



Editorial

Enterprise resource planning—modeling and analysis

The management of materials, information, and other resources in organizations has expanded beyond the role of typical operations managers. Along with the breakdown of internal and external organizational boundaries has come the more open environment that is espoused by enterprise resource planning (ERP) systems. Practitioners and managers throughout the world have realized the enormity and importance of these evolved systems. No longer are they just for the exclusive use of large multinational organizations, but are diffusing to small and medium-sized organizations as well.

These systems are meant to encourage and support communication and cooperation among various functions, vendors, and customers of organizations. The ERP system is a central enabler to recent managerial concepts such as concurrent engineering, design for “x”, supply chain management, e-commerce, agile and virtual enterprises. Thus, their importance is strategically vital to organizations that wish to remain competitive. Practitioners have realized this importance by spending billions of dollars on these systems and supporting processes. Not only do ERP systems enable these concepts but may at times mean the rise or fall of organizations in an increasingly competitive market where globalization has been localized.

Yet, researchers have been slow to critically investigate the roles of ERP systems in organizations. Thus, we have decided to help expand the field of knowledge in this area and bridging some knowledge gaps by offering this special issue of the *European Journal of Operational Research*. The

articles that appear in this special issue deal with the conceptual and strategic frameworks, empirical research, case studies, and analytical models focusing on improving the design and development of ERP systems for improving organizational competitiveness. The concepts that are investigated in this paper cover a number of disciplines and issues. Thus the material covered here should be of interest to a wide variety of managerial disciplines and levels of management. ERP systems are the major managerial tool and technology that requires the multidisciplinary attention of operations management, information systems, finance, marketing, organizational behavior and human resources fields. That is because they are operational systems that rely heavily on data and information with profound strategic implications for any organizations.

This brief introduction is to provide the reader of this special issue with an overview of 11 articles appearing here. This special issue is presented in order to motivate researchers and practitioners in the modeling and analysis, and application of ERP systems. The articles cover a broad set of issues of ERP that include the pre-implementation attitudes and organizational readiness for implementing an ERP system, implementation procedures and critical success factors, implementation issues of ERP with a case study, the impact of ERP on supply chain management, a taxonomy of critical factors, and an empirical analysis on ERP implementation.

ERP has come to mean many things over the last several decades. Jacobs and Bendoly in their invited review paper, “Enterprise Resource

Planning: Developments and Directions for Operations Management Research” review and categorize ERP research, what there currently is of it, into two distinct research streams. The first focuses on the fundamental corporate capabilities driving ERP as a strategic concept. A second stream focuses on the details associated with implementing information systems and their relative success and cost. This paper briefly discusses these research streams and suggests some ideas for related future research. Those academicians and practitioners initiating a research stream in this area will find this review quite helpful.

ERP systems are highly complex information systems. The implementation of these systems is a challenging project and involves a high level of investment that place tremendous demands on corporate time and resources. Many ERP implementations have been classified as failures because they did not achieve predetermined corporate goals. The article, “Enterprise Resource Planning: Implementation Procedures and Critical Success Factors” by Umble, Haft and Umble identifies success factors, software selection steps, and implementation procedures critical to a successful implementation. A case study of a largely successful ERP implementation is presented and discussed in terms of these key factors. Implementing an ERP System is expensive and time consuming. A substantial cost is associated with pre-implementation involvement and training designed to encourage acceptance and effective implementation of the system. Abdinnour-Helm, Lengnick-Hall and Lengnick-Hall in their paper, “Pre-Implementation Attitudes and Organizational Readiness for Implementing an Enterprise Resource Planning (ERP) System” discuss the importance of assessing employee attitudes throughout the ERP implementation process. Employee attitudes are a key factor in determining ERP implementation success or failure. The results of this study indicate that, contrary to conventional wisdom, extensive organizational investments in shaping pre-implementation attitudes do not always achieve the desired effects. Despite allocation of significant resources, such as time, money and effort, length of time with the firm and position had a greater impact on attitudes toward ERP capabilities,

value, acceptance and timing than high levels of pre-implementation involvement.

As discussed earlier, ERP can provide significant improvements in efficiency across a company, but only when implemented correctly. Otherwise, an ERP system could be a curse and drag the whole enterprise into spiraling inefficiency. Planning for ERP systems and their implementations requires an integrated approach to meet the requirements of various functional areas as well as extended enterprise. With a brief overview of ERP implementations, Mandal and Gunasekaran in their paper, “Issues in Implementing ERP: A Case Study”, describe some experiences of an ERP implementation in a water corporation. The case study reveals some of the intricacies during the planning and implementation stages that may occur in any company in any part of the world. Suggestions are offered in resolving the issues of implementing ERP.

Akkermans, Bogerd, Yucesan and Van Wassenhove in their article, “The Impact of ERP on Supply Chain Management: Exploratory Findings from A European Delphi Study”, present results from a study on the future impact of ERP systems on Supply Chain Management (SCM). The study was conducted with 23 Dutch supply chain executives of European multinationals. Their study identified the following key SCM issues: (1) further integration of activities between suppliers and customers across the entire supply chain; (2) ongoing changes in supply chain needs and required flexibility from IT; (3) more mass customization of products and services leading to increasing assortments while decreasing cycle times and inventories; (4) the locus of the driver’s seat of the entire supply chain and (5) supply chains consisting of several independent enterprises. Then, it argues that experts saw only a modest role for ERP in improving future supply chain effectiveness and a clear risk of ERP actually limiting progress in supply chain management. ERP was seen as offering a positive contribution to only four of the top 12 future supply chain issues: (1) more customization of products and services; (2) more standardized processes and information; (3) the need for worldwide IT systems; and (4) greater transparency of the marketplace. They also iden-

tified the following key limitations of current ERP systems in providing effective SCM support emerge as the third finding from this exploratory study: (1) their insufficient extended enterprise functionality in crossing organizational boundaries; (2) their inflexibility to ever-changing supply chain needs, (3) their lack of functionality beyond managing transactions, and (4) their closed and non-modular system architecture.

Implementing an ERP system is generally a formidable challenge, with a typical ERP implementation taking anywhere from one to five years. The story of the success of ERP systems in achieving the stated objectives is mixed. Some companies have had very successful implementations while others have struggled. The article, “Enterprise Resource Planning: Managing the Implementation Process”, by Mabert, Soni and Venkataraman empirically investigates and identifies key differences in the approaches used by companies that managed their implementations on-time and/or on/under-budget versus the ones that did not using data collected through a survey of US manufacturing companies that have implemented ERP systems. Logistic regressions are used to classify on-time and on/under-budget firm groups based on the survey responses and to identify the significant variables that contribute to on-time and on/under-budget implementation performance. The results indicate that many different factors ranging from pre-implementation planning to system configuration influence performance, which managers should be sensitive about when implementing major systems like ERP.

Somers and Nelson in their article, “The Impact Strategy and Integration Mechanisms on Enterprise System Value: Empirical Evidence from Manufacturing Firms”, “conceptualizes the fit” of ERP systems in manufacturing firms by conducting a study to identify how well organizational strategies and integrating mechanisms fit management’s expectations of the system’s value. The empirical findings indicate that the extent of BPR, competitive strategy, adequacy of end-user training, role of steering committee, package functionality, integration of IT, and manufacturing decisions related to technology, workforce, quality, production planning and organization are

important determinants of management’s perceptions of system value.

Single-vendor enterprise information technologies (EITs) are seen, as enablers for accomplishing this goal, a number of organizations are concerned about the high cost and time involved in such a solution. An alternative new paradigm has emerged in the form of componentized EITs, which are stand-alone software components that can be easily integrated with one other, and which provide the advantages of easing cash-flow problems and of decreasing customization times. Research in evaluation of componentized EITs lacks objective assessment tools that simultaneously consider both procurement and inter-component integration issues. The article, “A Multiperiod Optimization Model for the Procurement of Component-Based Enterprise Information Technologies” by Sundarraj and Talluri fills this gap by proposing a multiperiod integer-programming model to assist decision-makers in the procurement of componentized EITs, considering component costs as well as inter-component integration costs over a given planning horizon.

The paper, “Enterprise Resource Planning: A Taxonomy of Critical Factors”, by Al-Mashari, Al-Mudimigh and Zairi presents a taxonomy of the critical success factors in ERP implementation process. ERP benefits cannot be fully realized unless a strong alignment and reconciliation mechanism is established between technical and organizational imperatives based on the principles of process orientation. It is suggested in the taxonomy that measurement takes place in a balanced perspective, and for the purpose of providing useful information that can enable the decision making process and, which can help deliver the corporate objectives and therefore lead the business competitively forward. The taxonomy is based on a comprehensive analysis of ERP literature combining research studies and organizational experiences. The taxonomy reflects the essential features of ERP systems, as being built based on the principles of business process management. Furthermore, it argues that ERP benefits can be realized when a tight link is established between implementation approach and business process performance measures.

ERP systems are the new types of information systems for enterprise integration. By adding functionality to previous manufacturing resource planning systems, the aim is to integrate functions and processes within a manufacturing firm. In the paper, “Enterprise Resource Planning Survey of Swedish Manufacturing Firms”, Olhager and Selldin present a survey of ERP implementation in Swedish manufacturing firms, concerned with ERP system penetration, the pre-implementation process, implementation experience, ERP system configuration, benefits and future directions.

Ash and Burn in their article, “A Strategic Framework for the Management of ERP Enabled e-Business Change” review the results of a three year study into Internet enabled ERP implementations around the world. The study identified different stages of growth with differing sets of problems at each stage. A framework for e-business change was used to evaluate the mature stage of e-ERP in six international organizations. The emergent model proposes various antecedents to successful e-business change management in ERP environments. A case study of the first B2B e-business integration with Dell Computer Corporation and its largest corporate customer is examined in the context of this model. The case demonstrates the integration of ERP and non-ERP systems, using Web-based technologies, to optimize an overall B2B value chain. Finally the paper emphasises the role of change management and cultural readiness when adopting e-business solutions and identifies critical areas for future research.

Overall, what we see in this special issue is that we are still early in the research life cycle on ERP systems where we are still trying to understand what is making them work and what does and does not work in organizations. Thus, many papers have focused on the implementation process in various organizational settings and environments. The descriptive and evaluative results of these many papers can help further development of more prescriptive mechanisms and tools to help ERP become more successful for organizations

adopting these systems. There is also ample opportunity for more traditional operations management and operational research work in terms of modeling in this area to help improve the operational performance of these systems through analytical modeling. Yet, operational modeling researchers will have to be more creative and careful when developing these analytical models because of the variety of characteristics that make ERP different than their predecessors such as MRP and MRPII type systems.

We were overwhelmed by the response to the Call for Papers on, “Enterprise Resource Planning: Modeling and Analysis”. We could not have done this by ourselves, thus we appreciate the efforts and the professionalism of all who were involved in making this special issue possible, including the authors, referees and editorial staff of the *European Journal of Operational Research*. These efforts included reviews by at least two referees. The Guest Editors gratefully acknowledge the assistance provided by the Editors of the *European Journal of Operational Research* and more than 50 anonymous referees who reviewed manuscripts for this special issue.

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