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Enterprise Resource Planning

Technology Note

Elizabeth Benson, purchasing manager for Tristen, Inc., hung up the phone and turned quickly to her desktop computer. She had just received word of a fire in a manufacturing plant belonging to a key vendor. The vendor provided Tristen, a tier-one automotive supplier, with a number of resins used to manufacture plastic parts that went into the dashboard assemblies Tristen sold to auto manufacturers. Fire had damaged the process for making a key resin. The vendor was calling to alert Benson and to offer whatever assistance it could in allocating its now scarce resin supply.

Both Benson and the vendor knew that if the situation was not dealt with quickly both Tristen's and their auto manufacturing customer's lines would soon shut down for lack of parts. Losses would mount by the hundreds-of-thousands of dollars per hour. Fast action was needed.

Benson's first move was to generate an on-line report of resin inventory across all of Tristen's raw materials warehouses. This allowed her to assess where shortages were most likely to occur. Next she called up the manufacturing forecast for the next several days to analyze where product would be needed and when. Using this information Benson generated materials movement requests to reallocate the resin across the organization. She also transmitted purchase order revisions to the vendor in order to reroute incoming resin shipments to appropriate locations.

No matter how good a job Tristen did in reallocating its own inventory, the battle would still be lost if the company's other vendors ran out and were unable to supply Tristen with needed sub-components. By running a "where-used" report across the Bills-of-Materials for all the sub-components in the item database, Benson was able to generate a list of vendors that needed notification of the impending shortage. Checking again with the production plan, Benson forecast each vendor's resin needs, so that appropriate supplies could be sent.

Still facing a shortage, Benson's final step was to search the item database for alternative materials that could be used. Checking these alternatives against a list of approved vendors yielded several supply combinations. A quick cost rollup calculation allowed for vendor

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selection and the generation of a series of purchase orders for immediate EDI transmission to the new sources.

Three hours after she had begun Benson rested. In that short time she had managed to avert a disastrous plant shutdown, both for Tristen and its customers. Savings potentially ran into the millions of dollars. Benson thought about how only a year ago such a feat would have been impossible. In the course of an afternoon she had processed information from Procurement, Engineering, Inventory Management, Finance, and Manufacturing. Without the high levels of integration and standardization offered by Tristen's new information systems, days or weeks would have passed before they could have acted as they did. More likely, they would not have been able to act at all.

The above is a hypothetical example of the capabilities that an Enterprise Resource Planning (ERP) system can provide to a company. ERP, when successfully implemented, links financial, manufacturing, human resources, distribution, and order management systems into a tightly integrated single system with shared data and visibility across the business. Potential benefits can include breakthrough reductions in working capital, huge bounties of information about customer wants and needs, and—perhaps most important—the ability to view and manage the extended enterprise of suppliers, alliances, and customers as an integrated whole (see **Exhibit 1** for a sample ERP “footprint”).

ERP systems are also expensive, complex, and notoriously difficult to implement. Systems integrators with expertise in ERP implementation are usually brought in to help with installation of the software. Total implementation cost (including software, hardware, consulting, and internal personnel) can run as high as two or three percent of a company's revenues (e.g., \$100 million for a \$5 billion company).

Industry Background

ERP has its roots in Europe and in the manufacturing industry. In 1979 the German-based company SAP (short for “Systeme, Anwendungen, und Produkte in Datenverarbeitung” or “systems, applications, and products in data processing”) released R/2, an early version of ERP software. R/2 was a mainframe-based software package that integrated financial and operational data into a single database, with the goal of significantly reducing the effort invested in managing data entry and paperwork. In 1994, SAP released its next generation software known as R/3, marking a shift in technology platforms from mainframe to the increasingly popular UNIX-based client-server architecture. By 2001 SAP reported that it alone accounted for more than 36 thousand software installations in 15 thousand companies, spread across 120 countries.¹ Total license revenue (i.e., software costs, exclusive of any hardware or implementation services) in 2000 exceeded \$17 billion. **Exhibit 2** provides a breakdown by company of license revenue, market share, and estimated growth.

Firm's Experiences with ERP Implementation

Surveys conducted at the Harvard Business School show consistently that many executives think it is at least moderately likely that:²

¹ Source: SAP corporate press release dated June 13, 2001.

² Source: HBS Surveys on Enterprise Computing, 1998-2001.

- 1) ERP technology will not support their businesses;
- 2) Their organization can not make changes needed to extract benefits from new systems;
- 3) ERP implementation might actually damage their business.

Implementation of ERP is more costly (by a factor of three to ten, depending on the target company) than the product itself. These costs are driven by a variety of factors including the high cost of implementation assistance provided by systems integration firms, the heavy reengineering focus traditionally adopted by implementing companies, and the need for implementing companies to replace high percentages of their existing information technology architecture in order to support ERP. Surveys reveal that despite planning for these high investments, many implementing companies experience cost and schedule overruns, and underachieve relative to their expectations on benefits.

There is also some evidence that ERP implementations fail at a high rate. Depending on definitions of "failure," some have suggested that the rate is greater than 50 percent. Notable examples of companies that have experienced difficulty, and public notoriety, for their experiences with troubled ERP implementations include Hershey (Stedman 1999), Nike (Konicki 2001), and Whirlpool (Collett 1999). HBS survey respondents cite user acceptance of process change, budget and schedule overruns, availability of adequate skills, and technical failure as key risks to ERP implementations.

Despite concerns, firms continue in their ERP efforts because of the opportunity for substantial reward. In some cases, firms recognize benefits in the tens or hundreds-of-millions of dollars.³ The most popular reasons cited by survey respondents for pursuing the implementation of ERP include a desire to standardize and improve processes, to improve the level of systems integration, and to improve IT responsiveness and information quality. Another oft-cited driver of ERP implementation prior to 2000 was the need for the respondent's companies to resolve "Year-2000" issues and to prepare for the conversion of the European Union's conversion to a single currency.

ERP and Business Issues

One of the primary business issues having to do with ERP centers on the question of how much standardization in business process is good for a company. Managers experienced in ERP implementation recommend caution when considering changes to core ERP code. As a result, successful ERP implementation often requires that business processes be changed to meet software functionality. At issue is whether competitive advantage can be gained from a standardized software package, when a firm's competitors also have the opportunity to implement it. In response to this issue, several successful implementers recommend a hybrid approach to implementation in which changes to ERP code are allowed, but only in circumstances where the competitive advantage derived from using non-standard processing is clearly demonstrable. Deciding what constitutes sufficient competitive advantage to justify software modification remains one of the more daunting project management challenges surrounding ERP implementation.

When changes to the software's code are made, firms face the additional issue of maintaining the ability to upgrade to future releases of the ERP package. Strategies range from internally maintaining skills and documentation to make future changes, to encouraging (or in the case of some large or

³ See, for example, Cisco Systems, Inc.: Implementing ERP (HBS Case #699-022) and Tektronix Inc.: Global ERP Implementation (HBS Case #699-043).

critical clients, demanding) the software vendor to incorporate modifications into future software releases. If changes cannot be incorporated quickly enough, the ERP system may negatively influence the flexibility and responsiveness of business operations (see sidebar).

A second issue that managers face is the decision about whether to adopt a single vendor's offering to cover the entire ERP footprint, or to adopt a "best in breed" approach in which separate software packages are selected for each process area and integrated with one another. HBS survey responses indicate that approximately 60 percent of companies adopt a best in breed strategy.

Dell Computer's experience illustrates the relative benefits of the two approaches. The advantage of a single vendor strategy is that functionality is well integrated and the client company can deal with a single product company in addressing problems and changes. The primary disadvantage of the single vendor approach is that it can limit flexibility. The advantages and disadvantages of best-in-breed ERP, mirror those of the single vendor strategy. Best in breed potentially offers greater flexibility, but integration and vendor relationships become complex.

A third concern faced by managers contemplating ERP is the staffing model to be used for the project. ERP implementations are long and intense. Projects can last for years. Project managers routinely seek out the best, most knowledgeable employees for participation in the project. Full-time involvement is the norm, with employees often vacating their former positions. The reason only the best employees are sought is straightforward – these will be the individuals who will define the future operating practices of the firm. The challenge of their allocation to the project arises in more than one dimension. First, when allocated full time to the implementation project, the firm may lose employees' day-to-day contributions in the areas in which they formerly excelled. Managers in these areas may be unhappy with the project for taking key staff. Furthermore, process performance may suffer as lower skilled, less knowledgeable employees are forced to cover for the absence of those allocated to the ERP project. Project managers must develop a plan at the inception of the ERP project to mitigate the negative effects of forming the implementation team on the rest of the business.

A second staffing challenge comes at the end of the implementation. The end of an ERP implementation can sometimes lead to attrition among the highly skilled employees attached to the project. Sometimes this attrition is caused by the fact that employee's former functional areas have backfilled staff in their absence. Other times, skilled employees may be "poached" by consulting firms and other companies engaged in implementations of their own. ERP project managers must focus *before* the end of the implementation on planning for the reintegration of desirable employees back into the business.

In 1994, Dell Computer began implementing SAP's R/3 to run its manufacturing operations. At the time, the company was the number three computer maker in the world. Two years later, in 1996, the company abandoned R/3. Terry Kelley, Dell's Chief Information Officer justified the decision by saying: "Over the two years we were working with SAP, our business model changed from a worldwide focus to a segmented regional focus... [SAP] was too monolithic to be altered for changing business needs."

In 1997, the company chose i2 Technologies (a supply chain vendor) to manage raw materials and Oracle for order management. A year later, Dell selected Glovia for manufacturing. "We keep carving out pieces of the puzzle and delivering quicker value than if we were putting in one huge ERP system." said Kelley.⁴

⁴ *InformationWeek*, May 11, 1998.

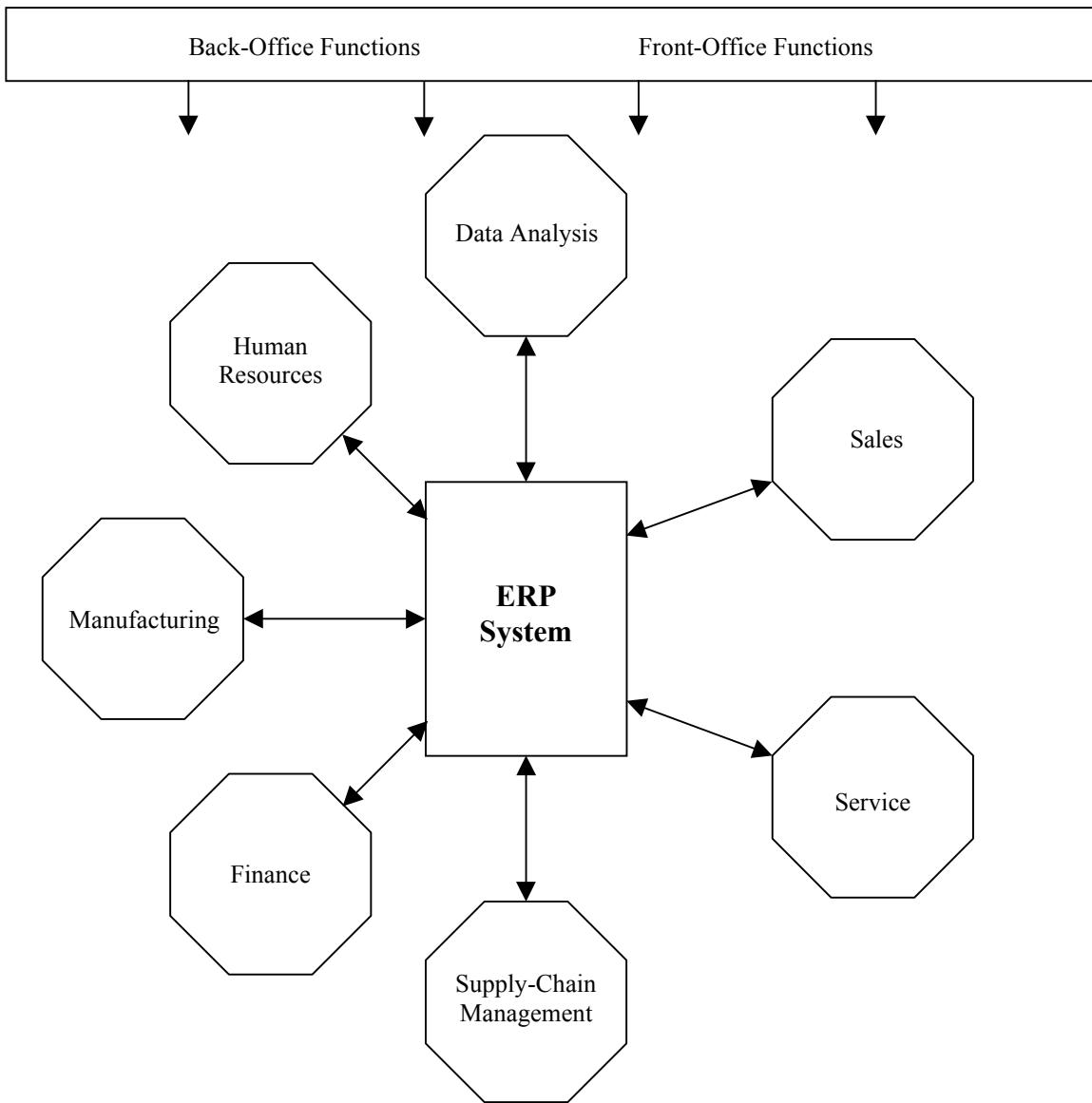
Future Directions

ERP will likely remain a fixture in firms' information technology plans. Growth is forecast to continue in this market, albeit at slower rate than has previously been the case. As a result of this slower growth rate, particularly in the traditional Fortune 500 target market, ERP vendors should be expected to continue pursuing three sometimes related strategies.

First, ERP vendors will continue to target additional functional niches such as customer relationship management (CRM), and advanced demand planning software (APS). By moving into these functionality niches vendors intended to expand the "footprint" of their product and extend their penetration of existing customers.

Second, ERP vendors will continue to move "down market", offering their products to smaller companies. In doing so, vendors can be expected to push ahead with attempts to simplify product offerings and implementation approaches.

Finally, ERP vendors will continue to press ahead with the "web-enablement" of their systems. Web-enablement potentially enhances ERP vendor's ability to move down market by reducing costs and increasing implementation flexibility. For example, in a web-enabled environment, firms' have a greater ability to outsource the maintenance of the system itself, choosing when and where to deploy different ERP modules instead of having to incur the investment for the entire architecture up front. For both small and large firms, web-enablement offers the prospect of simplifying the technical aspects of delivering functionality to the end user, be they in their office, home, or some remote location.

Exhibit 1 ERP Footprint

Source: Davenport 1998.

Exhibit 2 Profile of leading ERP companies

Company (2000 data)	Sales (in \$ millions)	Market Share	Growth
SAP	5,939	30%	10%
Oracle	2,870	15%	14%
PeopleSoft	1,736	9%	17%
J.D. Edwards	980	5%	2%
Geac	901	5%	0%
Others	7,228	36%	8%

Source: AMR (2001)

Endnotes

- AMR (2001). The Report on Enterprise Management, AMR Research, Inc.: 42.
- Collett, S. (1999). "SAP Gets Stuck in the Spin Cycle." Computerworld Vol. 33, No. 45 (November 8, 1999): 1.
- Davenport, T. (1998). "Putting the Enterprise into the Enterprise System." Harvard Business Review (July/August 1998): 121-131.
- Konicki, S. (2001). "Nike Just Didn't Do it Right, Says I2 Technologies." Information week (March 5, 2001): 32.
- Stedman, C. (1999). "Failed ERP Gamble Haunts Hershey." Computerworld Vol. 33, No. 44 (November 1, 1999): 1.