation in companies.[15] We conducted eight case studies, shown in Table 1, across a range of industries, looking in particular at companies implementing ERP software. The names of the organizations have been changed but the case details are accurate. To choose cases representing different industries and implementation strategies, we used theoretical sampling, adding cases to the research sample until we obtained a general implementation model. The data collection framework (see Figure 1) gave us a well-defined focus for our semistructured interviews. We asked questions about the companies' general background, legacy systems, implementation approach, and project outcome.

We revised the framework as our theory developed through the iterative process of case study research. We collected data by interviewing key company business and IT personnel, including managers, users, and consultants, and through project documents, annual reports, and company Web sites. The interviews were held every six months during the ERP projects, starting from the formation of the strategy to the integration of the systems into the organization.

The following two case studies, Threads and Statco, demonstrate the complex interaction of strategic and tactical factors and show how these factors affect the final project outcome.

Threads

Threads is an international textile firm that had fragmented legacy systems. There were over 40 separate accounting systems, and the information systems were a mixture of custom software packages that had Y2K compliance problems. The fragmentation inhibited the company's strategic vision, a coordinated approach to the European market. An integrated marketing system would allow the company to focus on customer service across the different manufacturing sites.

The senior management at Threads recognized this and developed a business that incorporated a new organizational structure in Europe based on a new business model. The strategic objectives were to improve the customer interface by linking sales and marketing with production and distribution systems across Europe, hopefully reducing overhead costs by at least 10 percent. The ERP strategy was to roll out the SAP R/3 package over Europe country by country; full functionality of the system was exploited immediately and the system was run in parallel with the existing systems. Threads aimed to have 90 percent of its business processes in each country the same.

Threads' top managers supported the project; this gave them control. Furthermore, board pressure to reduce overhead costs in Europe gave the project a high profile within the company, and at least two senior directors were actively involved in the day-to-day execution of the project.

There was a clear project schedule that aimed to implement a fully functional ERP system and reengineer the business process. This implementation process has taken three years though the idea for the project and changes to the project's scope can be traced over six years. The delays are primarily due to the changes in the project scope. Originally, the ERP system was to support the business processes of a particular product market within the business, but between 1993 and 1996 Threads determined that the whole business needed to be supported by the same system. The geographic complexity associated with designing common systems across Europe and a high turnover of external consultants also contributed to the delay. We estimate that the

combination of these factors have extended the life of the project by around 30 to 50 percent.

The project team, including consultants, top internal staff from functional business areas, and a change manager, managed the BPC and software configuration process. The senior project group and project directors involved in the day-to-day implementation met regularly. Numerous workshops, involving approximately 150 staff, were held to facilitate client consultation and to examine business processes. Thirty main business processes were identified and then defined in detail, providing the basis for configuring SAP. In isolated instances, some local systems were retained but the objective was still to achieve 90 percent commonality across all countries.

Due to its pervasive nature, a new ERP platform forms a critical infrastructure in any company for at least the next decade.

The team secured client acceptance by involving users in the system testing process at pilot sites and requesting feedback. The high levels of communication throughout the project facilitated troubleshooting although some problems were difficult to resolve, such as differences in national business processes. The change manager was responsible for ensuring that users were aware of the current state of the project and managing human-resources issues. The Threads change manager and the external consultants also had different approaches to managing the change process; the consultants preferred a radical approach whereas the company preferred a more incremental change process.

Statco

Statco is a European stationery supplier. Its legacy systems were the result of a history of mergers and acquisitions, and its business was comprised of autonomous companies, each with its own IT system. All these systems were not Y2K compliant and were not capable of running an integrated business.

There had been problems in the past when some of these autonomous companies had tried to integrate, but the senior management still wanted to create a unified business and chose an ERP system to support it. Their ERP strategy provided each site with a system that matched or exceeded the functionality of the existing legacy system. When all the sites were on the common platform, they aimed to implement the remaining functionality of SAP. Statco chose not to customize the systems, and they staggered the implementation. They did not run the old and new systems in parallel.

The project had top-management support and the managing director was active. The two-year project schedule implemented SAP quickly across all sites to establish a basic common system and then built up functionality across the whole business. The methodology was to fast-track SAP implementation in the sites needing only the minimum ERP functionality.

Project representatives at each site obtained client acceptance through user testing trials and extensive training on the system and new business processes. Users also received a project newsletter. To maintain standards, the training continued after the system went up.

The project team, including managers taken out of the business to work full time on the project, was cross-functional and had a charter detailing the project philosophy. The BPC and software configuration activities were split between in-house staff and consultants, but the team also sought technical expertise for software configuration from experienced SAP consultants. The philosophy of the BPC was to align the business processes to the software, simplifying the processes to eliminate redundant activities. The main forum of communication throughout the project was weekly meetings so that decisions could be made rapidly. Careful testing and trial runs of the system before the final delivery date avoided additional problems.

Case Study Analysis

Threads set a clear business vision to overcome extremely complex legacy systems but the implementation process was very slow, because the project's scope included the entire business. These difficulties were exacerbated by the ERP strategy; they attempted to implement a fully functional SAP at each new site. Therefore, even with top-management support and a clearly articulated business vision, the project was very difficult. The level of client consultation was exhaustive: the philosophy of the HR director was to involve users at all stages in the BPC activities, which reflected the paternal culture of the firm and their nonadversarial approach to change. Although the implementation was viewed

as a success, it took much longer than expected and cost five times more than the original estimates.

Threads contrasts sharply with Statco. The Statco legacy systems were much simpler than Threads'. Although it was also an international project, the actual business is simpler from an information management perspective. The lack of a dominant culture also meant that the managers in the separate business units were more open to change. The fast-track implementation strategy provided the basis for further development. Therefore, the project schedules and plans were simpler to manage, and the project was completed on time and within budget. Statco's testing of basic SAP systems was also simpler than Threads', where full systems were tested in parallel with the legacy systems.

Due to its pervasive nature, a new ERP platform forms a critical infrastructure in any company for at least the next decade. An analysis of the Threads and Statco cases reveals that, in addition to standard project management CSFs such as top-management support and a clear business vision, factors specific to ERP implementation—such as legacy systems, ERP strategy, business process change, and software configuration—have a critical influence on the implementation process and outcome.

ERP systems are now the most common IT strategy for all organizations, and we've designed this framework to help management plan this difficult and complex task. There are different approaches to ERP strategy ranging from skeleton implementations to full functionality. There are also important differences in how organizations manage the gap between their legacy systems and the ERP business processes. It appears easier to mold the organization to the ERP software rather than vice versa.

Managers considering an ERP project should ask themselves the following questions:

- What is the status of the company's legacy systems and how will they affect the transition to ERP and common business processes?
- Is there a clear business vision with quantifiable objectives that can be achieved and delivered through the ERP project?
- Would a fully functional system or a skeleton one be more suitable to the organization? What are the implications of both approaches on the speed of implementation and service to our customers?
- Does the senior management understand the magnitude and pace of organization and technical change that is implicit in large-scale ERP projects? Are they prepared to allocate sufficient resources?
- Do we have clear project schedules and plans?

The next wave of information systems projects will be linking ERP systems to economic partners and connecting satellite systems to the core ERP system, such as knowledge databases, customer relationship management systems, and new product design systems. However, these more ambitious strategies cannot be considered until that core has been successfully implemented. ❖

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