

# Examining the Factors Influencing ERP Usage and Its Impact on Panoptic Empowerment and End User Performance

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## Abstract

Complex information systems like the Enterprise Resource Planning (ERP) integrate the data of all business areas within the organization. The implementation of ERP is a difficult process as it involves different types of end users, organizational culture and setting. Effective usage of ERP leads to its success but the degree of usage depends on many factors. Based on literature, a conceptual research framework was proposed and examined to find the effect of some of the individual (absorptive capacity, computer self-efficacy), organizational (organizational support) and technological (complexity) factors on the usage of ERP and its impact on end users. Data were collected from 153 users of ERP across organizations through a survey questionnaire. Results of statistical analyses suggest that computer self-efficacy, organizational support, and complexity are the significant predictors of ERP usage which in turn has significant influence on panoptic empowerment and individual performance.

## Introduction

Modern organizations are making significant investments in complex information systems such as the Enterprise Resource Planning (ERP) systems. Despite the various benefits promised, more than two thirds of ERP system projects result in failure (Chang et al., 2008). A closer look at the nature of reported problems clearly suggest that the ERP implementation issues are not just technical, but encompass wider behavioral factors (Skok & Doring, 2001). Organizations should understand the system adoption from the user's perspective to prepare their employees to face new challenges and learn how to make good use of the technology to reap tangible benefits (Chang et al., 2008). Indian organizations have been exposed to advanced uses of Information Technology (IT) in organizations from more developed countries, through joint ventures and technology transfer initiatives made possible by increased international trade and commerce. They have encountered organizational and cultural problems during the adoption and implementation of new IT in general (Dasgupta, Agarawal, Ioannidis, & Gopalakrishnan, 1999). Thus, it is crucial to understand the influence of the various factors influencing the acceptance of ERP in the Indian context. Based on the review of extant literature, this study is done to identify some of those factors and their effect on the acceptance and usage of ERP. With little research existing to study the impact at the individual level, this study also seeks to find the impact of usage of ERP system on the users.

## **Literature Review and Hypotheses**

### **ERP Implementation**

ERP systems can be defined as a means of integrating all business functions across a company through the use of a single system that can serve all the needs of the different functions (Koch, 2001). It requires changes not only in systems but also in processes and other social dimensions (Kwahk & Kim, 2008) and in the coordination among the members of the organizations to make it work (Chang et al., 2008). Further, implementation in developing countries face specific difficulties over and above those found in industrialized countries (Xue, Liang, Boulton, & Snyder, 2005). This distinction between cultures suggests that information technology and management practices should be modified for different cultural contexts (Ananadarajan, Igarria, & Anakwe, 2002).

### **Technology Acceptance**

There are several theoretical models to explain the user acceptance towards information systems such as Technology acceptance Model (Davis, 1989), Computer Self efficacy (Compeau & Higgins, 1995), Task–Technology Fit (Goodhue, 1995) and Theory of Planned Behavior (Ajzen, 1991).

Technology Acceptance Model or TAM is a widely applied Information System (IS) model to explain end user adoption of IT. It is a powerful model of user acceptance of computer technology (Igarria, Guimaraes, & Davis, 1995). Recently, TAM has been applied to ERP systems to explain the complex implementation and adoption issues of stakeholders and end users (Amoako-Gyampah & Salam, 2003).

TAM is based on the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980). It theorizes that an individual's behavioral intention to use the system is determined by two beliefs: Perceived Usefulness and Perceived Ease of Use (Venkatesh & Davis, 2000). Davis (1989) defined Perceived Usefulness (PU) as "the degree to which a person believes that using a particular system would enhance his or her job performance." PU for the individual is most likely the result of improved job performance and user motivations (Robey & Farrow, 1982). Studies have reported that PU is positively associated with system usage (Thompson et al., 1991). Perceived Ease of Use (PEOU) is defined as "the degree to which a person believes that using the system will be free of effort". According to TAM, perceived usefulness is also influenced by perceived ease of use because, other things being equal the easier the system is to use, the more useful it can be. People with PEOU are more likely to believe in the ease and usefulness of the system (Robey & Farrow, 1982).

### **Role of External and Contextual variables on the use of ERP**

TAM predicts that external variables are expected to influence technology acceptance behavior indirectly by affecting beliefs, attitudes, or intentions (Szajna, 1996). Orlikowski (1993) demonstrated that adopting and using a specific IT is not solely dependent on the characteristics of the IT but is also dependent on other external aspects such as organizational or social context and individual characteristics and attitudes. The following are the external variables considered in this study.

### **Individual Characteristics**

**Computer Self-Efficacy:** Self-efficacy is a measure of a user's confidence in their ability to use a technology (Taylor & Todd, 1995). It is the people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances (Bandura, 1986). In the context of using computers and IT, computer self efficacy, therefore, is defined as a judgment of one's capability to use a computer and is an

important antecedent of perceived usefulness (Compeau & Higgins, 1995). Venkatesh and Davis (2000) modeled and empirically tested the determinants of PEOU and found that an individual's computer self-efficacy is a strong determinant of PEOU and behavioral intention.

**Absorptive Capacity:** Zahra and George (2002) suggested that absorptive capacity was an important factor for an organization to implement new IS successfully. Cohen and Levinthal (1990) defined it as the ability of an organizational member to value, assimilate and apply new knowledge. At the level of the individual, absorptive capacity refers to memory development, in which accumulated prior knowledge enables the ability to store new knowledge into one's memory and to recall and use it (Cohen & Levinthal, 1990). The individual's absorptive capacity of understanding, assimilating and applying knowledge influences the performance of ERP users (Park, Suh, & Yang, 2007).

### **Organizational Characteristics**

**Organizational Support:** In organizations with using a technical system, organizational support affects behavioral intention to use the system (Fishbein & Ajzen, 1975). Organizational support was identified as two broad areas, technology support and management support (Lee, Kim, Rhee, & Trimi, 2006). Ralph (1991) defined technical support as people assisting the users of computer hardware and software products, which can include hotlines, online support service, machine-readable support knowledge bases, faxes, automated telephone voice response systems, remote control software and other facilities. Top management support is defined as the willingness of top management to provide the necessary resources and authority or power for project success (Slevin & Pinto, 1987). Organization support has been found to be crucial for successful adoption of a new system but little work has been done on the effect of internal technical support on technology acceptance (Lee et al., 2006).

### **Technological Characteristics**

**Technological Complexity:** ERP systems, similar to other management information systems, are often perceived as very complex and difficult to be implemented (Xue et al., 2005). Aiman-smith and Green (2002) defined technological complexity as the extent to which a new technology is more complicated for its user than the previous technology used for the same or similar work and represents an increase in the number of things the user must do at once. Complexity is found to have a negative impact on the adoption of information technologies (Igbaria et al., 1995).

### **Impact of ERP usage**

The impacts and the outcomes of the usage of ERP should be investigated from different perspectives especially with a view to study how the human factor influences success and how users can improve ERP's performance significantly (Botta-Genoulaz & Millet, 2006). Little research has addressed the link between user acceptance and individual and organizational outcomes and there has been no systematic investigation of the impact of technology on employee job characteristics (Venkatesh et al., 2003). The following are some of the variables which are considered in this study.

**Panoptic Empowerment:** The ERP system has not only increased the ability of the organizations to gather more information in greater detail and in real time, but also brings about more widespread dispersal of information throughout the organization. This expanded access to information not only gives them added flexibility, but also allows them to make decisions which used to be formally referred upwards or to other departments due to a lack of information (Sia, Tang, Soh, & Boh, 2002). The central concept of empowerment is the

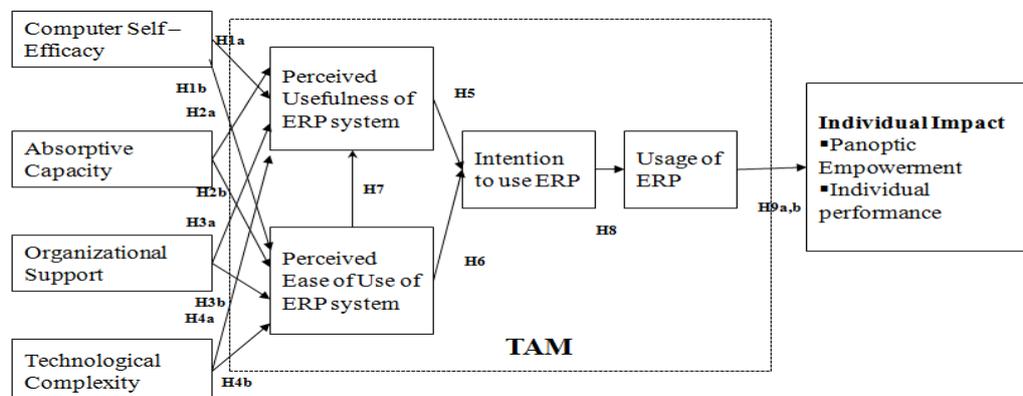
delegation of power to staff/employees in order to make and implement their own decisions (Psoinas, Kern,& Smith, 2000).

The Panopticon is an early nineteenth century design for prisons, developed by Bentham. The principal effect of the Panopticon is to induce in the prisoners a state of conscious and permanent visibility that assures the automatic functioning of power and they begin to act as if they are being observed because they cannot tell when or whether they are being observed (Foucault, 1979). An ERP similarly employs a gaze because it records all user actions, which can be observed in real-time and also stored for later observation. Thus, with no extra effort ERP surveillance is essentially continuous (Sia et al., 2002).The greater visibility of information provided by the common shared database not only empowers workers to do their work more efficiently and effectively but also makes them more visible to others throughout the organization who can then easily exercise process and outcome control (Elmes et al., 2005). This is referred to as panoptic empowerment which combines the concept of empowerment and multidirectional visibility. There is simultaneous increase in control and empowerment occurring through the mediating effects of formation visibility (Elmes et al., 2005). This contrasts with Sia et al’s (2002) studywhere there was greater emergence of greater panoptic control without corresponding increase in empowerment though the technology was capable of both. Hence more research is required to generalize the findings to other organizations.

**Individual Performance:** Organizations that spend millions of dollars on IT are primarily concerned about how their investment will influence organizational and individual performance. IT impact on work at the individual level is a direct consequence of system use, which in turn is a major factor of determining organizational impact (Torkzadeh& Doll, 1999). Users would adopt an ERP system if they perceived ERP would assist them to attain desired performance outcomes (Amoako-Gyampah& Salam, 2004). Goodhue and Thompson (1995) argued that IT was more likely to be used in organizational settings and would have a positive impact on individual performance if the capabilities of the IT matched the tasks that the user had to perform.Some of these studies that have used individual performance in their study have stated positive relationships between IS and performance (Venkatesh, 2000) while other studies have stated otherwise (Millman&Hartwick, 1987).

The review of literature shows that although there has been research on ERP, there has been little research existing to find the impacts of the acceptance of ERP on the employees. Many of the existing research on ERP adoption are primarily undertaken in developed countries and very few on the developing countries like India. Based on this research gap, the following research model (Figure 1) is proposed to study the effects of the various factors affecting the usage of ERP and its impacts on the employee attitude and behaviors in the Indian context.

Figure 1 - The proposed research model



The acceptance of ERP is influenced by various external variables. In this study we have categorized the external variables as individual, organizational and technological characteristics and we hypothesize the following:

*Hypothesis H1a:* There is a positive relationship between computer self efficacy and perceived usefulness of ERP system.

*Hypothesis H1b:* There is a positive relationship between computer self efficacy and perceived ease of use of ERP system.

*Hypothesis H2a:* There is a positive relationship between absorptive capacity and perceived usefulness of ERP system.

*Hypothesis H2b:* There is a positive relationship between absorptive capacity and perceived ease of use of ERP system.

*Hypothesis H3a:* There is a positive relationship between organizational support and the perceived usefulness of ERP system.

*Hypothesis H3b:* There is a positive relationship between organizational support and the perceived ease of use of ERP system.

*Hypothesis H4a:* There is a negative relationship between complexity and the perceived usefulness of ERP system.

*Hypothesis H4b:* There is a negative relationship between complexity and the perceived ease of use of ERP system.

The relationships between the TAM variables are replicated in our model in the context of ERP system.

*Hypothesis H5:* There is a positive relationship between the perceived usefulness of ERP system and the intention to use the ERP system.

*Hypothesis H6:* There is a positive relationship between the perceived ease of use and intention to use the ERP system

*Hypothesis H7:* There is a positive relationship between perceived ease of use of ERP system and perceived usefulness of ERP system.

*Hypothesis H8:* There is a positive relationship between the intention to use and usage of ERP.

Literature suggests that the acceptance and usage of ERP will have an outcome at the individual level however little research has empirically examined this link. Hence panoptic Empowerment and individual Performance have been considered as the outcome variables measured at the individual level. The following are the hypotheses to be tested.

*Hypothesis H9a:* There is a positive relationship between the usage of ERP and panoptic empowerment

*Hypothesis H9b:* There is a positive relationship between the usage of ERP and individual performance.

## **Research Methodology**

### **Sample and Procedure**

To test the proposed model and hypothesis, a survey questionnaire was developed. The research targets were end users of the ERP systems in India. The study was carried out in organization that had implemented an ERP system. Out of the 153 responses that were received 69.9% were male. Most respondents (43.1%) were between 26 and 35 years old. Only 27.7 % of the respondents had prior experience with ERP before the current implementation in their organization. The demographic information of the participants is shown in the table 1.

Table 1: Demographic details of the respondents

<b>Demographic Characteristics</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Age</b>		
<25	25	16.3
26-35	66	43.1
36-45	28	18.3
>45	34	22.2
<b>Gender</b>		
Male	107	69.9
Female	46	30.1
<b>Experience</b>		
Less than 1 yr	1	0.70
between 2 to 5 yrs	38	24.8
between 5 to 10 yrs	48	31.4
more than 10 yrs	66	43.1
<b>Type of Industry</b>		
Manufacturing	40	26.1
Automobile	39	25.5
Banking and Finance	25	16.3
IT/ITES	37	24.2
Others	12	7.8

## Measures

Computer self-efficacy was measured using the ten items developed by Compeau and Higgins (1995). Absorptive capacity was measured using the five items of Szulanski (1996). Seven items to measure organizational support was adopted from Igbaria (1990) and Thompson et al. (1991). Technology complexity was measured using four items from Thompson et al. (1991). TAM scales of perceived usefulness, perceived ease of use, and behavioral intention were measured using items adapted from Davis (1989) and Davis et al. (1989). Intention to use was measured using two items from Ajzen and Fishbein (1980). To measure panoptic empowerment, fifteen items of Sia et al., (2002) was used and for individual performance, two items of Goodhue and Thompson (1995) was used.

## Results

Reliability was tested using Cronbach's alpha value (Table 2). All of the coefficients of reliability measures for the constructs exceed the threshold of 0.70. In the reliability test, Cronbach's alpha value for perceived usefulness was highest (0.938), and complexity was lowest (0.775).

Table 2: Scale Reliabilities

<b>Construct</b>	<b>No of Items</b>	<b>Cronbach's alpha</b>
Computer Self-Efficacy	10	0.813
Absorptive Capacity	5	0.904
Organizational Support	7	0.899
Complexity	4	0.775
Perceived Usefulness	4	0.938
Perceived Ease of Use	4	0.832
Intention to Use	2	0.825
Usage of ERP	2	0.878
Panoptic Empowerment	15	0.900
Individual Performance	2	0.841

Multiple regressions were performed to test the hypotheses and the results are summarized in table 3. The presence of multi-collinearity for the regression equations was

assessed using the variance inflation factor (VIF). The VIF values for the independent variables ranged from 1.360 to 1.980. Neter et al. (1996) suggested that, “a maximum VIF value in excess of 10 often indicated that multi-collinearity may be unduly influencing the least-square estimates.” The VIF values we obtained were much smaller, which indicated that there was no serious multi-collinearity problem among the independent variables.

To test hypotheses H1a, H2a, H3a, H4a computer self-efficacy, absorptive capacity, organizational support and complexity were regressed on perceived usefulness. Computer self-efficacy ( $\beta = 0.302$ ,  $p < .01$ ), organizational support ( $\beta = 0.452$ ,  $p < .01$ ), complexity ( $\beta = -0.137$ ,  $p < .05$ ) were associated with perceived usefulness supporting hypotheses H1a, H3a, H4a respectively. Hypothesis H2a was not supported since absorptive capacity ( $\beta = 0.057$ ,  $p = 0.343$ ) was not significantly related to perceived usefulness. To test hypotheses H1b, H2b, H3b and H4b computer self-efficacy, absorptive capacity, organizational support and complexity were regressed on perceived ease of use. Computer self-efficacy ( $\beta = 0.439$ ,  $p < .01$ ), organizational support ( $\beta = 0.386$ ,  $p < .010$ ) and complexity ( $\beta = -0.145$ ,  $p < .01$ ) were associated with perceived ease of use supporting hypotheses H1b, H3b and H4b respectively. Absorptive capacity ( $\beta = 0.00$ ,  $p = 0.995$ ) was not significantly related to perceived ease of use too, thus no support was found for hypothesis H2b. Both perceived usefulness ( $\beta = 0.419$ ,  $p < .010$ ) and perceived ease of use ( $\beta = 0.293$ ,  $p < .010$ ) were significantly related to intention to use ERP supporting hypotheses H5 and H6. Perceived ease of use ( $\beta = 0.805$ ,  $p < .010$ ) were related to perceived usefulness supporting hypothesis H7. Intention to use ( $\beta = 0.425$ ,  $p < .010$ ) was significantly related to usage of ERP supporting hypothesis H8. Further Usage of ERP were associated with panoptic empowerment ( $\beta = 0.158$ ,  $p < .010$ ) and individual performance ( $\beta = 0.335$ ,  $p < .01$ ) supporting hypotheses H9a and H9b respectively. Table 3 shows the regression results.

Table 3: Regression Results

R <sup>2</sup>	Dependent Variable	Independent Variable	Beta
0.750	Perceived Usefulness	Computer Self-Efficacy	0.302**
		Absorptive Capacity	0.057
		Organizational Support	0.452**
		Complexity	-0.137*
0.736	Perceived Ease of Use	Computer Self-Efficacy	0.439**
		Absorptive Capacity	0.000
		Organizational Support	0.386**
		Complexity	-0.145**
0.712	Intention To Use	Perceived Usefulness	0.419**
		Perceived Ease of Use	0.293**
0.740	Perceived Usefulness	Perceived Ease of Use	0.805**
0.304	Usage of ERP	Intention To Use	0.425**
0.255	Panoptic Empowerment	Usage of ERP	0.158**
0.459	Individual Performance	Usage of ERP	0.335**

\* $p < 0.05$ , \*\* $p < 0.10$

Overall, our findings confirmed the findings of the earlier work for the TAM variables. The relationship between the external variables like computer self-efficacy, organizational support and complexity and the TAM variables were found to be significant. Also the usage of ERP had significant impact on the individuals. Contrary to the hypotheses, we did not find any support for the significant relationship of absorptive capacity with perceived usefulness and perceived ease of use. These results deviate from previous findings. Based on Cohen and Levinthal's (1990) study that prior knowledge underlies absorptive capacity and has important implications for the development of absorptive capacity, a possible reason for these results may be due to the fact that most of the respondents did not

have prior experience in ERP. Only 28.2% of respondents had prior knowledge about ERP before the current implementation in the organization.

### **Implications and Conclusion**

Findings of this study provide valuable insights for managers to manage efficiently to adopt ERP system across the organization. The management should understand the critical effects of individual, technological and organizational characteristics on the acceptance of ERP. Managers should have the goal of not just making use of the system but to make employees satisfied with using the system, to improve their performance and also to empower them to make decisions. This in turn has positive impact on the organization's performance and success of ERP. The main purpose of this paper was to gain an understanding of the various factors affecting the acceptance of ERP by the employees in the organization and the impacts of the usage on the employees in the Indian context. The results revealed that computer self-efficacy, organizational support and complexity emerged as predictors of the adoption of ERP. Further, usage of ERP was associated with panoptic empowerment and individual performance. However, with the small sample size it's very difficult to come to a concrete conclusion at this stage. Moreover, it's hard to demonstrate the causality between variables with a co-relational study. Findings of this study provide a base for future in-depth research on the same.

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