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Carol Brown
Indiana University

Iris Vessey
Indiana University

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ERP IMPLEMENTATION APPROACHES: TOWARD A CONTINGENCY FRAMEWORK

Carol Brown
Iris Vessey
Indiana University
U.S.A.

1. RESEARCH OBJECTIVES AND QUESTIONS ADDRESSED

In the last few years, the way in which systems are provided in many manufacturing and service organizations has changed significantly: rather than developing and maintaining customized mainframe applications for single business clients, IS professionals are involved in the implementation of large-scale, cross-functionally integrated, packaged systems on client-server platforms. Enterprise resource planning (ERP) systems are on-line, interactive systems that can provide a "total" solution to an organization's information systems needs by addressing a large proportion of business functions. They support a process-oriented view of the business as well as business processes standardized across the enterprise. Today, these packages are implemented on client/server architectures that are more flexible and scalable than mainframe systems. Five major vendors of ERP software have emerged, with SAP AG being the leader with more than a 30% market share.

The difficulties of initial ERP implementations have been widely cited in the trade press, yet to date we have too little research with which to theorize the important predictors for initial and ongoing ERP implementation success. Toward this end, this research project is designed to increase our knowledge about ERP implementation practices. Our overall research question is: What ERP implementation variables appear to be critical to successful implementation and what contingency factors are associated with these key ERP implementation choices? As a first step, we review selected prior literature in order to develop a preliminary contingency framework. Due to the lack of prior research and the complexity of the phenomenon, we then employ a case study methodology utilizing a theoretical sampling approach. The objectives of our cross-case analyses are to both refine the research model and to develop propositions for future testing. Our findings are also expected to be of considerable interest to the practitioner community.

2. THEORETICAL FOUNDATIONS AND PRELIMINARY FRAMEWORK

Our tracking of the academic and trade literature over the past 18 months has yielded no systematic investigation by IS researchers of ERP implementation practices from a contingency perspective. To identify the ERP implementation variables that may be critical to successful implementation, we therefore rely on a synthesis of prior IS research on traditional systems development and implementation, together with the trade literature and early teaching cases on ERP implementations. We then incorporate these variables into a preliminary contingency framework. For this study, our focus is on practices associated with initial ERP implementation success, defined as the completion of an ERP package implementation close to projected time and costs.

One of the most widely-cited variables critical to the successful implementation of a large customized system is *top management support* (see Ginzberg 1981). Given the cross-functional nature and large budget of a typical ERP implementation, the extent of top management support appears to be an important characteristic. Two types of top management support roles have been associated with systems implementation projects: the project *sponsor* and the project *champion* roles (Martin et al. 1999). The project sponsor is responsible for budgetary support and ensuring that key business representatives play a role on the project team. The project champion may or may not be a formal member of the project team, but can play a key role in change management efforts. In some organizations, the sponsor also serves as the business champion for the project; in other situations, a champion emerges from among the key business leaders.

The *composition and leadership of the project team* have also been recognized as important variables in systems implementation. Shaft and Vessey (1995) have argued that both business (application) and technical knowledge improve the quality of traditional information systems analysis and design. These findings support the notion that R/3 implementations require not only package knowledge, but also business process knowledge (e.g., ASAP World Consultancy and Blain 1997; Bancroft, Seip and Sprengel 1998). In addition, since R/3 package implementations typically involve cross-functional process integration, key project team roles will be played by representatives from multiple business units who may be assigned full-time to the project (Norris et al. 1998). According to the trade literature, it is also not uncommon for an ERP project to be business-led (Doane 1997; Norris et al. 1998).

The trade literature suggests that attention to change management will be a critical success factor, given the large-scale process and system changes associated with enterprise-wide ERP implementations. The *change management* literature, which argues for the importance of not only pre-planned communications and training, but also the need to improve solutions (Mintzberg 1987; Orlikowski and Hofman 1997), appears to be relevant here, given the amount of organizational learning typically associated with ERP implementations.

The fact that third-party consultants are most often used as implementation partners, at two to 10 times the cost of the ERP software for the initial implementation (Doane 1997), also supports the notion that ERP implementations are complex and that new project management skills will be needed to manage the complexity (Ryan 1999). Implementation choices reported in the trade press that appear to be related to project complexity include the extent of process innovation, the degree of package customization, and the conversion strategy: phased, "big bang," or pilot, or some combination of these strategies (Welti 1999).

Figure 1 incorporates these potentially important ERP implementation variables into our preliminary contingency framework for this study. First, we begin our study with an assumption that characteristics of the organization, including industry and competitive strategy, will influence the ERP package capabilities that are sought by the organization. The only published cross-organizational report known to the authors (Davenport 1998) draws considerable attention to the need to think through the business implications of implementing an ERP system. After first calling attention to the "enormous technical challenges," Davenport concludes that disaster can result if a company fails to reconcile the technological imperatives with the business needs of the enterprise itself. Second, preliminary findings from the authors' own field survey of ERP adoption decisions suggest that the ERP package capabilities sought can be summarized in terms of seven factors: new ways of doing business, IT cost reduction, data integration, flexibility/agility, IT purchasing, global capabilities, and Year 2000 compliance (Brown and Vessey 1999).

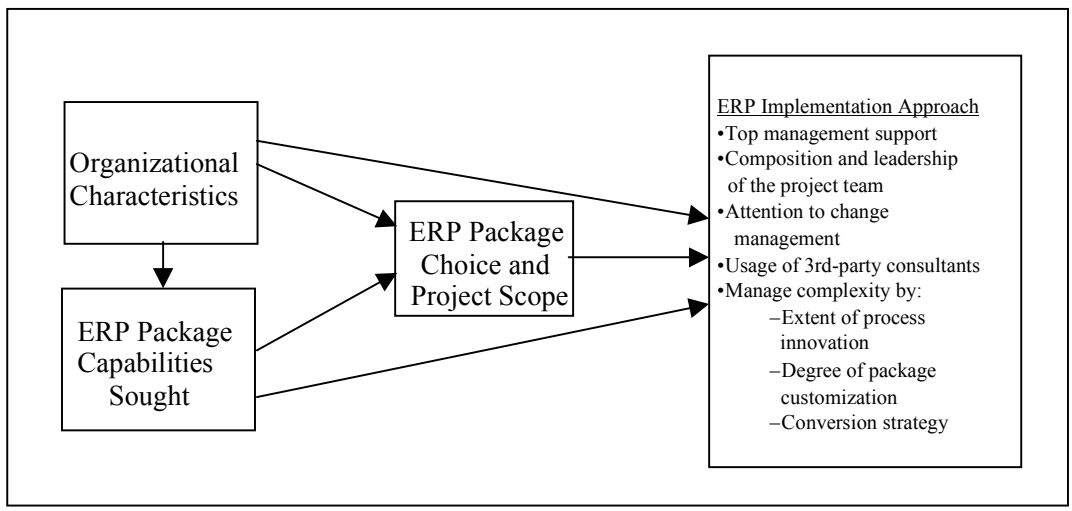

Figure 1. Contingency Framework for ERP Implementation Approach

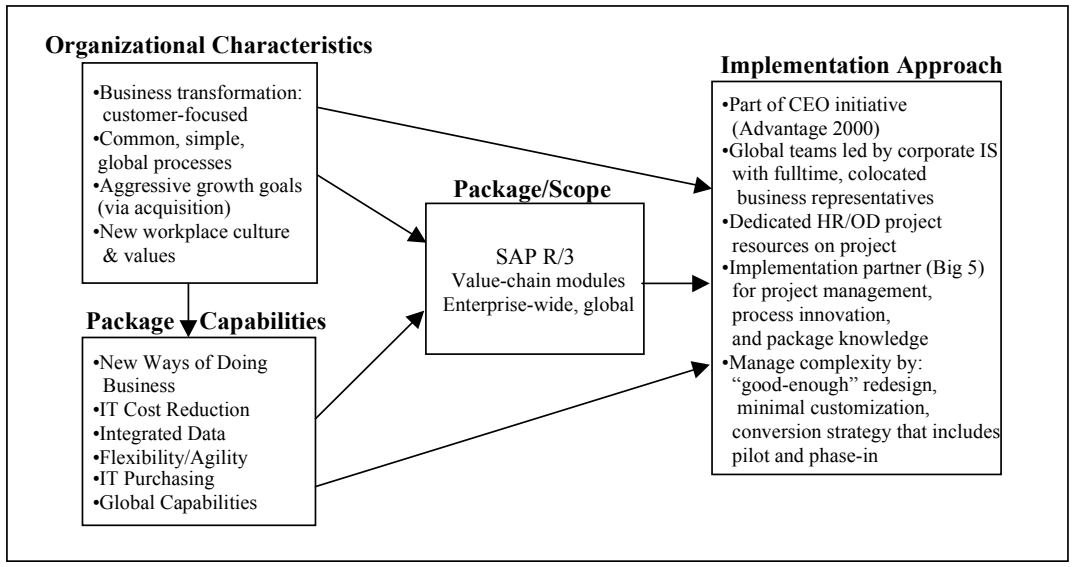

Figure 2. ERP Teaching Case (Martin et al. 1999)

Third, the organizational characteristics and ERP package capabilities sought are assumed to influence the ERP package choice and project scope (modules, business units, geographies). The scope of implementation is a distinction not well addressed in the prior literature. ERP implementations typically addressed in the literature include ERP modules for *value-chain activities* (Porter and Millar 1985): materials management, production and operations, sales and distribution. However, many other companies purchase so-called ERP packages for functions that *support* the value chain only: human resources (HR) and/or financial/accounting modules. When no value-chain modules are involved, we refer to such implementations as "support" implementations (vs. "value-chain" implementations). Further, some firms are implementing ERP modules with the expectation of enterprise-wide solutions, while in other cases the solutions are implemented at the division level (or business unit level) only. Finally, some enterprise-wide solutions are also global solutions.

Some subset of variables for all three of these factors (organizational characteristics, ERP package capabilities, and package choice and scope of implementation) are then expected to influence the key ERP implementation choices identified from the literature (see above). To demonstrate the potential utility of the framework, Figure 2 maps a published teaching case on a global SAP R/3 implementation into the framework (Martin et al. 1999).

3. RESEARCH METHODOLOGY

A case research methodology was chosen for this study in order to collect rich descriptive data on ERP implementation practices from multiple stakeholders. This research approach allows us to take advantage of unique features that may yield emergent variables not in our literature-based preliminary framework. The primary drawback of this approach is that the generalizability of our results will be limited to a refined research model and propositions for future research (Yin 1984).

The selection of the case study sites will be based on a theoretical sampling method (see Eisenhardt 1989). For this study, six companies will be paired on key variables in an attempt to elucidate theoretically-useful findings with a small set of case studies. Based on our preliminary framework, for example, pairings on three variables are expected to yield such findings: industry (manufacturing, service), ERP package choice (vendor, modules), and project scope (single or multiple divisions, functions, geographies). Preliminary discussions with key contacts in each firm, as well as secondary reports, will be used to identify companies with ERP projects that were initially successfully based on time and cost estimates for the project as well as management perceptions of implementation success.

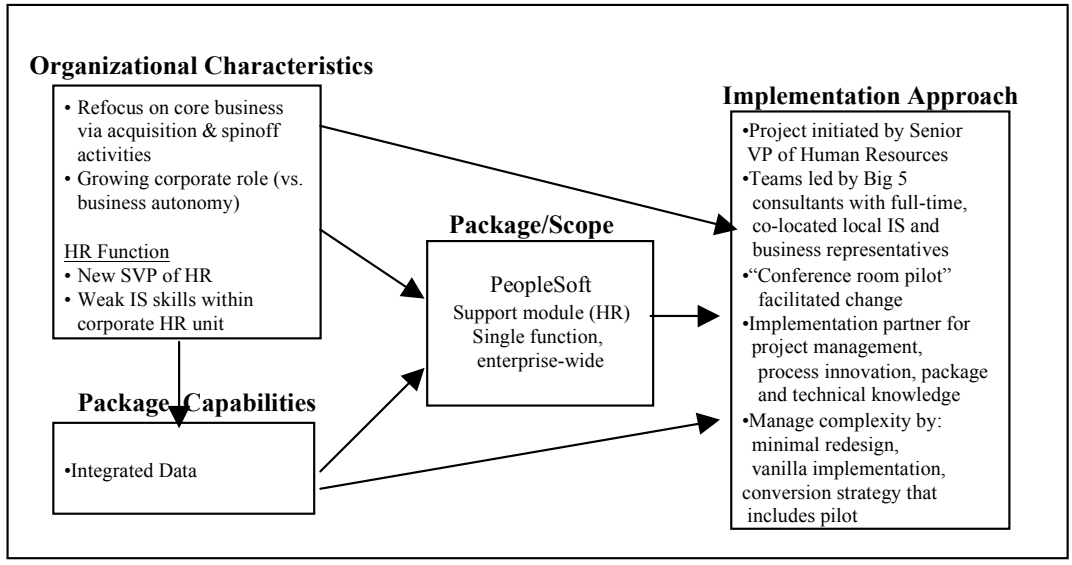

Figure 3. Service Case Study #1

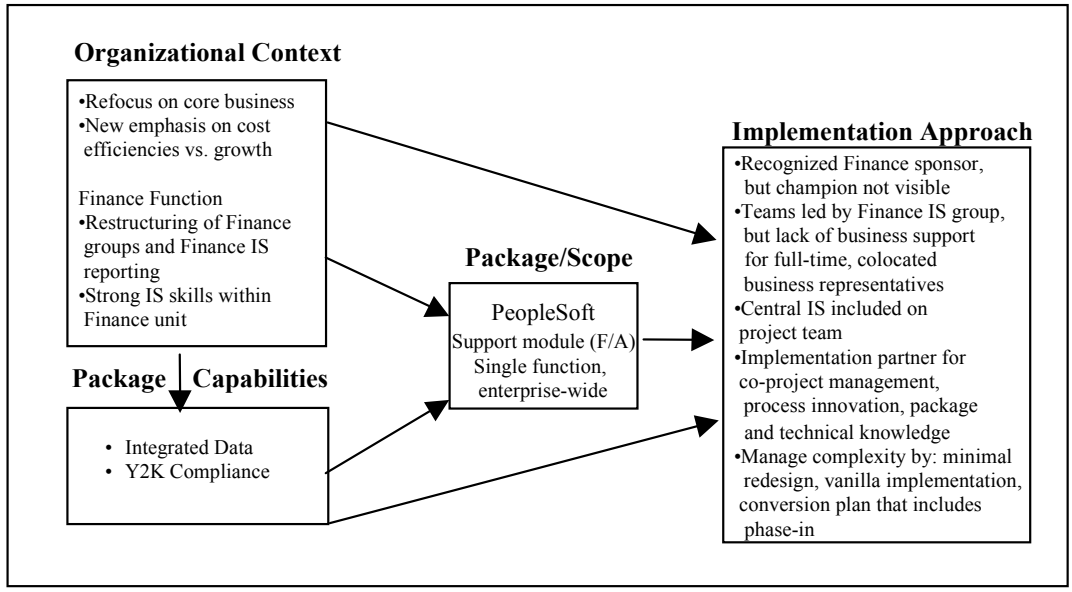

Figure 4. Service Case Study #2

For each case study, on-site interviews with IS and non-IS stakeholders and other participants will be conducted. Semistructured interview guides, based on the preliminary contingency framework and the prior literature, have been developed. Aggregate descriptions of the key variables of interest will be prepared for each case site and then validated with at least the primary contact at that firm. Cross-organizational analyses will be conducted first for each case pair and then across all case pairings.

4. CURRENT STATUS OF THE PROJECT

Preliminary data using the semistructured interview guides designed for this study have already been collected from one pair of case studies. This initial pair of companies was matched on industry (financial services), modules (PeopleSoft support modules: finance and human resources only), and enterprise-level scope (function). This type of case study pairing was important for us to better understand potential differences between support implementations and the value-chain implementations more commonly addressed in the trade literature (as defined above).

Figures 3 and 4 summarize our preliminary case study findings, for a single function only, at these two case sites. Service #1 involves the implementation of PeopleSoft's basic Human Resources module (including basic HR records, payroll, base benefits), which were selected for their data integration capabilities. The project was viewed as an initiative of the Senior VP of HR, and it was led by a Big 5 consulting firm. Nine interviews were conducted with business and IS personnel in the HR function, as well as in the consultancy, and a 23-page confidential report with aggregate findings has been provided to the primary contact.

Service #2 also sought a more robust package that would provide more sophisticated data integration capabilities, as well as a Y2K-compliant replacement package. The project was jointly led by an experienced former IBMer, who was a member of the IS group within the Finance function, and the implementation partner. Seven interviews were held with business and IS personnel in the Finance function as well as central IS personnel. A 17-page confidential report with aggregate findings has been drafted and the presentation slides summarizing our findings at this case site have been approved by our primary contact.

The authors have been awarded funding to collect data from additional case sites during the summer of 1999. A preliminary list of case sites has been prepared and preliminary interest has already been obtained from the CIOs or ERP project leads at several of the potential sites.

5. EXPECTED CONTRIBUTIONS

ERP system solutions are in demand today by both manufacturing and service organizations because they provide an integrated solution to an organization's information systems needs. This research study has been designed to increase our knowledge about ERP implementation approaches and the contingent variables that influence the tradeoffs associated with these variables.

We began our study by scanning the ERP literature. Our synthesis of this literature with selected prior IS research on system implementation has yielded a preliminary contingency framework that has guided our selection of case studies and the development of interview guides. Although any conclusions drawn at this time must be characterized as premature, our preliminary analysis of the findings summarized in Figures 3 and 4 has already yielded some useful insights that were not found in the published literature. First, the distinction between value-chain and support implementations appears to be critical to meaningful ERP implementation research results. For example, for ERP implementations of support modules only, as for Service #1 and Service #2, the organizational variables of interest are not only corporate-level variables, but also functional unit variables. Second, for business-led projects, a key characteristic of the project team composition is the usage (or non-usage) of central (corporate) IS resources. Further, unlike the SAP implementation in Figure 2, the PeopleSoft implementations at Service #1 and Service #2 were both packaged system *replacements*, and some of the tradeoffs for these ERP implementations were influenced by previous packaged system implementation experiences within their respective functions. It also appears that the project management pitfalls experienced by Service #1 and Service #2 did not substantively differ from what we already know about managing other packaged system implementation projects. These observations lead us to suggest that support module implementations led by single business functions may be qualitatively different from ERP implementations involving value-chain modules.

Again, with the caution that these are preliminary results, a comparison of the two service cases with the teaching case in Figure 2 suggests that there may also be some "universal" practices across value chain and support implementations. The similarities include relatively "vanilla" approaches to package customization, "good enough" process innovation at the time of system implementation, an aggressive schedule (relative to the number of resources devoted to the project), and an initial conversion strategy that included some kind of pilot or phase-in strategy. Further, each of these companies used a major consulting firm as implementation partner (different partner for each) and each company had to actively address knowledge transfer issues to become self-sufficient.

Should these findings hold true after the final cross-case analyses, then we expect to generate propositions such as the following:

- Vanilla approaches, "good enough" process innovation, an aggressive time schedule, and either a pilot or phase-in strategy are implementation tactics associated with initial project success for both value-chain and support implementations.

- Explicit, measurable activities to ensure knowledge transfer from implementation partner to internal employees are associated with initial project success for both support and value-chain implementations.

Our preliminary findings suggest that this study will be a useful contribution toward better understanding the contingency variables associated with ERP implementation choices. Our study is also expected to yield some initial insights that will be useful to practice and we already have some preliminary evidence of interest from the practitioner community.

6. PRESENTATION AT ICIS

Our expectation is that we will have collected data from three theoretically-useful pairs of case studies of ERP implementations. After an introduction to our study, we intend to use the framework presented to highlight our within-case and cross-case findings.

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