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ERP

EXPERIENCES

AND

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EVOLUTION

Enterprise resource planning systems are configurable information systems packages that integrate information and information-based processes within and across functional areas in an organization. The current generation of ERP systems also provides reference models or process templates that claim to embody the current best business practices.

Integration has been the Holy Grail of MIS since the early days of computing in organizations. As early as 1969 Blumenthal proposed an integrated architecture and a framework for organizational information systems [1]. However, due to the high level of organizational and technical complexity associated with their development and implementation, integrated enterprise-wide systems have been difficult to achieve in practice. For example, in the late 1980s and early 1990s, several attempts to develop integrated enterprise-wide corporate data models did not succeed

because of a lack of development and resource continuity over the long time horizons typically needed to build and implement these systems.

While these attempts for creating in-house integrated systems were floundering in various organizations, first-generation ERP systems packages were beginning to appear in the manufacturing industry. SAP and Baan, both European companies with backgrounds in industrial engineering, manufacturing, and operations, laid the groundwork for large-scale adoption of ERP systems in manufacturing organizations such as Boeing, Mercedes-Benz, BMW, and Ford. The development of these ERP systems was an

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inside-out process of evolution starting from standard inventory control (IC) packages, to material requirements planning (MRP), manufacturing resource planning (MRP II), further expanding to include other enterprise processes such as sales and order management, marketing, purchasing, warehouse management, financial and managerial accounting (finance), and human resource management. The evolution to extended-ERP systems continues to include interorganizational processes such as supplier and customer relation management.

ERP and ERP vendors were the major success stories of the mid-1990s. In addition to the European stalwarts (SAP and Baan), companies such as Oracle, Peoplesoft, and JD Edwards were beginning to make inroads in the ERP market. ERP revolution was in full swing with market capitalization of major vendors such as SAP and Baan approaching astronomical heights. Mid-1998 saw a severe correction in the market with Baan stock plummeting to one-tenth of its highs and SAP suffering a decline in stock value. By mid-1999 articles such as "ERP R.I.P." [3], "ERP: Staying Out of Trouble" [2], and "ERP's Fight for Life" [4] in influential business and trade press were predicting the imminent demise of ERP. Market analysts observed that by this time most of the Fortune 500 companies had already installed ERP systems. As some of the growth in ERP sales was presumably due to Y2K problems, with the approach of 2000 the bloom on the ERP rose was considered to be over. Moreover, the complexity of ERP and associated high costs and problems of ERP implementations were causing organizations to reexamine their plans for acquiring and implementing enterprise-wide systems.

However, current evidence suggests that news of the demise of ERP has been somewhat premature. As Everdingen et al. report in this special section, the large, relatively untapped market of midsize compa-

nies is now beginning to embrace ERP. Also, while ERP is relatively well established in the U.S., Germany, Scandinavia, and The Netherlands, it has only recently started making inroads in developing countries such as India, Brazil, and China, as well as in industrialized nations such as Singapore, Japan, the U.K., and Spain. Furthermore, ERP from its traditional base in manufacturing and logistics is now expanding into industries traditionally relying on in-house development or specialized packages. These include industries such as wholesale, service, maintenance and repairs, project industry, finance, banking, and insurance. The move into these new markets and industries requires new software products, knowledge, and competencies that do not currently exist in the present generation of ERP vendors with their origins in manufacturing and logistics.

ERP is now considered to be the price of entry for running a business, and at least at present, for being connected to other enterprises in a network economy. Furthermore, ERP is becoming a platform for applications such as executive information systems, data mining, and supply chain management. Therefore the market for ERP is likely to continue to expand and grow. However, as the articles in this special section point out, a number of organizational and technical issues remain to be resolved before the potential of ERP can be fully realized.

Willcocks and Sykes, in their provocative article, "The Role of the CIO and IT Function in ERP," observe that most CIOs and their IS/IT departments seem to have been "asleep at the wheel" in understanding and dealing with the ERP phenomenon. Typically, ERP initiatives in organizations are motivated by senior executives other than the CIO. Furthermore, usually senior business executives do not perceive the IS department and the CIO as having the right strategic vision and capabilities for implementing ERP initiatives. Consequently, these initiatives are

often implemented using expertise from outside the organization. The CIO and the IS/IT department are sidelined in these initiatives—relegated to the supporting role of maintaining and operating systems developed and implemented by others. Willcocks and Sykes suggest how the CIO and the IS department can transform themselves in dealing with the challenges of adopting, implementing, and if necessary, adapting enterprise-wide systems to the specific needs of their organization.

In keeping with their practitioner counterparts, academics in business school IS departments also seem to have been asleep at the wheel of the school bus. Coming out of industrial engineering schools, ERP itself, and the research on ERP has primarily been shaped by the engineer's view of organizations. Up until 1998, when the ERP phenomenon first appeared on the radar of the trade press, most IS academics were not aware of this revolutionary change. On the side of research, IS academics now seem to be catching up, and interesting preliminary results are beginning to appear in specialized, usually vendor-sponsored conferences and workshops, and in minitracks in IS conferences. However, most of the early research has not examined the implications and complexity of enterprise-wide information integration and the normative nature of reference models. In education, some universities, recognizing the multidimensional, integrative, and normative nature of ERP, are using ERP to integrate their business curriculum. The article by Becerra-Fernandez et al. describes one such effort.

A KEY PREMISE OF ERP SYSTEMS IS THE UNDERLYING, sometimes unstated, but often implicitly promoted notion that the reference models in ERP systems embody best business practices. Reference models supposedly reflect preferred business models including underlying data and process models as well as organizational structures. As Soh et al. eloquently point out, there can be considerable mismatches between the actual country, industry, and company-specific business practices and the reference models embedded in the ERP systems. While at the abstract level the idea of "universal" best practices may be seductive, at the detailed process level these mismatches create considerable implementation and adaptation problems.

Mismatches can also occur between the assumptions about organizational structure implicitly embedded in the reference models of the ERP software and the actual organization. The current generation of ERP packages is based upon a traditional hierarchical, functional view of organizations. Consequently, adap-

tations may be needed at both organizational as well as the system and software levels, leading to complex and difficult trade-offs. In addition, work in organizations can be distributed over many geographically and/or organizationally dispersed locations. Depending upon the level of decentralization and autonomy at these sites, integration of information and processes, and therefore ERP systems becomes an important issue. The article by Markus et al. examines the variety of multisite structures and the configuration and implementation issues associated with them.

ERP systems are continuously evolving in terms of technology and functionality. ERP vendors are regularly introducing new versions of their packages. Often these versions are quite different from the previous versions (for example, Triton, Baan IV, and Baan ERP) and sometimes not backward compatible. The problem of migrating between versions is further compounded if the user organizations have made modifications to the software or built custom interfaces between the ERP system and their in-house applications. Using a broadly based field study, Kremers and van Dissel examine the reasons for and factors inhibiting such migrations.

Next, given the packaged nature of ERP, a disconnect can exist between specifying the organization's information requirements and the solution proposed by ERP. Traditionally this disconnect is addressed by using people who have ERP configuration expertise in the detailed capabilities, options, and parameters of the ERP package. However, there is no guarantee that such knowledge is sufficient to understand the requirements from the organization's perspective. Thus the solution finally implemented may be determined more by the capabilities and options inherent in the ERP package rather than the organization's underlying information requirements. In order to address this dilemma, enterprise modeling tools such as ARIS for SAP and Baan's DEM have been developed. However, given the monolithic nature of current ERP packages, these tools do not resolve this dilemma and end up being tools for selecting options and parameter setting. The article by Scheer and Habermann in this special issue discusses the issue of ERP modeling tool support and future directions in their application.

The preceding problems have their genesis in the monolithic architecture of ERP systems. The design of the current generation of ERP systems is based upon the assumption that the requisite variety and complexity in organizations can be best accommodated by increasing the number of parameters, options, and configurable functionality in the ERP system (as in the transition from Baan IV to Baan

ERP). However, variety and complexity can also be managed through an alternate minimalist strategy. This strategy relies on composing large systems from largely independent components that are assembled to meet situation-specific requirements.

The idea of software components has evolved from object-oriented systems modeling. Components hide their internal complexity, communicate through clearly defined interfaces, and are both configurable and extensible. Similar to the concept of browsers that provide a platform for third party plugins, a component-based strategy would rely on a minimal ERP backbone supplied by few key ERP vendors together with a variety of domain-specific components supplied by third-party software houses. In those cases where the needed components are not available, the user organization will need to adapt or develop its own components. The organization is further responsible for selecting, assembling and when necessary, installing new versions of these components. The article by Sprott describes how the componentization of ERP packages is likely to evolve.

Such a component strategy would address the issues identified previously. First, firms would be able

to gradually acquire and assemble component-based ERP solutions customized to their specific needs. This would reduce the problem of mismatch between organizational requirements and ERP solutions. It should also lower the cost of acquiring and implementing reasonably customized ERP solutions for small- and medium-size enterprises. Migrations will become more gradual as outdated components are upgraded individually instead of the whole system. Moreover, in multisite implementations, the versions implemented at each site can be tailored to the site itself. Modeling toolsets, instead of being mainly configuration tools, will need to evolve to incorporate support for selecting, configuring, and extending components and for wiring components together. Finally this strategy should give the CIO and the IT department a renewed central role in identifying the organization's information requirements and implementing the ERP system.

What of the future? At present, ERP focuses mainly on structured transaction data in organizations. As we move to a more Web-based multimedia world, enterprise-wide information is also likely to expand to include multimedia documents such as engineering drawings, scanned documents, and audiovisual product descriptions. Second, ERP has focused primarily on transaction processing. The extensive databases provided by ERP are likely to provide the platform for decision support, data mining, and executive information systems. Finally, so far the development of ERP has been an inside-out process. On the other hand, supply chain management software such as i2, Manugistics, and SC21 aim to foster outside-in interorganizational integration. As we move closer to a network economy, these two initiatives will need to converge. A component-based ERP architecture is likely to facilitate these developments. ■

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