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End User Adoption of ERP Systems: Investigation of Four Beliefs

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INVESTIGATION OF FOUR BELIEFS

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ABSTRACT

This paper studies the effects of four beliefs of a group of end users on the adoption of ERP systems. The beliefs examined were perceived usefulness, ease of use, expected capability, and expected value. A sample of 58 SAP users was collected, via online survey, from a large company in Saudi Arabia. The validity and the reliability of the data collection instrument were tested using the exploratory factor analysis and Cronbach's Alpha coefficients, respectively. Using multiple regression analysis, the perceived ease of use and the expected value of ERP system was found to have a significant direct effect on the acceptance of ERP system. However, the perceived usefulness and expected capability did not have a direct significant effect on acceptance of ERP systems. The study provides insights for organizations implementing ERP systems in developing countries.

Keywords

ERP adoption, beliefs, perceived usefulness, ease of use, expected capability, expected value, Saudi Arabia.

INTRODUCTION

Enterprise resource planning (ERP) systems implementation is growing in developed as well as in developing countries (Kamhawi, 2007; Huang and Palvia, 2001). While there are abundant research studies on ERP systems acceptance in the developed countries, there is a paucity of research on the acceptance of ERP in developing countries. Although companies worldwide invest heavily in ERP systems implementations, a significant proportion of these implementations does not succeed. One commonly cited reason for such failures is the reluctance or unwillingness of end users to accept ERP systems. Therefore, a good understanding of end users acceptance of ERP systems and its correlates is essential to ERP implementation success. Hence, the objective of this study is to investigate the relationships of four different beliefs, namely perceived usefulness, perceived ease of use, expected capability, and expected value of an ERP system with its acceptance in a developing country setting, namely Saudi Arabia.

LITERATURE REVIEW

The ERP system is an integrated set of modules that help organizations integrate their information flow and business processes by using a single database that collects and stores data in real time with a standardized user interface (Aladwani, 2001; Abdinnour-Helm et al., 2003). The ERP system can support different departments, business lines and functions across the entire enterprise with the capability of including any business transaction run by any user within any department regardless of the inputs. When ERP systems are fully realized in a business organization, they can yield many key benefits and improvements such as: reducing cycle time, enabling faster information transactions, reducing inventory, increasing productivity, maintaining tightened supply chain links, reducing transportation and logistics costs, laying groundwork for e-commerce, etc. (Abdinnour-Helm et al., 2003; Calisir and Calisir, 2004).

ERP system is a costly and risky investment due to the enormous resources to be allocated for their implementation. While companies are willing to invest in ERP systems, they want to make sure that their investments yield the expected benefits.

The demand for ERP systems is rapidly increasing, but not all implementation cases led to significant organizational improvements. This suggests that ERP failures need to be understood and solutions leading to success need to be found (Calisir and Calisir, 2004). A number of potential explanations have been identified in the literature that are broadly classified as human/organizational, technical, and economic (Sarker and Lee, 2003). Among the human factors are the end-users' perceptions and attitudes on accepting ERP systems. That is to say, the perceptions of employees who are expected to use the ERP system can have a critical impact on the degree to which its implementation effort succeeds or fails; and unless end users have positive attitudes about it and behave in ways that take advantages of its benefits, the ERP will have little impact on the organization (Abdinnour-Helm et al., 2003).

This study focuses on identifying factors that influence end users' attitude toward an ERP system acceptance. Specifically, we examine the users' perceptions on four beliefs, including perceived usefulness, ease of use, expected capability, and expected value, as shaping attitudes towards ERP acceptance.

RESEARCH MODEL

The baseline research model for this study is the technology acceptance model (TAM) described by Davis (1989). In the original TAM, information system (IS) adoption is determined by intention to adopt it. The intention, in turn, is determined by attitudes toward the IS and perceptions concerning its usefulness. Attitudes are formed from two beliefs: perceived usefulness and perceived ease of use as shown in Figure 1. However, the TAM has been criticized as unsuitable model for explaining end users' acceptance in mandated use environments (like ERP systems). Brown et al. (2002, p. 283-284) argue that "…if individuals must use a system, why do we care about the antecedents to mandated use?" and in mandated situations, "the system must be used to complete one's own job tasks that are also tightly integrated with the tasks of multiple other job performers". When use is mandated, a user freedom of choice is his/her favorable or unfavorable predisposition towards the use. That is, the positive or negative attitudes users form toward the system use. Nah et al. (2004) contended that adoption intention may not be adequate or suitable to measure users' mental acceptance if the use is mandated, and the attitude-intention-behavior relation may not hold in mandatory settings. The decision to accept or use the ERP system is usually taken by the management, and end users are required to use the ERP system to execute their duties. Therefore, we use attitudes towards ERP acceptance, as a surrogate measure for ERP adoption, instead of intention to use or actual use as the dependent variable of our research model.
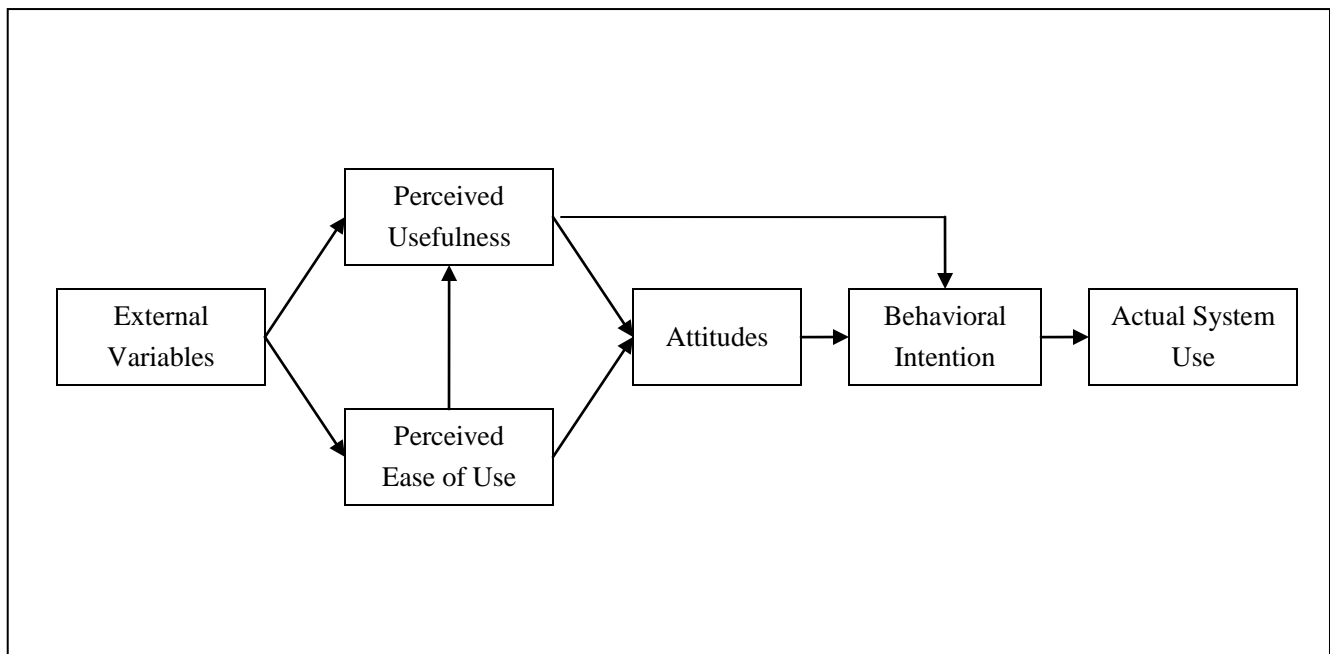

Figure 1: The Original TAM (Davis et al., 1989)

The TAM considers two beliefs, perceived usefulness (PU) and perceived ease of use (PEU), as having effects on technology acceptance (Davis, 1989). In this paper, we consider two additional beliefs, expected capability and expected value, identified by Abdinnour et al. (2003). Therefore, as depicted in Figure 2, four belief factors are hypothesized to have direct relationships with ERP acceptance.

Two important constructs in TAM, perceived usefulness (PU) and perceived ease of use (PEU), have direct or indirect effects on acceptance (Davis et al., 1989; Amoako-Gyampah and Salam, 2004; Nah et al., 2004). PU is defined as "*the degree to which a person believes that using a particular system would enhance his or her job performance*" (Davis, 1989, p. 320). PEU is defined as "*the degree to which a person believes that using a particular system would be free of effort*" (Davis, 1989, p. 320). In the original TAM, the behavioral intention to use a system is determined by the perceived usefulness and the user attitudes toward using the system which, in turn, is determined by both perceived usefulness and perceived ease of use (Davis et al., 1989). Davis (1989, p. 334) asserted that "… perceived usefulness is a strong correlate of user acceptance and should not be ignored by those attempting to design or implement successful systems"; and contended that all else being equal, an application perceived to be easier to use than another is more likely to be accepted by users.
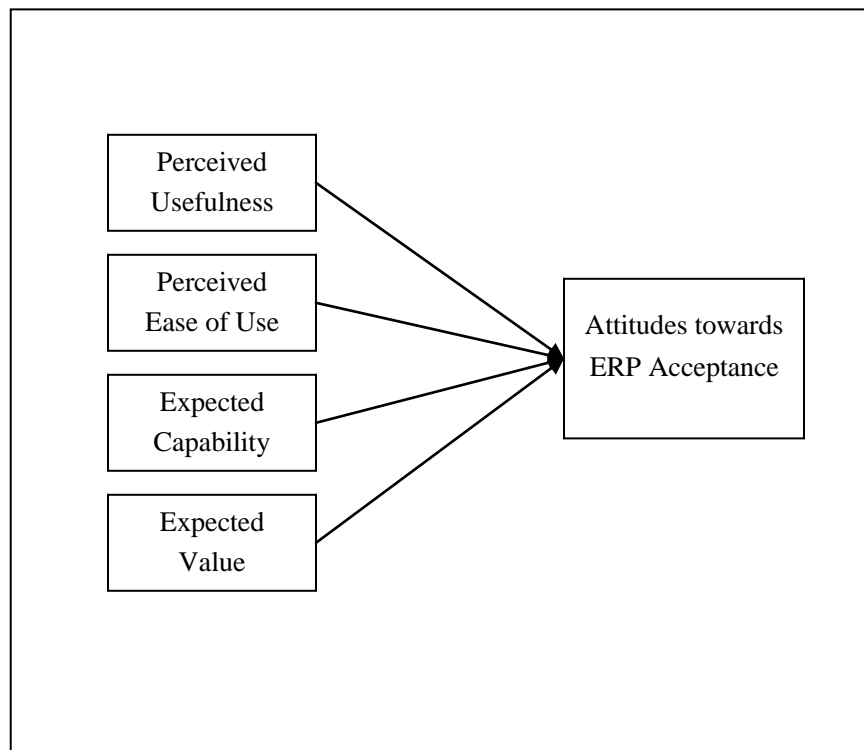

Figure 2: The Research Model

Previous research work by Kossek et al. (1994) showed that expected capability (EC) and expected value (EV) of IS could influence users' attitudes toward the implementation of an IT. The American Heritage College Dictionary (2002) defines capability as *"having the ability required for a specific task or accomplishment"*. The EC construct is meant to assess the expected abilities, features, and qualities of the new IS (Kossek et al., 1994). The EV of an information system measures the perceived financial, political, and overall value of the implementation project to the various organizations and their employees (Kossek et al., 1994). The value of something is its "*worth in usefulness or importance to the possessor*" (The American Heritage College Dictionary, 2002).

Based on the previous arguments, the following hypotheses were postulated:

H1: There is a positive direct relationship between Perceived Usefulness (PU) and attitudes towards ERP Acceptance (AC).

H2: There is a positive direct relationship between Perceived Ease of Use (PEU) and attitudes towards ERP Acceptance (AC).

H3: There is a positive direct relationship between Expected Capability (EC) and attitudes towards ERP Acceptance (AC).

H4: There is a positive direct relationship between Expected Value (EV) and attitudes towards ERP Acceptance (AC).

METHODOLOGY

Research Setting

The 29th December 2001 was the first day for a new ERP (SAP/R3) to go into production in ABC Company. The new ERP system was intended to replace over 400 old computer applications, running on the company's mainframe, which had been developed and maintained by different IT support groups within different departments without the involvement of the central IT department. The search for a new ERP system was begun in 1995 by committees of about 80 IT professionals. The main objective of the committees was to find the best solution to reduce the cost of maintaining all IT current and future potential computing needs corporate-wide. The committees reviewed leading companies' experiences and found that, at that time, SAP had been implemented in major companies that had the same business as ABC. The strategic objectives of SAP implementation were: 1) to get rid of the mainframe system, 2) to discard all legacy applications, and 3) to have one single database accessible to all users.

One IT staff member, from the Change Management Unit, said the only awareness activities for the new ERP system were some posters or ads posted in different places such as the main entrance of the company's main Health Center or the company's buses as a notification of SAP implementation in some departments. However, another source informed the researchers that before the "Go-Live" specified date, a group of IT specialists spent six months conducting seminars and presentations about the highlights of the new ERP all around the company's operational departments in the Kingdom of Saudi Arabia. Due to the tightly set deadline for SAP to go-live, many important implementation steps and change management programs were cut short or even skipped in order to meet the deadline.

Sample and Procedure

A field survey was employed to test the research hypotheses. Several efforts were made to convince the IT department to adopt this study and authorize the researchers to survey all SAP users. The benefits of conducting such a study were explained and presented for many departmental officials in the Public Relations Department, Publications Department, SAP Business Office, SAP Training Department, SAP Change Management Department, and SAP Training Department. Eventually, the Transportation management agreed to administer the survey in their department.

The survey was administered online. An e-mail message was sent to the personnel of the participating department inviting them to take the survey. The message contained a brief description of the study objectives and asked the employees to participate in the survey by accessing the online survey. The estimated size of the participating department is 500 employees. A reminder e-mail message was sent after one week from sending the first one. The total number of received responses was 58 responses.

Measures

The items used in constructing the survey for this study were adapted from several relevant prior research studies. Items for PU and PEU were adapted from the work of Adams et al. (1992). The items about expected capabilities, expected value, and attitudes towards Acceptance of ERP system were taken from the work of Abdinnour-Helm et al. (2003). All the adopted items were modified for the context of this study and, if necessary, paraphrased to suit a five-point Likert-type scale where 1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly Agree. All these items and their corresponding factor loadings (FL), means, and standard deviations (SD) are listed in Table 1.

Construct	Item	Measure	FL	Mean	SD
Perceived Usefulness (PU)	PU1	Using SAP in my job would enable me to accomplish tasks more quickly	0.84	4.17	0.86
	PU2	Using SAP would improve my job performance	0.83	4.19	0.83
	PU3	Using SAP in my job would increase my productivity	0.78	4.05	0.83
	PU4	Using SAP would enhance my effectiveness on the job	0.86	4.05	0.78
	PU5	Using SAP would make it easier to do my job	0.82	4.26	0.76
	PU6	I would find SAP useful in my job	0.84	4.33	0.71
Perceived Ease of Use (PEU)	PEU1	Learning to use SAP is easy to me	0.87	3.86	0.87
	PEU2	My interactions with SAP would be clear and understandable	0.73	3.88	0.88
	PEU3	It would be easy for me to become skillful in using SAP	0.60	4.12	0.68
	PEU4	When using SAP, I can easily control and determine the output of my interactions	0.82	3.93	0.75
	PEU5	I would find SAP flexible to interact with	0.82	3.79	0.87
	PEU6	I would find SAP easy to use	0.88	4.03	0.92
Expected Capability (EC)	EC1	My expectations of SAP are very high	0.81	4.02	0.83
	EC2	Data from SAP will always be on time	0.87	4.14	0.66
	EC3	Data from SAP will always be accurate	0.81	4.00	0.70
	EC4	SAP will be very easy to customize	0.65	3.71	0.97
Expected Value (EV)	EV1	Switching from the old system to SAP is essential	0.81	4.14	0.87
	EV2	The benefits of implementing SAP will outweigh the costs	0.78	3.95	0.91
	EV3	I see the value in having SAP	0.87	4.07	0.79
	EV4	SAP will help coordinate our work with activities in other company locations	0.80	4.03	0.82
	EV5	Supporting or working on SAP can enhance my career	0.78	3.90	0.89
Attitudes towards ERP Acceptance (AC)	AC1	It wouldn't bother me if SAP implementation were discontinued	0.38	3.12	1.26
	AC2	I am familiar with the functionality of SAP	0.67	3.83	0.78
	AC3	SAP is important to me	0.75	4.22	0.82
	AC4	Overall, I think SAP implementation project is/was very well run	0.79	3.88	0.84
	AC5	In general, l like the way SAP is designed	0.70	3.95	0.80
	AC6	A lot of improvement should be made in the way SAP is run	0.08	2.19	0.71
	AC7	My immediate supervisor supports SAP implementation	0.71	4.00	0.68
	AC8	SAP has little importance to me	0.41	3.53	1.19
	AC9	In general, communication on SAP has been good	0.62	3.97	0.77
	AC10	Overall, SAP is a great program and should be implemented	0.82	4.26	0.72

Table 1. Measurement Scales

RESULTS AND ANALYSIS

Sample Characteristics

Table 2 shows a summary of descriptive statistics for the sample respondents. Most of the users use SAP either to generate reports or to update data. More than 80% of the users used SAP for two years or less. The two SAP modules that are heavily used are Finance & Reporting and Human Resources. Forty three percent of the sampled users are university graduates. Their average age is 40 years old and their average period of service in the company is 18 years.

Reliability and Validity

Construct validity was assessed by examining the dimensionality and internal consistency of each construct. An exploratory factor analysis, with varimax rotation, was performed to assess unidimentionality; and internal consistency was assessed using Cronbach's Alpha. Based on factor score, all items loaded on single factor except items AC1, AC6, and AC8 as shown in Table 1. Hence; they are eliminated from the Acceptance construct. Furthermore, each construct has a Cronbach's alpha

greater than 0.7, as shown in Table 3, and thus has sufficient internal consistency to be judged a reliable measure of the construct (Nunnally, 1978).

Variables	Frequency	Percent
I mostly use SAP to:		
Update data	20	34
Browse data	12	21
Generate reports	16	28
Make decisions	10	17
I have been using SAP for:		
Less than 6 months	17	29
6 months - Less than 1 year	6	10
1 – 2 years	23	40
More than 2 years	12	21
My Department is:		
Transportation	48	83
Others	10	17
The SAP module I heavily use is:		
Finance and Reporting	22	38
Supply Chain Management	3	5
Plant Maintenance	2	3
Quality Management	3	5
Services Procurement	1	2
Human Resources	27	47
My level of education is:		
Below high school	8	14
High School	22	38
University graduate	25	43
Others	3	5
My job title is:		
Regular Employee	37	64
Supervisor/Foreman	18	31
Superintendent	3	5
	Mean	**St. Dev.**
Age	39.23	10.55
Years of service	17.98	9.32
Years working on legacy system	6.52	6.45

Table 2. Descriptive Statistics for Respondents

Factors	Number of Items	Mean	St. Dev.	Cronbach's Alpha
Perceived Usefulness	6	4.175	0.657	0.906
Perceived Ease of Use	6	3.940	0.664	0.879
Expected Capability	4	3.966	0.617	0.773
Expected Value	5	4.017	0.690	0.865
Attitudes towards ERP Acceptance	7	4.015	0.566	0.856

Table 3. Reliability Coefficients

Hypotheses Testing

The simple correlation matrix for the constructs is shown in Table 4. All the constructs are significantly correlated with each other. However; there is no sign of high multicollinearity among predictor variables since, as indicated in Table 5, all their Variance Inflation Factor (VIF) values are less than 10.

Factors	PU	PEU	EC	EV	AC
Perceived Usefulness (**PU**)	1				
Perceived Ease of Use (**PEU**)	0.565*	1			
Expected Capability (**EC**)	0.564*	0.636*	1		
Expected Value (**EV**)	0.542*	0.373*	0.731*	1	
Attitudes towards Acceptance (**AC**)	0.632*	0.682*	0.725*	0.737*	1

*P < 0.01

Table 4. Pearson Correlation Matrix

Correlations alone do not explain all the relationships between variables in a research study. Therefore, we used regression analysis to assess the relationships between the belief and the acceptance variables. As shown in Table 5, perceived ease of use (b = 0.41, p < 0.000) and expected value (b = 0.496, p < 0.000) have significant direct relationships with attitudes towards ERP acceptance. These two variables explain more than 72% of the variance in ERP acceptance. These results support H2 (perceived ease of use → acceptance) and H4 (expected value → acceptance). However; the results failed to support H1 (perceived usefulness → acceptance) and H3 (expected capabilities → acceptance).

Dependent Variable	Adjusted R^2	Independent Variables	Standardized Beta	T	p-value	Collinearity Statistics	
						Tolerance	VIF
Attitudes towards ERP Acceptance	0.724	PU	0.110	1.171	0.247	0.553	1.809
		PEU	0.410	4.136	**0.000**	0.494	2.025
		EC	0.039	0.315	0.754	0.312	3.209
		EV	0.496	4.553	**0.000**	0.409	2.448

Table 5. Regression Coefficient Analysis

DISCUSSION, LIMITATIONS AND CONCLUSION

This study examines the direct relationships of four beliefs with ERP acceptance in a mandatory environment. The overall model is significant (F = 38.29, p < 0.000) and explains 72.4% of the variance. The results show that both perceived expected value and perceived ease of use are strong predictors of attitudes towards ERP acceptance. This implies that organizations should enhance the users' belief structure by emphasizing the value of the ERP system for both the end users and the organization itself. Users should view the ERP system as vital to the organization and to their careers as well. Appropriate steps should be taken to form favorable beliefs that will lead to favorable attitudes towards ERP acceptance. Another implication is that ERP systems must be designed in such a way that they become easy to use, simple to learn, and flexible to interact with. ERP that is easy to use is less threatening to the user (Moon and Kim, 2001). That is, perceived ease of use is expected to have a positive influence on users' acceptance of ERP systems.

This study has several limitations. First, it was conducted in a single organization with a limited sample size. Therefore, the results may not be generalizable to other organizations in Saudi Arabia. Second, the online survey was sent to an email group that contained all the email addresses of one department's employees without prior consent, except from the department

manager, where some users consider this survey as unsolicited. Third, end users' beliefs were assessed at one point in time. A longitudinal study is very much needed to assess the belief change over time.

In conclusion, this study proposes using attitudes towards ERP acceptance as a surrogate measure for ERP adoption in a mandatory environment. Behavioral intention and/or actual use of IS are appropriate measures for adoption in voluntary settings, but not in the ERP context where usage is mandatory. Using data gathered from a sample of SAP users, it is found that perceived value and ease of use of ERP systems are key factors to their adoption. This study is of special interest for ERP implementation managers who are experiencing end-user resistance to accepting a newly implemented ERP system in their organizations.

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