User perceptions towards an ERP system

Comparing the post-implementation phase to the pre-implementation phase

Sue Abdinnour
Decision Sciences, FREDS Department, Barton School of Business, Wichita State University, Wichita, Kansas, USA, and
Khawaja Saeed
Frank Barton School of Business, Wichita State University, Wichita, Kansas, USA

Received 2 October 2013
Revised 3 February 2014
8 June 2014
Accepted 13 June 2014

Abstract

Purpose – The purpose of this paper is to explore how key users' perceptions (capability, value, timing, and acceptance) toward an Enterprise Resource Planning (ERP) system change from the pre-implementation to the post-implementation phase. The paper also examines how this change differs with varying levels of user involvement in the implementation process and users' positions in the company.

Design/methodology/approach – The authors survey the employees of a major aircraft manufacturing company in the Midwest and analyze the data using repeated measures ANOVA. The authors use time as a within-subject independent variable, and involvement/position at the company as between-subject independent variables.

Findings – The results reveal a significant drop in users' perceptions regarding the capability, value, and implementation timing of the ERP system. However, the perception of acceptance did not change significantly. Furthermore, there were more significant interactions of users' perceptions with employee position than employee involvement in the implementation process.

Research limitations/implications – The study offers a better theoretical understanding of how users' perceptions regarding an ERP system evolve over time. The use of one company is a limitation of the study, so future research can focus on extending the study in different sectors.

Practical implications – Management can design interventions to minimize users' negative perceptions about the ERP system and increase usage in the post-implementation phase. For example, management can design training customized toward users' positions in the company.

Originality/value – Post-implementation research in the ERP field is rare. Conducting a survey of users' perceptions allows the authors to take an in-depth look at attitudes toward an ERP system.

Keywords Involvement, ERP, Acceptance, Position, Post-implementation, Repeated measures ANOVA

Paper type Research paper

1. Introduction

Companies around the world have implemented Enterprise Resource Planning (ERP) systems to integrate their business processes and stay competitive. The focus in comprehending the value of ERP systems has shifted to better utilization and usage patterns characterized as best in class. As with any information system (IS), user perceptions about an ERP system play an important role in its usage and eventual success (Delone and Mclean, 2003). This study aims to evaluate this issue by assessing user perceptions of an ERP system and its implementation from a longitudinal perspective.

The premise is that positive user perceptions could lead to higher acceptance and better usage of the ERP system (Delone and Mclean, 1992). Similarly, negative user perceptions or unmet expectations could lead to resistance and more workarounds,

Journal of Enterprise Information Management
Vol. 28 No. 2, 2015
pp. 243-259

1741-0398
DOI 10.1108/JEIM-10-2013-0075

both of which will increase costs for the company. Regardless of how expensive and up-to-date the ERP system is at a company, if end-users avoid the use of the system and do not accept it well, then the expected benefits of ERP will not materialize. Our paper studies user perceptions toward an ERP system, namely, SAP, after it went live at a large complex aircraft manufacturing company in the Midwest. We compare users' post-implementation perceptions to their pre-implementation perceptions to see if they changed significantly. Further, we examine if users' involvement in the ERP implementation process and their position at the company has an impact on the changes in pre- and post-implementation users' perceptions.

Our paper is organized as follows. First, we provide the theoretical background for our study and list our hypothesis. Next, we provide the methodology for our research followed by the analysis and the results. Finally, we discuss the results and conclude the paper by presenting the limitations of our study, implications on research and practice, and avenues for future research.

2. Theoretical background and hypothesis

A recent comprehensive literature review of the ERP research (Schlichter and Kraemmergaard, 2010) classified 885 peer-reviewed articles published from 2000 to 2009 into different topic areas. The highest percentage (30 percent) of the research focussed on implementation aspects (how the ERP system can be introduced into the organization), which include topics such as ERP selection, implementation steps and problems, and critical success factors. The second highest percentage (20 percent) of the research focussed on management issues (how the implementation of ERP affects the management and the organization), which includes papers on organizational change, best practices, and cultural issues. Therefore, the top two ERP research categories account for 50 percent of the ERP research to date. The results seem to be consistent with a previous literature review (Moon, 2007), which looked at 313 articles between 2000 and 2006 and found that 43 percent of the research published focussed on the implementation theme and only 14 percent on using ERP. The review by Schlichter and Kraemmergaard (2010) provides a conceptual framework of the different areas of concern in ERP research and concludes that assessment of how to optimize the use of the ERP system in the organization remains a major area of concern.

The academic literature confirms the need to focus on the post-implementation stage to optimize the use of the ERP system, which is the focus of our study. At the post-implementation stage the users develop a deeper understanding of the ERP system features and its capabilities, thus initial perceptions are reassessed and revised based on actual user experience (Orlikowski and Gash, 1994). Longitudinal studies on IS acceptance have used the technology acceptance model (TAM) and expectancy disconfirmation theory (EDT) to offer insights on the change in user perceptions over time. These models emphasize that the belief change process offers a theoretical lens to understand the change in perceptions. The belief change process is manifested through multiple mechanisms such as sequential updating and feedback (Kim and Malhotra, 2005; Saeed, 2012). Researchers suggest that these mechanisms are tied to the information processing strategy employed by the user.

Developing on these works, we use a framework proposed in the Human Resource Management domain to select relevant user perceptions toward an ERP system. We use the acceptance of innovation measure (Kossek, 1989) and three other related measures (Kossek *et al.*, 1994) that were originally used in the context of evaluating the implementation of a new Human Resource Management IS. These measures overlap to

some extent with system quality and service quality variables proposed by the Delone and Mclean model of IS success (Delone and Mclean, 2003). The measures have been evaluated and validated in a prior study at the pre-implementation stage of an ERP system (Abdinnour-Helm *et al.*, 2003). The four measures are: acceptance (users' attitudes toward the ERP system); capability (functionality of the ERP system); value (overall benefit of the ERP system); and timing (the appropriateness of the speed with which the ERP system was implemented). Capability aspect of the ERP system can be derived from system quality and timing of implementation can be contextualized in service quality (Delone and Mclean, 2003). No prior study has evaluated these four measures at the post-implementation stage of an ERP system, but preliminary results showing *t*-tests comparisons (pre- vs post-implementation) were presented in a poster session at a conference (Abdinnour and Saeed, 2008).

Longitudinal studies of IS have shown that user perceptions are revised to the lower side from pre- to post-implementation (Bhattacherjee and Premkumar, 2004). This phenomenon is attributed to misalignment, unrealistic pre-implementation expectations, or user resistance to change (Kim and Kankanhalli, 2009; Wei *et al.*, 2005; Soh and Sia, 2005). Users' acceptance of the ERP system in the immediate post-implementation phase is tested as users make the switch from an old familiar system to a new system that poses a steep learning curve. Users' beliefs about the capability and value of the ERP system, as well as how well the project implementation was run, are largely formulated prior to the ERP system going live. Once the system is up and running, users go through a painful learning curve and may get frustrated because they cannot find the features they need or because there are too many screens to traverse to perform a task. They may revert to the old legacy system, if it is still available, or try to work around the new ERP system. Further, the downward revision can also be attributed to unreasonable expectations at the pre-implementation stage. As the management sets the stage for the implementation, often the system is sold to the employee as a transformational tool. The initial phase after implementation involves adjustment, error correction, and reconfiguration. Thus, the initial high expectations may be dampened at this stage. Hence, our first hypothesis:

H1. User perceptions of an ERP system' capability, value, timing, and acceptance will decrease significantly in the post-implementation phase as compared to the pre-implementation phase.

A general comparison of user perceptions regarding the ERP system over time provides information on the revision process that the user experiences but not much information on why the revision process took place. Adaptive level theory (Oliver, 1980) proposes that exposure to new situations is evaluated in the context of existing beliefs. Thus, it is important to evaluate the revision process in the context of how existing beliefs were developed. An important aspect to understand this issue is users' knowledge of organizational process, ERP system, and its implementation in the organization at the pre-implementation stage (Saeed, 2012). It is likely that individuals that show variation in such knowledge may develop different perceptions about the ERP system and consequently that difference may also manifest at the post-implementation stage. Thus, in addition to evaluating the four constructs across time, we explored the role of user involvement in the ERP implementation and user position in the company as factors that may provide further insight on change in user perceptions over time.

User involvement is an important part of the change management process that accompanies an ERP system implementation. User involvement at the

pre-implementation phase can provide users with increased knowledge and greater insights on the potential and shortcomings of the ERP System. The level of involvement may be different across users. For example, a user may be a member of the project team or may just be exposed to training and regular communication about the ERP implementation (Wickramasingle and Gunawardena, 2010; Francoise, 2009; Longinidis and Gotzamani, 2009). User involvement creates a sense of ownership that may be carried over to the post-implementation phase and exposes the user to the ERP system and its implementation at a much more elaborate level. Thus, users who are involved in the pre-implementation phase of an ERP system will have different perceptions of the ERP system in the post-implementation phase than users who were not involved. The involved users are likely to be more knowledgeable about the capability of the ERP system, its value, and the way it works, all of which should lead to higher acceptance of the new ERP system. At the post-implementation phase the expectations are likely to be revised based on actual system performance. On the other hand, users who were not involved in the pre-implementation phase and mainly relied on communication about what the system can do for them and for the company, will also adjust their initial perceptions after they start using the system in the post-implementation phase. Hence, our next hypothesis follows:

H2. User involvement in the ERP pre-implementation phase will have significant interaction with longitudinal user perceptions of an ERP system' capability, value, timing, and acceptance.

Fisher and Howell (2004) developed a process model using theories from several research streams (including IS and organization behavior) to help understand employee reactions to information technology (IT) systems. The premise is that employees, during the implementation phase of a new IT system, make assumptions about how the new system will change their role in the organization and what management values. Lim *et al.* (2005) suggest that system users and management do not frequently share a coherent vision of the new ERP system "due to their relative position in the organizational hierarchy, management and users may possess opposing views regarding the usefulness of ERP systems." Lin and Rohm (2009) also investigated the differences between managers and end-users regarding the success of an ERP implementation at a large (more than 20,000 employees) publicly traded pharmaceutical company in China. The results of their study were consistent with a previous similar study by Amoako-Gyampah (2004). Both studies concluded that there are significant differences between the perceptions of managers and end-users regarding the success of an ERP implementation.

Prior studies propose that employees are likely to assess how the new ERP system aligns with their job requirements and their role in the organization. Furthermore, employees situated at different levels of the organizational hierarchy may possess very different views on the implementation and value of the ERP system. For example, managers and directors may view the new ERP system as giving them more control to monitor the work, improve efficiency, and obtain consistent data for generating reports. Professionals and engineers, who compose a large number of employees in a complex aerospace and defense manufacturing company (the case used in this paper), are likely to understand the importance of the new ERP system and the impact it may have on their jobs. They may be more up-to-date with recent technologies and more tolerant of the bugs and issues that may arise with a new system. Production workers, leads, crew chiefs, and others who spend a lot of time on the production floor may be more impatient and quick to criticize the new system. They may view the new system as an unnecessary interruption

to their work and that they already have the "tribal" knowledge to build the product. So, changes in user perceptions from pre to post-implementation phase may vary across different job roles. Users with job roles who viewed the new system as a disruption in the pre-implementation phase are likely to show minor deviation in perceptions in the post-implementation phase. On the other hand, users with job roles who are most impacted by how well the implementation is managed and how well the system performs are likely to depict a larger change in perception. So, our third hypothesis is:

H3. User position in the organization (managers/directors, professionals/engineers, supervisors/production worker) at the pre-implementation phase will have significant interactions with longitudinal user perceptions of an ERP system' capability, value, timing, and acceptance.

Figure 1 illustrates our hypothesis testing diagrammatically. It shows how the four user perception variables (capability, value, timing, and acceptance) are tested in T1 (pre-implementation) and T2 (post-implementation) using the two contingency variables: involvement in the implementation process across two different groups and employee position in the company across three different groups.

3. Research methodology

In order to examine the hypotheses, we collected data from a large aircraft manufacturing company in the Midwestern USA that is a major competitor in the aerospace industry. The natural setting and the support from management gave us access to survey the employees prior to the implementation and several months after the ERP system went live, so we were able to match the responses in the post-implementation phase to those in the pre-implementation phase. We also solicited open-ended comments in the post-implementation phase. Comments, interviews, and other qualitative data are critical to complement a research study, especially when it is anonymous (Gonzalez *et al.*, 2010). The qualitative data usually provides extra insight as to what employees are thinking, beyond the structured survey method.

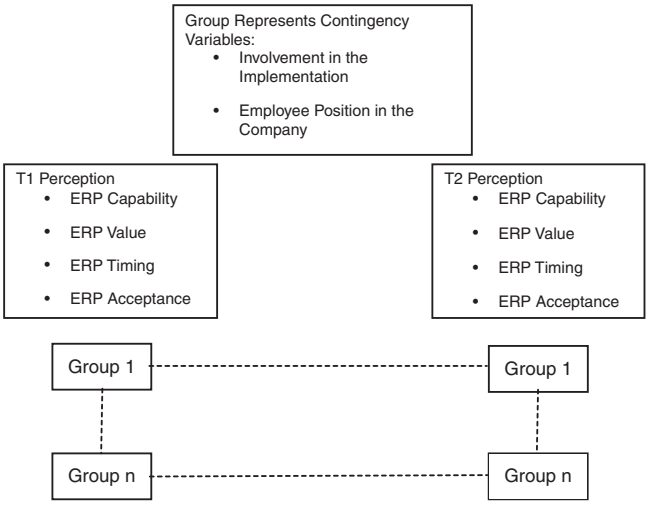

Figure 1.
Diagram summary of research hypotheses

3.1 Setting and data collection

The company initiated an ERP project to have a short implementation cycle, a system-wide go-live schedule (or big bang), and few efforts at customizing the ERP system. Large investments in change management efforts were made to create a clear and positive expectation of the benefits of the system. The company created elaborate training programs for ERP implementation in which top managers trained lower level managers who, in turn, trained supervisors, who then trained line workers. Involvement in the ERP implementation was at various levels: ERP project team, Cornerstones (employees in this category were the most involved in the implementation process), Teambuilders (employees in this category were less involved than those classified as Cornerstones), and Organization Mappers (employees in this category were least involved in the implementation process). The specific operational and organizational benefits of the ERP system were articulated and reiterated in meetings at the various levels, in documents, in presentations, and in training modules. The language used to describe both the ERP system and the implementation process highlighted the strategic nature of the initiative, the need to create a culture change, and the importance of viewing the ERP system as a business (not an IT) project.

We, in conjunction with members of the organization's change management team, identified employees in manufacturing and final assembly operations to receive the surveys. These employees were selected because managers believed they would be more directly affected by the introduction of the new ERP system and were more likely to be available for responding to the surveys in the post-implementation phase. We were told that all the employees had completed the initial training sessions (equivalent to an introductory course) for the new ERP system. The post-implementation survey took place approximately five months after the ERP system went live. The project manager and the change management team assisted us in conducting the survey, which took place on company time. Employees completed the surveys anonymously, placed the surveys in sealed envelopes, and dropped them in boxes situated at central locations in the company. A numbering scheme was used to uniquely identify the respondents in the post-implementation phase (T2) so they could be matched to the pre-implementation phase (T1).

We received a total of 723 completed responses in T2, out of 1,474 surveys that were sent out. The identity of 205 responses in T2 matched the identity of the respondents in T1. Table I gives the demographics of the T1-T2 matched sample by unit affiliation, involvement, and current position. We classified a user as involved if he/she participated in any of the ERP implementation activities. Since we wanted to focus on specific positions in our analysis, we excluded all the responses that did not provide their position. The remaining T1-T2 matched sample of 141 respondents is what we used in our analysis. Table I gives the demographics of this sample as well. In T2, we also received 81 comments from the respondents ranging in length from one line to a whole page. We used three judges to categorize the comments in T2 according to the four user perceptions measures in our study (capability, value, timing, and acceptance). First, we selected judges that had academic or practitioner experience with ERP systems. Second, we gave each judge the definitions for all of the four measures. Third, each judge determined independently if a comment had positive or negative reference to the measure. Finally, the three judges discussed their findings and reached a consensus rating for each of the comments.

	T1-T2 Complete sample $n = 205$		T1-T2 Sample used in analysis $n = 141$	
	n	%	*n*	%
Unit affiliation				
Manufacturing operations and support functions	150	74	101	72
Final assembly operations and support functions	27	13	24	17
Other	26	13	15	11
Involved in the ERP implementation				
Yes	57	30	48	36
No	135	70	85	64
Current position				
Manager/Director	32	16	32	23
Supervisor/Lead/Crew Chief/Production Worker	61	30	61	43
Professional/Engineer	48	24	48	34
Other	62	30	–	–

Table I. Demographics of the longitudinal sample

3.2 Measures and methods

The measures we used in T2, the individual items for each measure, and the reliabilities (Cronbach α) are listed below. For comparison purposes, the list also contains the T1 reliabilities obtained in an earlier study (Abdinnour-Helm *et al.*, 2003). Scale items and reliability measures are listed below.

Capability of ERP (T1 $\alpha = 0.80$; T2 $\alpha = 0.79$):

- What is your current general assessment of the system? (very little to a lot).
- I think that the data from the ERP system is: (always on time to never on time).
- I think that the data from the ERP system is: (very accurate to very inaccurate).
- I think the ERP system is: (very easy to use to very difficult to use).
- I think the ERP system is: (very easy to customize to my needs to very difficult).

Value of ERP (T1 $\alpha = 0.85$; T2 $\alpha = 0.85$):

- Overall, I think that the switch from legacy systems to ERP was: (more trouble than it is worth to absolutely essential at this time).
- Do you believe that the benefits of ERP outweigh the costs? (extremely likely to extremely unlikely).
- I see the value in having an ERP system.
- ERP helps coordinate our work with activities in other company locations.
- Supporting or working on the ERP system is enhancing my career (the last three items range from strongly agree to strongly disagree).

Timing of ERP (T1 $\alpha = 0.77$; T2 $\alpha = 0.80$):

- How quickly do you believe that the ERP implementation project is proceeding? (very quickly to very slowly).
- The progress of the ERP implementation 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 was: (outstanding to totally unacceptable).

- With regards to 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 (T1 $\alpha = 0.85$; T2 $\alpha = 0.84$):

- 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 is good.
- Overall, ERP is a great program and should be continued (all the items range from strongly agree to strongly disagree).

It is evident that the measures in T2 have maintained their high reliability (all were above 0.78). The questions in T2 were slightly changed from T1 to reflect the present tense in T2. For example, the question in T1 "I think the data from the ERP system will be (always on time to never on time)" was changed to "The data from the ERP system is (always on time to never on time)."

We first conducted repeated measures ANOVA (RM-ANOVA) with time as a single independent variable to evaluate if each of the four ERP system user perceptions measures changed significantly from T1 to T2. We then compared the results to our analysis of users' comments in T2 to see if the results were similar. We then divided the sample into subgroups by level of involvement in the ERP implementation and position at the company. We conducted RM-ANOVA twice, each with two independent variables (time and subgroup criteria), to test for significant interaction effects.

4. Analysis and results

For each of the four ERP system related perceptions measures in our study, the count, mean, and standard deviation in T1 and T2 are listed in Table II. The results of the RM-ANOVA with time as a single independent variable were as follows: the

		T1		T2		Sig.
	n	Mean	SD	Mean	SD	T1 vs T2
Capability	127	4.20	1.25	3.58	1.07	***
Value	128	4.44	1.51	3.73	1.46	***
Timing	115	3.46	1.25	3.16	1.18	*
Acceptance	124	4.13	1.25	4.08	1.01	ns

Notes: ns, not significant. *p value ≤ 0.05; ***p value ≤ 0.001

Table II. Repeated measures ANOVA with one independent variable – time

capability measure dropped significantly from an average of 4.20 in T1 to 3.58 in T2 ($p < 0.001$); the value measure dropped significantly from an average of 4.44 in T1 to 3.73 in T2 ($p < 0.001$); and the timing measure dropped significantly from an average of 3.46 in T1 to 3.16 in T2 ($p < 0.05$). Interestingly, however, the acceptance measure did not drop significantly. It went from an average value of 4.13 in T1 to 4.08 in T2 ($p = 0.582$). Figure 2 shows a plot of each of the meansfor the four measures over time.

The analysis of the 81 comments in T2 supported the results from the RM-ANOVA. There were a total of 28 comments referring to capability, 100 percent of which were negative comments; 45 comments referring to value, of which the majority (89 percent) was negative; and 17 comments referring to timing, 100 percent of which were negative. Out of a total of 44 comments referring to acceptance, only 68 percent percent of the comments were negative. Table III provides examples of negative comments for each measure.

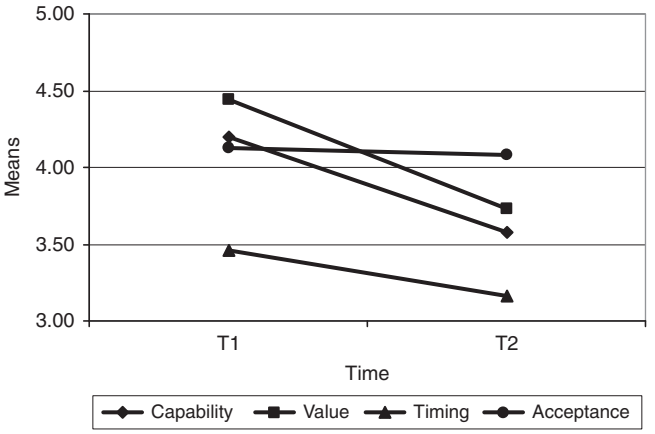

Figure 2.
Means of perceptions in T1 and T2

Measure	Comments
Capability	ERP may be a good system for tracking & accounting purposes, but is very ineffective for production. It is cumbersome and very few people have had the proper training. I have had none at all
	ERP has been hard to learn. I am using legacy and ERP both to do my job. I like legacy much more because I know the system
Value	We are here to build aircraft. We cannot get parts, vendor or company made; orders are incomplete, wrong, and way late. This system is good for lowering stock prices, delaying production, causing re-work and in general reducing production and increasing costs. Remember we build aircraft!!!
	This was a big waste of money. Things were better off left alone. It has wasted time and money and still doesn't work. We can't get parts to do our job. It is bad
Timing	Implemented too quickly, was too shallow in control thinking to be effective
	It was implemented too quickly by people who had no idea of what they were doing or what the outcome would be
Acceptance	A great many situations exist which ERP is either ill or not at all equipped to deal with
	A lot of people out here don't know how to use it. Management don't know how to use it to control production or the shop

Table III.
Examples of negative comments attributed to the perception measures

With *H1* mostly supported (one measure did not drop significantly in the post-implementation phase), we turn our attention to test the remaining hypotheses. To do that, we used RM-ANOVA twice, each time with two independent variables. Time was used as a within-subject independent variable in both RM-ANOVAs. The between-subject independent variables used were user involvement in the ERP implementation and position in the company. There are two levels for the involvement variable: employees who were involved in any way in the ERP implementation process (member of the ERP team, cornerstone, team builder, etc.) and those who were not involved at all. The position variable has three levels: Managers/Directors, Supervisors/Lead/Crew Chief/Production Workers, and Professionals/Engineers (Tables IV and V).

For the analysis by the level of involvement in the ERP system implementation, the interaction effect of the capability measure with involvement was significant, with $F(1,\ 119) = 4.52$ ($p < 0.05$) and the interaction effect of the acceptance measure

Table IV. Repeated measures ANOVA with two independent variables – time and involvement

		T1		Sig.	T2		Sig.	Sig.
	n	Mean	SD	T1	Mean	SD	T2	T1 vs T2
Involved								
Capability	45	4.46	1.29		3.53	1.17		***
Value	48	4.87	1.44		3.93	1.44		
Timing	42	3.65	1.32		3.14	1.23		
Acceptance	47	4.66	1.11		4.35	1.00		*
Not involved								
Capability	76	4.03	1.24	ns	3.59	1.04	ns	**
Value	74	4.18	1.53		3.58	1.49		
Timing	67	3.33	1.23		3.15	1.16		
Acceptance	71	3.85	1.23	***	3.94	1.00	*	ns

Notes: ns, not significant. *p value ⩽ 0.05; **p value ⩽ 0.01; ***p value ⩽ 0.001

Table V. Repeated measures ANOVA with two independent variables – time and position

		T1		Sig.	T2		Sig.	Sig.
	n	Mean	SD	T1	Mean	SD	T2	T1 vs T2
Manager/Director								
Capability	30	4.99	1.02		3.42	1.03		***
Value	32	5.23	1.36		4.06	1.22		
Timing	30	3.89	1.22		3.07	1.29		***
Acceptance	31	4.98	0.97		4.42	0.90		**
Supervisor/…/Production worker								
Capability	51	3.87	1.31	***	3.70	1.04	ns	ns
Value	50	4.04	1.46		3.55	1.52		
Timing	45	3.20	1.14	ns	3.11	1.09	ns	ns
Acceptance	49	3.84	1.25	***	3.96	0.99	ns	ns
Professional/Engineer								
Capability	46	4.07	1.12	**	3.55	1.15	ns	**
Value	46	4.33	1.48		3.70	1.55		
Timing	40	3.44	1.33	ns	3.29	1.20	ns	ns
Acceptance	44	3.85	1.16	***	3.98	1.07	ns	ns

Notes: ns, not significant; Sig. T1 and Sig. T2 results are in comparison with the Manager/Director group. **p value ⩽ 0.01; ***p value ⩽ 0.001

with involvement was significant, with $F(1, 116) = 5.05$ ($p < 0.05$). The statistical outcomes for the interaction effects of capability with involvement are best understood when looking at Figure 3. Two aspects of Figure 3 need to be examined. First, the slope of the line from T1 to T2 for the two groups (involved and non-involved) is compared. Second, the two groups in T1 and T2 are compared to see if the perceptions are significantly different. So first we look at Figure 3 to see if each line significantly slants from the *x*-axis. The statistical results were significant for the two groups – involved ($p < 0.001$) and non-involved ($p < 0.01$). This shows that employee perceptions about the ERP system capability within both groups (involved and non-involved) dropped significantly from T1 to T2. Second, we look at Figure 3 to see if the two points at T1 and the two points at T2 were significantly different. The statistical results were not significant – T1 ($p = 0.07$) and T2 ($p = 0.76$). Overall, this shows that the capability perception at T1 and T2 for the two groups was not significantly different. However, the capability perception for the involved group dropped more significantly than the non-involved group from T1 to T2. It is interesting to observe that at T1 the difference in capability perceptions across the two groups is fairly large, but the difference is almost negligible at T2. This suggests that user perceptions about ERP capability in the post-implementation phase were the same, regardless if they were involved or not involved in the pre-implementation phase.

Similarly, the analysis for the interaction effects of the acceptance measure with involvement shows that acceptance of the involved group dropped significantly from T1 to T2 ($p < 0.05$) but there was no significant change for the non-involved group ($p = 0.44$) (see Figure 4). Actually, the acceptance perception for the non-involved group increased slightly from T1 to T2, but the increase (3.85-3.94) was not significant. There were significant differences between acceptance perceptions of the involved and the non-involved group in T1 ($p < 0.001$) and T2 ($p < 0.05$). Overall, even though the involved group's acceptance of the system declined significantly over time (T1-T2), this group still had a much higher level of acceptance at T1 and T2 as compared to the non-involved group. Thus, *H2* was partially supported for interaction effects of involvement with the capability and acceptance measures.

For the analysis by the employee position at the company, the following interaction effects were significant: capability with position, with $F(2, 124) = 14.58$ ($p < 0.001$); timing with position, with $F(2, 112) = 3.70$ ($p < 0.05$); and acceptance with position,

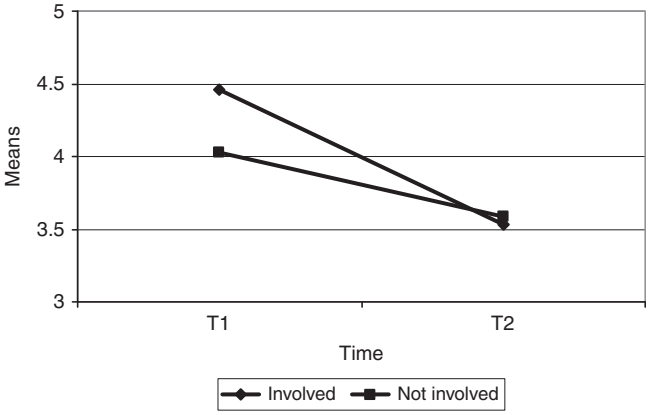

Figure 3.
Means of capability perception in T1 and T2 by level of involvement

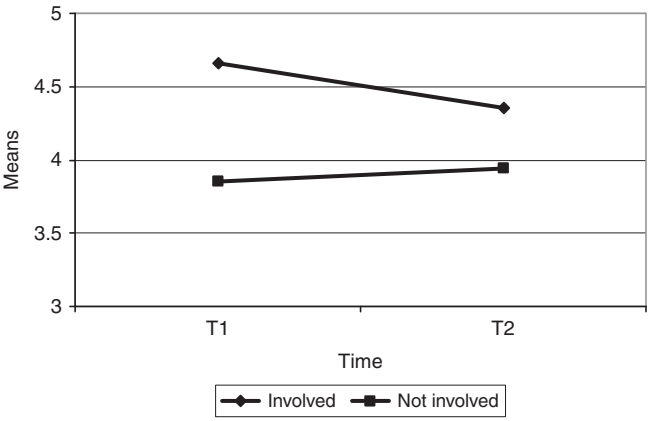

Figure 4.
Means of acceptance perception in T1 and T2 by level of involvement

with $F(2,\ 121) = 6.17$ ($p < 0.05$). Therefore, *H3* was mostly accepted. The analysis for the capability with position interaction showed that the perceptions about the capability of the ERP system dropped significantly from T1 to T2 for the manager/director ($p < 0.001$) and the professional/engineer groups ($p < 0.01$) but there was no significant drop for the supervisor/lead/crew chief/production worker group ($p = 0.29$); there were significant differences between capability perceptions of the manager/director group with the other two group in T1 – professional/engineer ($p < 0.01$) and supervisor/.../production worker ($p < 0.001$). However, there were no significant differences among the three groups in T2. So, the perceptions of the manager/director group and the professional/engineer group about the ERP capability converged to the level of supervisor/production worker at T2 (see Figure 5).

The analysis for the timing with position interaction showed that the perceptions about the timing of the ERP system dropped significantly from T1 to T2 for the manager/director ($p < 0.001$) but not for the other two groups. Further, the means for manager/director were significantly different at T1 and T2 from the other two groups. There were no significant differences on the timing perceptions at either T1 or T2 for Professional/engineer and supervisor/production worker (see Figure 6).

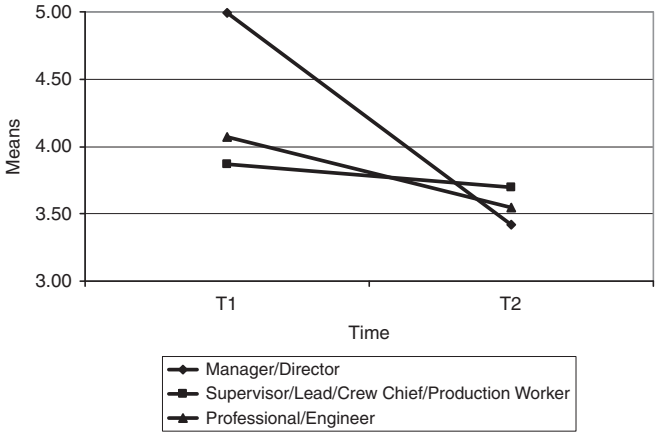

Figure 5.
Means of capability perception in T1 and T2 by position

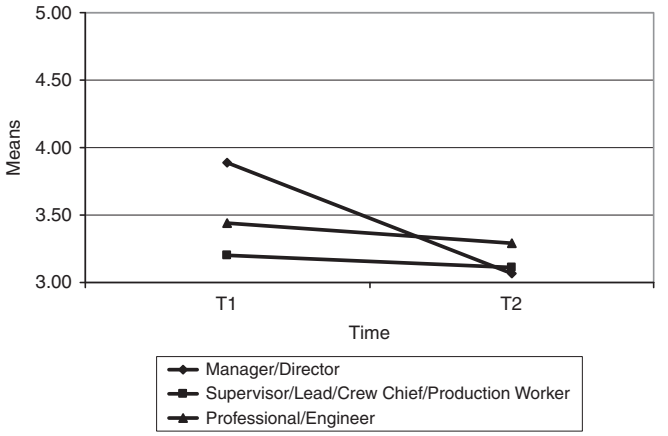

Figure 6.
Means of timing perception in T1 and T2 by position

The analysis for the acceptance with position interaction showed that the perception of acceptance of the ERP system dropped significantly from T1 to T2 for the manager/director ($p < 0.01$) but not for the other two groups; there were significant differences between acceptance perceptions of the manager/director group with the other two group in T1 – professional/engineer ($p < 0.001$) and supervisor/../production worker ($p < 0.001$). However, there were no significant differences among the three groups in T2 (see Figure 7).

Overall, the perceptions of ERP capability, timing, and acceptance for manager/director group dropped the most in the post-implementation phase. In the case of capability and timing the values for the manager/director group were actually lower than the other two groups at T2. The only exception was the acceptance perception where the values for the manager/director group, even after dropping from T1, were still higher than the other two groups at T2. The professional/engineer and supervisor/production worker groups showed a very similar pattern across time (T1 and T2) for timing and acceptance perceptions.

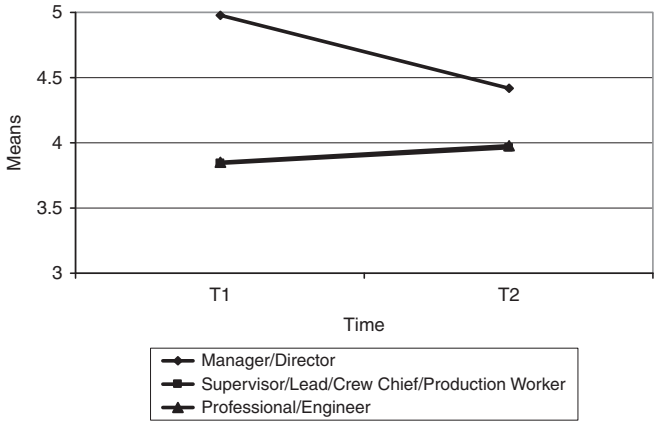

Figure 7.
Means of acceptance perception in T1 and T2 by position

5. Discussion

Employees at this company were not very positive about the ERP system in the pre-implementation phase (T1), but they were even less positive about it in the post-implementation phase (T2). The results clearly indicate that in the post-implementation phase, employees' perceptions of the ERP system' capability, value, and timing dropped significantly, whereas perceptions of employees' acceptance of the ERP system did not change much. This can be explained somewhat by the hype usually generated in the pre-implementation phase of an ERP system, to sell the employees about the system and all it can do for the company. Surprisingly, even though the users were disappointed with the ERP system and perceived the project as rushed with not enough time to get the employees ready for the change, they still felt that the change was important and had to be made. Thus, better results can probably be obtained by investing more time in making the users comfortable with the ERP system in the pre-implementation phase.

Analysis of the comments that users provided in the post-implementation phase support our findings. The majority of the comments were negative for each measure. However, the acceptance measure had the least percentage of negative comments. Also, some of the comments mirrored the fact that all measures dropped significantly in T2, except acceptance. For example, some employees commented that they found the system acceptable in the post-implementation phase, and saw the potential for it to be good in the future, but questioned its value or its capability or the way it was run. Below are two examples of such comments:

(1) The system has its good points and from what I can see will be a very good system, but the system is too slow and has too many places to go to get the job done. What I mean is that you have to click too many buttons just to close out a job or to look at a route sheet, etc. The system needs to have a lot less movement to get the task done.

(2) I think the system is good and would be of more use if all areas were using it to the extent it was intended. The way it's being used now limits its value.

The analysis by the level of involvement in the ERP implementation revealed a significant interaction with users' perceptions about ERP capability. Whether employees were involved or not involved in the ERP implementation, their perceptions about the capability of the ERP system dropped significantly from T1 to T2. In fact, the perceptions of the involved group dropped more significantly than the non-involved group. This finding was interesting, as one would have expected the involved group to exhibit better understanding about the overall capability of the ERP system, and to know that any problems that may surface in the immediate post-implementation phase will only be temporary. Furthermore, the acceptance of the ERP system by the involved group of employees dropped significantly in the post-implementation phase, whereas there was no significant change in acceptance for the non-involved employees. The involved group may have had access to more information about the ERP system than the non-involved group and knew how important the system was for the survival of their company, but they were disappointed with the system after it went live.

Managers/directors had significantly higher perceptions of the capability of the ERP system at T1 than professionals/engineers and supervisors/lead/crew chiefs/production workers. However, in the post-implementation phase, the perceptions of the manager/director group dropped significantly but those of the other two groups

did not drop significantly. So in the post-implementation phase, all employees, regardless of their position, had similar perceptions about the capability for the ERP system. A similar pattern was visible for the acceptance perception. As for the timing perception, the three groups showed no significant differences in T1 or T2, but the manager/director group experienced a significant drop in perceptions from T1 to T2. This clearly shows that the manager/director group definitely stands out as a group that had relatively more positive perceptions in T1 than the other two groups, but those perceptions dropped more significantly in T2 and got down to levels similar (or lower) to the other two groups in the post-implementation phase. It seems that the managers/directors were sold on the ERP system as a tool that would allow them to control work and track processes at T1, but then problems that surfaced immediately after the implementation disappointed them. Also, the nature of jobs for managers/director focusses more on the big picture whereas the jobs for Professional/Engineer and Supervisor/Lead/Crew Chief/production Worker are usually more focussed and technical. The big picture concerns affect the company and its future as a whole, something that managers/directors are usually more concerned about.

6. Implications

Our study has several implications for researchers and practitioners. Researchers can build on our work by further investigating the post-implementation phase, especially the immediate post-implementation phase (several months after going live). A better understanding of this phase can pave the way for a more successful experience in following phases and to increased usage of the ERP system. As for practitioners, our study provides specific measures of user perceptions toward an ERP system and user characteristics that shape such perceptions. Measuring and properly managing user perceptions in the pre-implementation phase can reduce user resistance to the new ERP system in the post-implementation phase. Implementing interventions, such as offering training or education to employees with certain positions in the company, can help overcome negativity and increase user acceptance of the new ERP system. Further, managers need to give more attention to transition strategies by including realistic expectations prior to implementation. Communication regarding an appropriate time frame when system usage may reach steady state and best practices on using features and functionalities of the ERP system can be effective in managing user perceptions through the transition.

7. Conclusions

We used four user perceptions (capability, value, timing, and acceptance), originating in the Human Resource Management literature, to examine users' perceptions toward a new ERP system in the post-implementation phase. These perceptions were then compared to ones in the pre-implementation phase using involvement in the ERP implementation process and position in the company as contingency variables. The four constructs offer alternatives to the typical measures (ex. ease of use, usefulness, usage, etc.) used in classical IS frameworks such as TAM. We analyzed 141 T1-T2 matched survey responses and 81 open-ended comments in T2. Our analysis of comparing the overall means of the measures in T1 and T2 was consistent with our analysis of the comments. Our analysis by level of involvement and position in the company support some of our hypothesis but not all.

The main limitation of our study is the use of one company, which only allows us to generalize our results cautiously. Also, a longitudinal study with three points in time

would have provided us with more information than just two points in time. On the positive side, we had a longitudinal sample that is larger than previous studies in the literature, we surveyed the end-users rather than just conduct interviews, and we obtained extra validation of our results using subjective data in the form of comment analysis. We would have gone back to the company for a third time to assess their perceptions after a year or more of using the ERP system, but the company outsourced the IS function to a third party making it impossible to reach the end-users.

References

Abdinnour, S. and Saeed, K. (2008), "Comparison of users' perceptions in the pre- and post- ERP implementation phases", 7th Pre-ICIS Annual Workshop on HCI Research in MIS, published abstract of a poster presentation, Paris, p. 11.

Abdinnour-Helm, S., Lengnick-Hall, M.L. and Lengnick-Hall, C.A. (2003), "Pre-implementation attitudes and organizational readiness for implementing an enterprise resource planning system", *European Journal of Operational Research*, Vol. 146 No. 2, pp. 258-273.

Amoako-Gyampah, K. (2004), "ERP implementation factors: a comparison of managerial and end user perspectives", *Business Process Management Journal*, Vol. 10 No. 2, pp. 171-183.

Bhattacherjee, A. and Premkumar, G. (2004), "Understanding changes in beliefs and attitude towards information technology usage: a theoretical model and longitudinal test", *MIS Quarterly*, Vol. 28 No. 2, pp. 229-254.

Delone, W.H. and Mclean, E.R. (1992), "Information systems success: the quest for the dependent variable", *Information Systems Research*, Vol. 3 No. 1, pp. 60-95.

Delone, W.H. and Mclean, E.R. (2003), "Delone and Mclean model of information systems success: a ten year update", *Journal of Management Information Systems*, Vol. 19 No. 4, pp. 9-30.

Fisher, S.L. and Howell, A.W. (2004), "Beyond user acceptance: an examination of employee reactions to information technology systems", *Human Resource Management*, Vol. 43 Nos 2/3, pp. 243-258.

Francoise, O. (2009), "ERP implementation through critical success factors' management", *Business Process Management*, Vol. 15 No. 3, pp. 371-394.

Gonzalez, R., Gasco, J. and Llopis, J. (2010), "Information systems outsourcing: a Delphi study from Spain", *Business Process Management Journal*, Vol. 16 No. 2, pp. 244-263.

Kim, H. and Kankanhalli, A. (2009), "Investigating user resistance to information systems implementation: a status quo bias perspective", *MIS Quarterly*, Vol. 33 No. 3, pp. 567-582.

Kim, S.S. and Malhotra, N.K. (2005), "A longitudinal model of continued IS use: an integrative view of four mechanisms underlying post-adoption phenomena", *Management Science*, Vol. 51 No. 5, pp. 741-755.

Kossek, E.E. (1989), "The acceptance of human resource innovation by multiple constituencies", *Personnel Psychology*, Vol. 42 No. 2, pp. 263-281.

Kossek, E.E., Young, W., Gash, D.C. and Nichol, V. (1994), "Waiting for innovation in the human resources department: godot implements a human resource information system", *Human Resource Management*, Vol. 33 No. 1, pp. 135-159.

Lim, E.T.K., Pan, S.L. and Tan, C.W. (2005), "Managing user acceptance towards enterprise resource planning (ERP) systems – understanding the dissonance between user expectations and managerial policies", *Europen Journal of Information Systems*, Vol. 14 No. 2, pp. 135-149.

Lin, F. and Rohm, C.E. (2009), "Managers' and end-users' concerns on innovation implementation: a case of an ERP implementation in China", *Business Process Management Journal*, Vol. 15 No. 4, pp. 527-547.

Longinidis, P. and Gotzamani, K. (2009), "ERP user satisfaction issues: insights from a Greek industrial giant", *Industrial Management and Data Systems*, Vol. 109 No. 5, pp. 628-645.

Moon, Y.B. (2007), "Enterprise resource planning: a review of the literature", *International Journal of Management and Enterprise Development*, Vol. 4 No. 3, pp. 235-264.

Oliver, R.L. (1980), "A cognitive model of the antecedents and consequences of satisfaction decisions", *Journal of Marketing Research*, Vol. 17 No. 4, pp. 460-469.

Orlikowski, W.J. and Gash, D.C. (1994), "Technological frames: making sense of information technology in organizations", *ACM Transactions on Information Systems*, Vol. 12 No. 2, pp. 174-207.

Saeed, K.A. (2012), "Evaluating the value of collaboration systems in collocated teams: a longitudinal analysis", *Computers in Human Behavior*, Vol. 28 No. 2, pp. 552-560.

Schlichter, B.R. and Kraemmergaard, P. (2010), "A comprehensive literature review of the ERP research field over a decade", *Journal of Enterprise Information Management*, Vol. 23 No. 4, pp. 486-520.

Soh, C. and Sia, S.K. (2005), "The challenges of implementing 'vanilla' versions of enterprise systems", *MIS Quarterly Executive*, Vol. 4 No. 3, pp. 373-384.

Wei, H., Wang, E. and Ju, P. (2005), "Understanding misalignment and cascading change in ERP implementation: a stage view of process analysis", *European Journal of Information Systems*, Vol. 14 No. 4, pp. 324-334.

Wickramasingle, V. and Gunawardena, V. (2010), "Critical elements that discriminate between successful and unsuccessful implementations in Sri Lanka", *Journal of Enterprise Information Management*, Vol. 23 No. 4, pp. 466-485.

About the authors

Dr Sue Abdinnour is a Omer Professor of Operations Management in the W. Frank Barton School of Business at the Wichita State University. She received her PhD from the Indiana University, Bloomington, USA and her MSc from the University of Southampton, UK. Her research interests include supply chain management, facility layout, enterprise resource planning, human-computer interaction, and the relationship between information systems and operations management. She has published her research in journals that include *Decision Sciences*, *Interfaces*, *European Journal of Operational Research, International Journal of Production Research, Annals of Operations Research, Journal of Engineering and Technology Management,* and *Production & Inventory Management Journal.* In addition to teaching and being active in research, Sue consults with industry and delivers various seminars to business executives. She has received various teaching and research awards. Dr Sue Abdinnour is the corresponding author and can be contacted at: sue.abdinnour@wichita.edu

Dr Khawaja Saeed is a Barton Fellow and an Associate Professor of Information Systems in the W. Frank Barton School of Business at the Wichita State University. He holds an MBA from the Asian Institute of Technology in Thailand and a PhD in Information Systems from the University of South Carolina. Dr Saeed has worked on various projects in companies operating in Thailand, Pakistan, Denmark, and USA. His research focusses on technology acceptance, electronic commerce, inter-organizational systems, and supply chain management. His work on these topics has been published in journals such as *Journal of Management Information Systems*, *Decision Sciences, Communications of the ACM, International Journal of Electronic Commerce, Journal of Organizational and End User Computing, Information Systems Journal, and Electronic Markets.* Dr Saeed is the recipient of the Stan Hardy Award for the best paper published in the field of Operations Management in 2005. He currently serves on the technology board for Boeing Wichita Credit Union.