Pre-implementation attitudes and organizational readiness for implementing an Enterprise Resource Planning system

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Abstract

Implementing an Enterprise Resource Planning (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. 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 extensive 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.

1. Introduction

Enterprise Resource Planning (ERP) applications are software suites that help organizations integrate their information flow and business processes. They typically support the different departments and functions in the organization by using a single database that collects and stores data in real time. When ERP systems are fully realized in a business organization, they can yield many benefits: reduce cycle time, enable faster information transactions, facilitate better financial management, lay groundwork for e-commerce, and make tacit knowledge explicit (Davenport, 2000). Since the potential benefits are large, many organizations are willing to undertake the difficult process of converting from whatever they currently use to an ERP system.

ERP is meant to replace the old systems, usually referred to as “legacy systems”, that provide support for specific functional areas. The information in a legacy system approach is spread across several different computer systems creating both direct and indirect costs. Direct costs include: maintaining the different systems, entering data more than once, and having to reformat data from one system to use it in another. Indirect costs, which are even more important, reflect the costs of communication failure. These costs are incurred when a company’s manufacturing system cannot
"talk" to its sales and ordering system or to its financial-reporting system (Davenport, 1998).

Many organizations are convinced they must have an ERP system to replace their legacy systems and to remain competitive. AMR Research in Cambridge, Massachusetts predicts annual sales of ERP software of $84 billion by 2002 (Kirkpatrick, 1998). The three major ERP vendors, SAP, Oracle, and PeopleSoft, have 30%, 15%, and 8% of the ERP market share (Grygo, 2000). A survey by the American Production and Inventory Control Society lists over 80 vendors of ERP software and compares them on various key features (APICS, July 2000).

Understanding the history and evolution of ERP is essential to understanding its importance to operations. In many respects, ERP was designed to overcome the operational problems that companies experienced with previous information systems. One of the earliest computerized information systems for operations management was Material Requirement Planning (MRP). MRP sought to automate manual procedures for planning and controlling production schedules. MRP systems were designed to work back from the sales orders to determine the raw material required for production (Orlicky, 1975). Companies often experienced difficulty implementing MRP systems. In addition, the technology frequently failed to yield the expected benefits. Failure was often caused by people problems rather than technical problems (Belt, 1979). Too often, managers disregarded the impact of such technology decisions on organization structure and performance measurement, and they underestimated the role of manufacturing in the company’s competitive strategy (Miller, 1981).

Manufacturing Resource Planning (MRP II) was introduced as a follow-up to MRP to resolve some of the most obvious operational problems. MRP II provided a closed loop system by taking into account capacity when developing production schedules (Wight, 1984). MRP II software was more sophisticated and included a set of modules for each of the different functional aspects of the production process. However, implementation challenges persisted with MRP II (Wilson et al., 1994). These continuing issues led to many discussions of methodologies for software selection, justification, and implementation strategies (Wallace, 1985; Turbine, 1993; Toomey, 1996; Ptak, 1997). Prism, used by a firm that manufactures a range of sanitary products, is one example of an approach to evaluating the implementation of MRP II software (Bayhan, 1999). Swan et al. (1999) used surveys and interviews to compare the diffusion and design of MRP II in four European countries. The data indicate that there are few examples of "plain vanilla" implementations of standard packages, and a company had to reconfigure the system to ensure it fits effectively in their unique operating environment.

Several different production control systems appeared after MRP II, including Just-in-Time (JIT) and Theory of Constraints (TOC). Benton and Shin (1998) provide an overview of the manufacturing planning and control environment associated with MRP and JIT. They attempt to resolve some major controversies in the MRP/JIT literature and uncover the potential for MRP/JIT integration as a solution. Plenert (1999) examined the design and the usage differences between MRP and JIT, and between MRP and TOC and concluded that MRP is not out-of-date simply because newer systems became available. Ozdamar et al. (1998) recently developed a hierarchical decision support system (HDSS) for production planning that integrates MRP with aggregate planning, production family planning, and end item planning. The modules of HDSS were tested using real data provided by a company.

In some respects, ERP may be considered as the next generation of MRP II systems because it blends the functionality of MRP II with other applications areas (quality, maintenance, marketing, accounting, etc.). According to Ptak and Schragenheim (2000), rather than being just MRP II with a new name, ERP is the next logical sophistication level in an evolutionary series of computer tools for operations. ERP is not only limited to manufacturing companies, but is useful for any company that has a need to integrate their information across functional areas. While companies experienced implementation problems with MRP and MRP II systems, and history can provide some good lessons, it is expected that the
implementation problems with ERP systems will be much worse because ERP systems are very complex and have a massive impact on the entire organization, and not just on operations.

Implementing an ERP system is very expensive and time consuming. It can cost a Fortune 500 company $30 million in license fees and $200 million in consulting fees (not to mention additional millions in computers and networks) and can take 3 years or more (Kirkpatrick, 1998) before the system yields its maximum benefit. According to Deloitte Consulting’s global director for aerospace and defense, some aerospace companies are spending much more than the projected $30 million. The cost of software licenses and installation can range between $300 and $400 million with installation typically running 2.5 times the value of the licenses. This can put a financial drain on companies for at least 2 years before they realize a return on their investment (Hughes, 1999).

Problems in implementing ERP systems have led to some spectacular failures (Bailey, 1999; Boudette, 1999). Whirlpool experienced delays in shipments of appliances to many distributors and retailers. Allied Waste Industries, Incorporated found SAP too expensive and too complicated to operate. Waste Management Incorporated aborted its SAP implementation after it had spent $45 million of the estimated $250 million needed.

What factors lead to a successful implementation of an ERP system in an organization? While to date there is no empirical evidence that sheds light on this question, numerous consultants and authors provide their opinions and anecdotal data. Most consultants and authors advocate a rational approach to organizational change. This approach assumes a rather orderly, step-by-step sequence of activities that will result in a successful implementation.

Davenport (2000) describes the major elements of a rational approach to implementing an ERP system. There are two parts to this approach: (1) preparing the people, and (2) preparing the technical system. Preparing the people involves gaining support from future users of the system, training them how to use the technical aspects of the system, and familiarizing them with how jobs and processes will change after implementation. Preparing the technical system involves converting data from the legacy systems to the required formats, installing the ERP software, and testing the ERP software.

To prepare the people, Davenport (2000) recommends that prior to implementation, an organization should create a structure that includes specific roles: an executive sponsor, a project leader or manager, process owners, super users, a vision and planning team, and implementation teams. The executive sponsor performs various functions, both substantive and symbolic, to ensure that the implementation receives the necessary attention and support to succeed. The project leader or manager orchestrates the many issues associated with the business, technological, and organizational change. Process owners take responsibility for how their processes fit with the overall system. Super users serve as “typical” users during the testing and piloting of the system, and then train others who have jobs similar to their own during implementation. The vision and planning team determines the overall fit between the ERP system and the organization. The implementation teams do the detailed process designs, system configuration switches, and training plans. Most organizations employ a mix of their own information technology (IT) employees, employees from non-IT business functions, and external consultants to fill these various roles during implementation.

To prepare the technical system, Davenport (2000) describes the following processes: configuration, interface development, data standardization and conversion, and testing and performance management. Configuration involves fitting the ERP system to the business and simultaneously fitting the business to the ERP system. Interface development involves creating links to various types of existing systems within the organization. Data standardization and conversion involves cleaning, matching, reformatting, and updating information from one system to another (i.e., legacy system to ERP system). Testing and performance management involves not only testing the technical system but also simulating the way business will be conducted once the ERP system is running.
A “rational-empirical” approach to change management makes two assumptions: (1) people are rational, and (2) once a proposal has been clearly explained, individuals see that it is in their best interest and subscribe to the change (Chin and Benne, 1976). A major strength of this approach is that it requires presenting the logic of the change. People respond more positively to change when the process and details are explained to them. However, even when individuals understand that a change is in their best interest, we cannot assume that they will comply (e.g., most people know that it is in their best interest to lose weight, exercise, or stop smoking—yet many of those same people do not behave rationally and make the needed changes!). In addition, no matter how well we think a change is explained, we cannot assume that an individual understands it in the way we intended it. If we want people to comply with change, we need also to consider their perceptions of what they have been told.

The rational approach to organizational change has been criticized as insufficient for explaining the complexities of technology implementation. Goodman and Griffith (1991) describe this approach to technology implementation as follows:

“If one wants to successfully introduce technological change, then the task is to change the right variables, such as level of participation or degree of top management support. This rational perspective assumes that cause and effect relationships are relatively identifiable. It also assumes relatively clear objectives for the technology. Lack of implementation success implies that the right variables (e.g., training) were not changed.”

The rational approach to organizational change has been challenged by organizational theorists who view change as chaotic, disorganized, and not characterized by a simple means–end hierarchy. Furthermore, the rational approach does not take into account the political processes associated with implementation. On the other hand, a political perspective proposes that ambiguity and conflicts of interests characterize both the objectives of the implementation as well as the process itself. Thus, organizational change associated with technological implementations, such as the introduction of an ERP system into an organization, is a complex process that is not well explained by a simple, rational approach.

This paper examines the role of employee attitudes in ERP implementation effectiveness in order to provide a better understanding of the “people” side of ERP implementation. Employee attitudes toward ERP systems and how these systems are introduced into organizations can either hinder or facilitate implementation success, despite the rational approach to change an organization may take. Furthermore, employee attitudes toward ERP systems are dynamic, changing over time as employees experience the ERP system more directly.

2. Theoretical framework and research hypotheses

Technology has both objective and “socially constructed” components (Goodman and Griffith, 1991). The objective components include such characteristics as the design and input characteristics of the technology and how it functions. The socially constructed component of technology includes the meanings people attach to the technology, which affects how they feel about the technology and how they behave. Different constituencies within an organization (e.g., managers vs. production workers) may have different social constructions of the same technology. Regardless of how sophisticated and elegant a technology may be (e.g., ERP software), it will have little impact on an organization unless people both have positive attitudes about it and behave in ways that take advantage of its benefits.

While no scientific research has been conducted on how employees respond to a new ERP system, there is considerable research on users’ reactions to information systems in other settings (Kossek et al., 1994). There is ample evidence to demonstrate that perceptions of employees who are expected to use a new IT can have a critical impact on the degree to which an implementation effort succeeds or fails (Knights and Murray, 1992; Parsons et al., 1991; Gattiker and Hlavka, 1991; Davis et al., 1989; Majchrzak et al., 1987).
Employee attitudes about a technology like ERP are dynamic and shift from inferential to descriptive over time (Herold et al., 1995). When employees have little direct experience with a new technology, their attitudes toward it are likely to be general and based on few attributes. Furthermore, their attitudes are likely to be inferential, based on accumulated past experiences and/or second-hand learning. On the other hand, when employees have direct experience and first-hand learning, their attitudes toward a new technology are likely to be more descriptive and more specific. Enthusiasm and interest in a new technology are likely to wax and wane throughout an implementation process as employees gain more information and more direct experience. The organizational challenge is to maintain interest and support in the ERP system throughout the implementation process.

Examining ERP implementation from a chronological, process perspective aids in understanding when and how employee attitudes play an important role in determining implementation effectiveness. Herold et al. (1995) identified six phases of technology implementation. Pre-adoption is the stage at which organizations begin to consider the need to change technologies, identify technology options, and consider strategic directions. Once they have decided on an option, the result is an adoption. The adoption point marks the beginning of the pre-implementation phase. This involves such activities as planning for the technology introduction, deciding on the role of the vendor and in-house resources in managing the introduction, providing preliminary training, planning the logistics of the change, deciding whether a pilot study will be used, and deciding whether everything will be changed at once or whether a gradual phase-in will be used. If a pilot study is used, it represents a distinct stage in the process. In the pilot study stage, employees see the technology for the first time, talk to their colleagues about it, and form impressions of how things are likely to change in the future. The next stage is the actual implementation, which may take a long period of time, and identifying when it ends may be difficult. The post-implementation stage, or “routinization,” represents a return to equilibrium—the new technology has been implemented, it is being used, and people are reaching whatever accommodation to it that they are likely to reach. Over time employee attitudes likely converge on what Goodman and Griffith (1991) describe as a “normative consensus”, or agreement about the use and value of the new technology.

Herold et al. (1995) propose that the time period prior to physical implementation, a pre-implementation phase, is worthy of additional research attention because of its role in shaping the attitudes of those who will be charged with the implementation. They further suggest that since early, pre-implementation attitudes toward a technology may be the “starting point” for attitudes which shape future implementation phases, and because these early attitudes may be central in shaping behaviors early on (e.g., spreading of negative rumors, involvement in early planning and design phases, resistance to informational attempts), it is important to understand the nature and origins of such attitudes.

This paper focuses on factors that influence attitudes or predispositions toward an ERP system in the pre-implementation stage as possibly important determinants of implementation behaviors. Specifically, we examine the role of levels of involvement with the early implementation process, job tenure, and job type on shaping attitudes toward an ERP system in the pre-implementation stage.

Employees who have greater levels of involvement in the pre-implementation stage are likely to have more direct experience, or first-hand learning with the new ERP system. This more direct experience as well as status conferred on them for ensuring an effective implementation are likely to cause them to have more positive attitudes toward the ERP implementation. Thus, our first hypothesis is the following:

H1. Greater levels of involvement in the pre-implementation stage will lead to more positive attitudes regarding the expected capabilities of the ERP system, the expected value of the ERP system, acceptance of the ERP system, and the timing of the ERP implementation.
Conventional wisdom about new technology suggests that older and less educated workers will be more resistant than younger or better educated ones (Herold et al., 1995). Employees with higher levels of job tenure are similarly likely to be more resistant to a new technology since it can lead to potentially dramatic changes in the ways they do their jobs or even job loss. Consequently, we hypothesize the following:

**H2.** Employees with lower levels of job tenure will have more positive attitudes than employees with higher levels of job tenure regarding the expected capabilities of the ERP system, the expected value of the ERP system, acceptance of the ERP system, and the timing of the ERP implementation.

Managers and professionals are more likely to experience the benefits of ERP technology as improvements in their day-to-day tasks and activities. The information and speed made possible by an ERP system can significantly improve their productivity and operational control. In contrast, production workers and others are less likely to directly experience the benefits made possible by ERP technology, and consequently are more likely to view it less favorably (at least in the pre-implementation stage). Furthermore, production workers may view the ERP system as creating greater accountability for their job outcomes, making it possible for managers to constantly scrutinize their performance. Therefore, we hypothesize the following:

**H3.** Employees in management and professional/engineer jobs will have more positive attitudes than employees in supervisor, production worker, and other job types regarding the expected capabilities of the ERP system, the expected value of the ERP system, acceptance of the ERP system, and the timing of the ERP implementation.

3. Research design

3.1. Setting

This study was conducted in a large aircraft manufacturing organization in the Midwest, which over the past decades had accumulated a number of “legacy systems” to manage information. The organization made the decision to adopt the ERP system developed by SAP to replace its legacy systems. They decided to adopt an accelerated implementation schedule that involved little customization of the software with the intent of gaining a competitive advantage in the marketplace. The beginning of January 2000 marked the implementation phase of the new ERP system. At that time, the new ERP system was “turned on” while the old legacy systems (except for one used by human resources) were “turned off.” Pre-implementation activities took place in 1999 and included creating sponsors with different levels of involvement in the implementation, communication and education efforts, and training and support. Data for this study were collected during the pre-implementation phase in November 1999, just prior to the implementation phase beginning in January 2000.

3.2. Survey administration

A survey instrument was used to collect data from the employees. The ERP Activation Team manager at the time wrote two letters. One of the letters informed the company managers and administrative assistants about the importance of the upcoming survey. The other was a cover letter addressed to all employees endorsing the survey and reassuring them about the confidentiality of their responses.

The administrative support staff for the ERP team prepared packets that were sent out to the employees through the intracompany mail system. Each packet contained the cover letter, survey instrument, and an envelope addressed to the university research team (the envelope had a label indicating that it could only be opened by the university researchers after it was sealed). Surveys were mailed on a specific day and were to be completed by a specific day. Researchers were not present during any of the administration process. Each employee was given the choice to either drop the sealed envelope containing the completed survey in a big box or return it through intracompany
mail to the assistant who distributed the surveys. The confidentiality of all respondents was ensured and there was no way to identify individual respondents.

### 3.3. Sample

The organization employed over 5000 employees. The researchers in conjunction with organization officials identified three units to survey: manufacturing operations (and support functions), final assembly operations (and support functions), and human resources. These units were selected because they were believed to be more directly affected by the introduction of the new ERP system. We separated out human resources because of their presumed importance of their role in implementing the ERP system. However, the responses from this department were extremely low and, given the relatively small size of the unit, did not provide a useful sample. We attributed this to the general lack of acceptance of the change on the part of this department, which we had heard about from other company officials. In this case, low response itself is an indicator of lack of receptivity. Surveys were sent to 1894 employees and 946 employees responded (approximately 50%). Table 1 includes the characteristics of the sample:

#### Table 1

<table>
<thead>
<tr>
<th>Sample characteristics</th>
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<tbody>
<tr>
<td><strong>Unit affiliation</strong></td>
<td></td>
</tr>
<tr>
<td>Manufacturing operations and support functions</td>
<td>621</td>
</tr>
<tr>
<td>Final assembly operations and support functions</td>
<td>117</td>
</tr>
<tr>
<td>Other</td>
<td>157</td>
</tr>
<tr>
<td><strong>Length of time at the company</strong></td>
<td></td>
</tr>
<tr>
<td>Less than 1 year</td>
<td>47</td>
</tr>
<tr>
<td>1–5 years</td>
<td>294</td>
</tr>
<tr>
<td>6–10 years</td>
<td>129</td>
</tr>
<tr>
<td>11–15 years</td>
<td>114</td>
</tr>
<tr>
<td>More than 16 years</td>
<td>347</td>
</tr>
<tr>
<td><strong>Current position</strong></td>
<td></td>
</tr>
<tr>
<td>Manager/director</td>
<td>148</td>
</tr>
<tr>
<td>Supervisor/lead/crew chief</td>
<td>168</td>
</tr>
<tr>
<td>Production worker</td>
<td>123</td>
</tr>
<tr>
<td>Professional engineer</td>
<td>212</td>
</tr>
<tr>
<td>Other</td>
<td>263</td>
</tr>
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</table>

Respondents were asked if they expected to use SAP in doing their job i.e. potential users (a yes/no response). Respondents were also asked if they participated (a yes/no response) in Cornerstone meetings/workshops, Teambuilder meetings/workshops, or Organization Mapping meetings/workshops.

*Cornerstones* represented the highest level of involvement in the implementation process. As described in company literature, Cornerstones were to lead the organization to understand and implement the changes required to deliver business results. They were chosen because of their influence, credibility, and authority within the organization. Their tasks included: promoting the vision, becoming knowledgeable about the new processes, making decisions with the ERP Team, co-sponsoring integration and testing, implementing role and organization change, mobilizing Teambuilders, communication and education, and ensuring that people were prepared for training.

*Teambuilders* represented the second highest level of involvement in the implementation process. As described in the company literature, Teambuilders were assigned the role of practical application of change management to the organization. They were chosen because of their influence, good interpersonal skills, ability to make things happen, credibility and respect, and practical business knowledge. Their tasks included: becoming “super users” of the ERP system, participating in ERP team workshops and meetings, facilitating communication activities, generating feedback from employees, conducting process education, training users, and planning, executing, and monitoring changes.

*Organization Mapping* represented the third highest level of involvement in the implementation process. Employees who only participated in Organization Mapping attended workshops in which they: mapped their processes as they would be defined by the ERP system, identified the impact of ERP on their processes, determined required
changes, and developed implementation plans for changes in roles and jobs, structures, performance measures, policy, skills mix, and training.

Top management selected Cornerstones and Teambuilders. The two groups were meant to be distinct given their purpose. Only a small number of people were selected for these roles in the pre-implementation process for two reasons. One, the company wanted Cornerstones and Teambuilders to be advocates of the new ERP system. Consequently, these people were carefully chosen for their positive attitudes and desired employee traits. Two, these people were chosen because they were influential within their peer and workgroups. This way, training a few people could create “missionaries” who could then spread the work about the new ERP system in their respective areas. In contrast, attendance to Organization Mapping workshops was voluntary and was meant to draw a large number of employees from different parts of the organization. Cornerstones and Teambuilders were encouraged to attend the Organization Mapping workshops, but participation was not restricted to these select groups. According to information provided to us, the company was disappointed at the low turnout for Organization Mapping workshops.

We used the collected data to identify three mutually exclusive groups of employees who were designated as being involved in the pre-implementation phase: 38 were classified as Cornerstones, 22 as Teambuilders, and 24 as Organization Mapping. Assuming that actual involvement was consistent with intended involvement, Cornerstones were

<table>
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<th>Table 2</th>
<th>Scale items and reliability measures</th>
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| **Expected capability of ERP (alpha = 0.80)** | What are your current general expectations of the system?  
(very little to a lot)  
I think that the data from the ERP system will be:  
(always on time to never on time)  
I think that the data from the ERP system will be:  
(very accurate to very inaccurate)  
I think the ERP system will be:  
(very easy to use to very difficult to use)  
I think the ERP system will be:  
(very easy to customize to my needs to very difficult) |
| **Expected value of ERP (alpha = 0.85)** | Overall, I think that the switch from legacy systems to ERP is:  
(more trouble than it is worth to absolutely essential at this time)  
What do you believe is the likelihood that the benefits of ERP will outweigh the costs?  
(extremely likely to extremely unlikely)  
I see the value in having an ERP system  
ERP will help coordinate our work with activities in other company locations  
Supporting or working on the ERP system can enhance my career (the last three items range from strongly agree to strongly disagree) |
| **Timing of ERP (alpha = 0.77)** | How quickly do you believe the ERP project is proceeding?  
(very quickly to very slowly)  
The progress on the ERP project to date is:  
(too slow to too fast)  
Given all the factors beyond the ERP Project Team’s control (vendors, technical glitches, etc.) the time frame for program implementation is:  
(outstanding to totally unacceptable)  
With regards to the progress toward implementing the ERP system, I currently feel:  
(extremely frustrated to not at all frustrated)  
I am very satisfied with the progress of ERP system development (strongly agree to strongly disagree) |
| **Acceptance of ERP implementation (alpha = 0.85)** | It wouldn’t bother me if ERP were discontinued  
I am familiar with the functionality of the ERP system  
The ERP system is important to me  
Overall, I think the ERP project is very well run  
In general, I like the way the ERP system is designed  
A lot of improvement should be made in the way the ERP system is run  
My immediate supervisor supports ERP implementation  
ERP has little importance to me  
In general, communication on the ERP system has been good  
Overall, ERP is a great program and should be implemented (all the items range from strongly agree to strongly disagree) |
more involved than Teambuilders and Teambuilders were more involved than the group who participated only in Organization Mapping. All 84 involved respondents were users of the system. We also identified a fourth group of users who did not get involved in any of the three forms of pre-implementation training. This group is called the “Non-involved” group.

Respondents were asked, “How long have you worked at XXX Company?” Job tenure was measured by a response to one of the following choices: less than 1 year, 1–5 years, 6–10 years, 11–15 years, and greater than 16 years.

Respondents were asked, “What is your current position?” Job type was measured by a response to one of the following choices: manager/director, supervisor/lead/crew chief, production worker, professional/engineer, and other.

Respondents were asked about their attitudes towards the new ERP system. Employee attitudes were measured using modifications to three scales developed by Kossek et al. (1994) and one scale developed by Kossek (1989). The original scales examined attitudes toward implementation of a human resource IT system. In this study, the scales were modified to examine attitudes toward implementing the new ERP system. Table 2 contains the adapted items in each scale and the reliabilities of the scales. Expected capabilities used a 5-item, 7-point Likert-type scale to assess the utility and customization capabilities of the new ERP system (alpha = 0.80). Expected value used a 5-item, 7-point Likert-type scale to measure the perceived financial, political, and overall value of the ERP system (alpha = 0.85). Timing used a 5-item 7-point Likert-type scale to measure the perceived appropriateness of the speed with which the ERP system was being implemented e.g. too fast, too slow, about right (alpha = 0.77). Acceptance used a 10-item, 7-point Likert-type scale to assess level of acceptance by potential users of the ERP system (alpha = 0.85).

4. Results

Three separate one-way multivariate analysis of variance (MANOVA) were conducted to test the study hypotheses. Analyses of the impact of levels of involvement on the dependent measures were performed at the group level of analysis. Analyses of the impact of job tenure and job type on the dependent measures were performed at the individual level of analysis.

4.1. The impact of levels of involvement on ERP pre-implementation attitudes

A one-way MANOVA was conducted to determine the effect of four levels of involvement (Cornerstone, Teambuilder, Organization Mapping and Non-involvement) on the four dependent variables: capability, value, acceptance, and timing. Significant differences were found among the four levels of involvement on the dependent measures, Wilks’ $\lambda = 0.936$, $F(12, 1286) = 2.710$, $p < 0.001$. The multivariate $\eta^2$ based on Wilks’ $\lambda$ was 0.022. Table 3 contains the means and standard deviations of the dependent variables for the four groups.

Analysis of variance (ANOVA) was conducted on each dependent variable as follow-up tests to the MANOVA. To control for Type I error across the multiple ANOVAs, we used a traditional Bonferroni procedure and tested each ANOVA at the 0.0125 level (0.05 divided by the number of ANOVAs conducted: 4). Only one of the ANOVAs approached an acceptable significance level. The ANOVA on the “value” variable was $F(3, 489) = 3.042$, $p < 0.05$. Consequently, there were no noteworthy significant differences on the four dependent variables across the four levels of involvement despite the significant main effect.

4.2. The impact of job tenure on ERP pre-implementation attitudes

A one-way MANOVA was conducted to determine the effect of five levels of job tenure (<1 year, 1–5 years, 6–10 years, 11–15 years, and >16 years) on the four dependent variables: capability, value, acceptance, and timing. Significant differences were found among the five levels of job tenure on the dependent measures, Wilks’ $\lambda = 0.899$, $F(16, 1727) = 3.814$, $p < 0.001$. The multivariate $\eta^2$ based on Wilks’ $\lambda$ was 0.026. Table 4
Table 4
Means and standard deviations for dependent measures by job tenure

<table>
<thead>
<tr>
<th>Dependent measures</th>
<th>Job tenure</th>
<th>Mean</th>
<th>Std. deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capability ($p &lt; 0.001$)</td>
<td>&lt;1</td>
<td>4.6963</td>
<td>1.0204</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>1–5</td>
<td>4.4368</td>
<td>1.0965</td>
<td>190</td>
</tr>
<tr>
<td></td>
<td>6–10</td>
<td>4.3100</td>
<td>1.1644</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>11–15</td>
<td>3.8597</td>
<td>1.4030</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>&gt;16</td>
<td>3.9493</td>
<td>1.2485</td>
<td>209</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>4.1860</td>
<td>1.2334</td>
<td>493</td>
</tr>
<tr>
<td>Value ($p &lt; 0.05$)</td>
<td>&lt;1</td>
<td>4.2947</td>
<td>1.4300</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>1–5</td>
<td>5.0636</td>
<td>1.0335</td>
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<td>11–15</td>
<td>4.1682</td>
<td>1.4457</td>
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<tr>
<td></td>
<td>&gt;16</td>
<td>4.2329</td>
<td>1.4304</td>
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<td>Total</td>
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<td>1.4307</td>
<td>493</td>
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<td>Acceptance ($p &lt; 0.001$)</td>
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<td>3.6895</td>
<td>0.9503</td>
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<td></td>
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<td>3.7045</td>
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<td>11–15</td>
<td>4.0875</td>
<td>1.1315</td>
<td>409</td>
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<tr>
<td></td>
<td>&gt;16</td>
<td>4.0268</td>
<td>1.1150</td>
<td>493</td>
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<td></td>
<td>Total</td>
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<td>1.1150</td>
<td>493</td>
</tr>
<tr>
<td>Timing</td>
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<td>1.0500</td>
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<tr>
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<td>1.1945</td>
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<tr>
<td></td>
<td>11–15</td>
<td>3.3582</td>
<td>1.1825</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>&gt;16</td>
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<td>1.1091</td>
<td>209</td>
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<td></td>
<td>Total</td>
<td>3.4094</td>
<td>1.1596</td>
<td>573</td>
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contains the means and standard deviations of the dependent variables for the five levels of job tenure.

ANOVA was conducted on each dependent variable as follow-up tests to the MANOVA. To control for Type I error across the multiple ANOVAs, we used a traditional Bonferroni procedure and tested each ANOVA at the 0.0125 level (0.05 divided by the number of dependent variables: 4). The ANOVA on the “capability” variable was significant, \(F(4, 568) = 6.801, p < 0.001, \eta^2 = 0.046\). The ANOVA on the “value” variable was significant, \(F(4, 568) = 12.397, p < 0.001, \eta^2 = 0.083\). The ANOVA on the “acceptance” variable was significant, \(F(4, 568) = 5.737, p < 0.001, \eta^2 = 0.039\). The ANOVA on the “timing” variable was non-significant, \(F(4, 568) = 2.739, p = 0.028, \eta^2 = 0.019\).

Post hoc analyses were conducted for each of the significant ANOVAs (capability, value, and acceptance) to find which levels of tenure had the strongest effects on the dependent variables. To control for Type I error across the pairwise comparisons, each comparison was tested at the 0.01 level (0.05 divided by the number of comparisons: 5).

For the capability variable, two of the comparisons were significant. Respondents with job tenure levels “1–5 years” were significantly higher on the capability variable than those with “11–15 years” and “greater than 16 years” job tenure.

For the value variable, four of the comparisons were significant. Respondents with job tenure levels “less than 1 year” were significantly higher on the value variable than those with 11–15 years or “greater than 16 years” job tenure. Respondents with job tenure levels 1–5 years were significantly higher on the value variable than those with 11–15 years or “greater than 16 years” job tenure.

Table 5
Means and standard deviations for dependent measures by job type

<table>
<thead>
<tr>
<th>Dependent measures</th>
<th>Current position</th>
<th>Mean</th>
<th>Std. deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capability ((p &lt; 0.001))</td>
<td>Manager</td>
<td>4.5604</td>
<td>1.0299</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>Supervisor</td>
<td>4.0140</td>
<td>1.1711</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Production worker</td>
<td>3.8000</td>
<td>1.2654</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Professional/engineer</td>
<td>4.2268</td>
<td>1.1733</td>
<td>142</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>4.2073</td>
<td>1.3120</td>
<td>165</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>4.1919</td>
<td>1.2183</td>
<td>567</td>
</tr>
<tr>
<td>Value ((p &lt; 0.001))</td>
<td>Manager</td>
<td>4.9958</td>
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<td>Supervisor</td>
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<td></td>
<td>Production worker</td>
<td>3.9094</td>
<td>1.5173</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Professional/engineer</td>
<td>4.4901</td>
<td>1.3695</td>
<td>142</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>4.1927</td>
<td>1.4400</td>
<td>165</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>4.3492</td>
<td>1.4223</td>
<td>567</td>
</tr>
<tr>
<td>Acceptance ((p &lt; 0.001))</td>
<td>Manager</td>
<td>3.2750</td>
<td>0.9211</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>Supervisor</td>
<td>4.0160</td>
<td>1.1019</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Production worker</td>
<td>4.2453</td>
<td>1.0933</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Professional/engineer</td>
<td>4.0317</td>
<td>1.0970</td>
<td>142</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>4.0091</td>
<td>1.1419</td>
<td>165</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3.9183</td>
<td>1.1203</td>
<td>567</td>
</tr>
<tr>
<td>Timing</td>
<td>Manager</td>
<td>3.6833</td>
<td>1.1129</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>Supervisor</td>
<td>3.3080</td>
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<td>100</td>
</tr>
<tr>
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<td>Production worker</td>
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<td>64</td>
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<tr>
<td></td>
<td>Professional/engineer</td>
<td>3.4634</td>
<td>1.3060</td>
<td>142</td>
</tr>
<tr>
<td></td>
<td>Other</td>
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<td></td>
<td>Total</td>
<td>3.4138</td>
<td>1.1607</td>
<td>567</td>
</tr>
</tbody>
</table>
For the acceptance variable, two of the comparisons were significant. Respondents with job tenure levels 1–5 years had a lower mean score (indicating greater levels of acceptance) than those with 11–15 years or “greater than 16 years” job tenure.

4.3. The impact of job type on ERP pre-implementation attitudes

A one-way MANOVA was conducted to determine the effect of five job types (manager, supervisor, production worker, professional/engineer, and other) on the four dependent variables: capability, value, acceptance, and timing. Significant differences were found among the five job types on the dependent measures, Wilks’ $\lambda = 0.884$, $F(16, 1708) = 4.399$, $p < 0.001$. The multivariate $\eta^2$ based on Wilks’ $\lambda$ was 0.030. Table 5 contains the means and standard deviations of the dependent variables for the five job types.

ANOVA was conducted on each dependent variable as follow-up tests to the MANOVA. To control for Type I error across the multiple ANOVAs, we used a traditional Bonferroni procedure and tested each ANOVA at the 0.0125 level (0.05 divided by the number of dependent variables: 4). The ANOVA on the capability variable was significant, $F(4, 562) = 4.531$, $p < 0.001$, $\eta^2 = 0.031$. The ANOVA on the value variable was significant, $F(4, 562) = 8.773$, $p < 0.001$, $\eta^2 = 0.059$. The ANOVA on the acceptance variable was significant, $F(4, 562) = 10.802$, $p < 0.001$, $\eta^2 = 0.071$. The ANOVA on the timing variable was non-significant, $F(4, 562) = 2.687$, $p = 0.031$, $\eta^2 = 0.019$.

Post hoc analyses were conducted for each of the significant ANOVAs (capability, value, and acceptance) to find which job types had the strongest effects on the dependent variables. To control for Type I error across the pairwise comparisons, each comparison was tested at the 0.01 (0.05 divided by the number of comparisons: 5).

For the capability variable, only one of the comparisons was significant. Managers were significantly higher than production workers on the capability variable.

For the value variable, three of the comparisons were significant. Managers were significantly higher than supervisors, production workers, and “others” on the value variable. However, managers were not significantly different from professionals/engineers on this variable.

For the acceptance variable, managers had a lower mean score (indicating greater acceptance) than supervisors, production workers, professionals/engineers, and others.

5. Discussion

A year had passed since the organization we studied implemented its ERP system. They continue to have problems realizing ERP’s full benefits. During various meetings with the authors of this paper, members of the organization have provided numerous examples that indicate a less than satisfactory adaptation to the new system. This is not surprising given an examination of the data reported in this study. Attitudes toward the new ERP system prior to implementation provided early warning signals of the troubles that were forthcoming.

First, similar to many other firms that implement ERP systems, this organization relied upon a standard “rational-empirical” process advocated by vendors and consultants. In fact, a great deal of time, money and effort was spent on consultants to ensure a smooth transition from legacy systems to the ERP system. Unfortunately, attitudes toward ERP implementation do not seem to have been affected by these efforts which followed the consultant’s recommendations. Level of involvement in pre-implementation training with the consultants (Cornerstones, Teambuilders, or Organization Mapping) appeared to have little influence on attitudes toward ERP. Contrary to expectations, exposure to the ERP system and greater levels of involvement in its implementation did not seem to dramatically change the attitudes of employees. Perhaps employees viewed the implementation of the new ERP system as just another management effort that “looked good on paper, would be put into place for a short time, and eventually
abandoned. Expectations such as these do not lead to the commitment Goodman and Griffith (1991) indicate is necessary for effectively implementing new technologies. Hypothesis 1, therefore, was not supported. Across all levels of involvement, the capabilities and value and acceptance of the ERP system were rated more positively than the timing of the implementation. However, as noted in Table 3, the mean scores across all dependent measures center around the middle of the range. This indicates a lack of enthusiastic endorsement of the ERP system.

Second, job tenure seems to be an important factor shaping attitudes toward the implementation of a new ERP system. Differences in capability, value and acceptance were found across job tenure levels. Timing was not apparently influenced by tenure. A normative consensus (Goodman and Griffith, 1991) i.e. a general agreement, emerged across all groups that implementation timing was unsatisfactory. Employees with less tenure (i.e., newer employees) were more sanguine about the potential capabilities and the potential value of the new ERP system than those employees who had been with the organization for longer periods of time. Employees with less tenure showed greater acceptance of the new ERP system than employees with 11 or more years tenure. Consistent with Hypothesis 2, newer employees appear to be more receptive to new information technologies than those who have been employed by the firm for a longer period of time. Additionally, newer employees have not likely experienced previous management and IT initiatives, so they have not formed negative attitudes about their potential capabilities or value.

Third, job type also seems to be an influential factor in shaping attitudes towards ERP implementation. Differences were found across job types on the variables capability, value, and acceptance. Managers were significantly higher on the capability variable than were production workers. This is not surprising, since managers are likely to be more familiar with information systems and their capabilities than the typical production worker in this firm. Production workers in this organization may have been more skeptical than their managers about the capabilities of the new ERP system. Overselling the benefits in the pre-implementation stage of the process may have contributed to production workers’ doubts. Managers were significantly higher than supervisors, production workers and others on the value variable, but not significantly different from professionals/engineers on this variable. Either a higher level in the organization hierarchy and/or a professional/engineering position may favorably shape employees’ appreciation of the potential benefits of ERP. Managers and professionals/engineers may have a broader knowledge base with which to evaluate the potential value of such technological innovations as ERP systems and the value that ERP offers may be more directly related to the contributions they make to the firm. Finally, managers were more positive than professionals/engineers, supervisors, production workers and others on acceptance of the new ERP system. Perhaps managers saw the new ERP system as both inevitable and likely to enhance their control over operations. As with job tenure, a normative consensus developed (Goodman and Griffith, 1991) across all job types that the timing of the implementation was not satisfactory.

In summary, three significant findings emerged from this study. First, organizational demography appears to be an important factor determining attitudes toward ERP implementation and its ultimate effectiveness. Demographics are characteristics of individual employees; organizational demography is the aggregation of these individual statistics to reflect a collective or organization-level property (Pfeffer, 1985). That is, organizations with a higher proportions of relatively new employees may find it easier to implement ERP systems than organizations with a higher proportion of older employees who have higher levels of tenure. Firms with large proportions of long-tenured employees may need to find creative ways to ensure that employees ‘unlearn’ attitudes developed through their experience with previous technology initiatives. Conversely, firms are likely to find it easier to convince their managerial and professional employees of the value and potential contributions of ERP to organizational effectiveness than to convince their operations level employees
of these benefits. This suggests that firm which have a history of trust and collaboration across hierarchical levels are likely to experience a smoother implementation experience that firms which have a tradition of adversarial relationships between managers/professionals and other employees.

Second, an exceptionally quick implementation approach may not provide the time necessary for employees to learn about the system and appreciate its potential value. The consistent dissatisfaction with implementation timing across demographic and involvement segments may signal the need to give employees time to absorb the change as well as learn how the system works.

Third, following a rational approach to ERP implementation as advocated by consultants and others will not necessarily overcome sources of organizational resistance to change. Two significant sources of resistance to change are job type (individuals in some jobs may find ERP systems more hassle than help), and length of time with the organization ("old timers" have a greater stake in existing legacy systems than newer employees). While pre-implementation training and explanation of benefits are certainly necessary to develop attitudes that facilitate effective implementation, they are clearly not sufficient investments to overcome strong organizational inertia. Firms will likely need to use other types of organizational levers such as changes in roles and responsibilities, incentives and reward systems, organization redesign to shape attitudes and behaviors in productive ways.

6. Conclusion

This study provides preliminary evidence supporting the importance of assessing employee attitudes throughout the ERP implementation process. Employee attitudes are a key factor in determining ERP implementation success or failure. Early attitudes about ERP systems, even before these systems are implemented, shape employee views that may be difficult to change once the systems become fully operational. That is, positive attitudes early on may lead to positive behaviors, which, in turn, lead to positive outcomes. Conversely, negative attitudes early on may lead to negative attitudes, negative behavior and a downward cascade of attitudes and experiences after implementation. Assessing employee attitudes prior to implementation of an ERP system can help identify organizational readiness for massive change. Once identified, organizations can tailor their implementation efforts to ensure a critical mass of positive effort and enhance the probability of success.

There are several limitations to the study, which should be noted. First, only a single organization was used in the study. While this allowed us to gain a greater in-depth understanding of the attitudes of these employees regarding ERP implementation, it is difficult to generalize the results to a different sample. Second, employee attitudes were assessed at only one point in time. While employee attitudes prior to implementation of an ERP system are important predictors of success, this study was limited by its inability to assess attitude change (or stability) over time. Third, no objective measures of ERP implementation outcomes were available for analysis. For example, we were not able to obtain data on cycle times, inventory, or other objective performance measures, which would indicate whether the ERP system had a positive or negative effect on significant organizational outcomes.

There are a number of productive avenues for future research in this area. An important first step is to replicate this study’s findings in other organizations to determine the generalizability of these results. It is important to understand the extent to which these findings apply to other types of firms and in other settings. Second, it would be useful to track and assess employee attitudes throughout the entire ERP implementation process. It is anticipated that attitudes will change over time and that experience with the system will shape employee reactions (Herold et al., 1995; Kossek et al., 1994). Therefore it would be extremely useful to assess employee attitudes before implementation, during the early stages of the process, and after the system has become rationalized within the firm. A better understanding of how
attitudes form and evolve as an ERP system is implemented will help explain why some implementations succeed and others fail. Third, it is important to compare attitudes and performance outcomes (i.e., inventory control, cycle times) across the implementation process. While there is every expectation that employee perceptions shape behaviors, and that behaviors, in turn, affect objective performance outcomes, this is an important causal chain to test empirically. It will be particularly interesting to determine whether positive outcomes can be achieved despite negative employee attitudes during the early stages of implementation. ERP systems may produce desirable outcomes even when employee attitudes are unfavorable; however, these systems may produce even better outcomes when employee attitudes are favorable.

References


