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Centralization and the success of ERP implementation

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Abstract

Purpose – Centralization, which indicates distribution of decision-making power in organizations, is well-discussed in innovation literature as one of the influencing factors of innovation implementation. Motivated by a gap in enterprise resource planning (ERP) research, the purpose of this paper is to investigate the influence of centralization on the success of ERP implementation.

Design/methodology/approach – Centralization is characterized twofold: policy-related centralization (PRC) and work-related centralization (WRC). ERP implementation success is captured in terms of user acceptance and the use of the ERP system. Using organizational innovation theory, six hypotheses relating centralization, ERP implementation success, and organization size are built and tested using data gathered from 51 Indian organizations that implemented ERP. The data are analyzed using partial least squares-structural equation modeling.

Findings – User acceptance is significantly inhibited by PRC. WRC has a negative influence on use. The negative influence of PRC on acceptance is more pronounced in the case of larger organizations. On the whole, a decentralized set-up is favorable to ERP implementation success.

Originality/value – The study highlights the impact of a centralized management structure on success of ERP implementation and in doing so, it demarcates the varied influence of two types of centralization. It contributes to the scarce research on ERP implementation using the strong theoretical basis of organizational innovation. The findings highlight the implications of centralization to the implementation outcomes, for organizations embarking upon ERP.

Keywords Organizational innovation, ERP implementation success, ERP use, ERP user acceptance, Policy-related centralization, Work-related centralization

Paper type Research paper

1. Introduction

In recent times, implementing enterprise resource planning (ERP) systems has become a trend across the globe and organizations are investing vast resources on it. ERP implementations are associated with a promise of benefits from automation and integration but they also carry the risk of failure. Some of the biggest failures were seen at Foxmeyer, Hershey Foods, and more recently, Avon Products (Koch, 2002; Kemp and Low, 2008). It has been suggested by some researchers that many new information systems (ISs) including ERP systems fail due to shortcomings in the implementation such as lack of facilitating implementation climate, inadequate user training, lack of users' commitment, absence of change management activities, and so on rather than technology shortcomings (Klein and Sorra, 1996; Kemp and Low, 2008). Accordingly, issues pertaining to the implementation of ERP in organizations have become an important subject for academic research.

Several studies on ERP implementation have focussed on identifying critical success factors (CSFs), i.e., factors most related to the success and/or failure of the implementation in different contexts (Esteves and Bohorquez, 2007; Esteves and Pastor, 2001; Finney and

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Corbett, 2007; Ram and Corkindale, 2014; Schlichter and Kraemmergaard, 2010; Shaul and Tauber, 2013). In an elaborate review of about 300 studies conducted during the period 1998-2010, Shaul and Tauber (2013) identified 94 CSFs. Despite such extant literature on CSFs, concerns exist on the usefulness of the factors identified to be influencing the success of ERP implementation (Esteves and Bohorquez, 2007; Esteves and Pastor, 2001; Ram and Corkindale, 2014; Shaul and Tauber, 2013). Not much literature explains how and why those factors are critical to implementation success (Ram and Corkindale, 2014). Further, hardly any research has attempted to operationalize the factors and offer empirical evidence of their influence on implementation success (Ram and Corkindale, 2014). Some scholars have observed that, overall, existing literature does not provide adequate guidance to organizations embarking upon ERP implementations to analyze and manage implementation outcomes (Esteves and Bohorquez, 2007; Finney and Corbett, 2007; Ram and Corkindale, 2014).

Positioned in this gap, we empirically examine the influence of a structural factor – centralization – on ERP implementation success in organizations. Centralization represents power distribution within the organization and is one of the formal communication channels among organizational members (Jansen *et al.*, 2006; Jaskyte, 2011). We conceptualize centralization along two dimensions that distinguish power distribution pertaining to policy-related decision making from that pertaining to work-related decision making and recognize ERP implementation as a form of organizational innovation. Our findings suggest that a less centralized set-up is more favorable to the success of ERP implementation and that the relationship is more prominent in larger organizations.

In the rest of this paper, we briefly present a review of literature on ERP implementation success factors and the gap in literature concerning the influence of centralization. We then discuss the theoretical framework used for the study followed by a discussion on the study constructs and hypotheses development. Subsequently, we detail the methodology used to collect data and the analyses used to test the hypotheses. The paper concludes with a discussion on the findings, their implications to research and practice and the limitations of the study.

2. Literature review

This section presents a review of the literature, pertinent to the study.

2.1 ERP implementation success factors and centralization

Over the years, studies on ERP have identified a number of CSFs. Identification of CSFs is aimed to assist managers in taking necessary actions in areas that have a bearing on the outcome (Boynton and Zmud, 1984). Ram and Corkindale (2014) listed 46 CSFs under four broad categories, namely, organization related, technological/ERP related, project related, and individual related. A more detailed listing is found in Shaul and Tauber (2013), which drew from a detailed review of over 300 research articles. The study identified 94 CSFs and classified them under 15 distinct constructs. Of the 94 CSFs listed by Shaul and Tauber (2013), we counted 86 that are specific to the ERP implementation stage.

Prominent success factors discussed include top management support, change management, conflict management, and knowledge transfer. The active involvement and direction of top management through the implementation reinforce the importance of the ERP project and provide the motivation needed to sustain the implementation (Garg and Garg, 2008). Top management can support by making a steering committee comprising of senior personnel overseeing the project (Legare, 2002; Somers and Nelson, 2001),

orchestrating, and coordinating the efforts of multiple change leaders (Martin and Huq, 2007), and committing to financial and technological resources (Dong, 2001). Change management factors include communication from senior personnel on the benefits of the ERP system (Kansal, 2007; Žabjek *et al.*, 2009), inter-departmental communication (Akkermans and Helden, 2002; Žabjek *et al.*, 2009), clarity on goals and objectives (Kansal, 2007), organizational consensus (Bradford and Florin, 2003; Gargeya and Brady, 2005), and training (Somers and Nelson, 2001). All these can contribute to organizational readiness to change, which itself has been discussed as an important success factor (Bosilj-Vuksic and Spremić, 2005; Gargeya and Brady, 2005; Motwani *et al.*, 2002).

Conflict management appears among the factors since conflict may sometimes emerge over the implementation strategy, owing to differences in political agendas of dominant groups inside the organization (Boersma and Kingma, 2005) and these conflicts could lead to drift and delay. Ward *et al.* (2005) suggested that choosing a suitable management approach based on power, interests, and rights, to resolve conflicts can contribute to the success of ERP implementation. The study further suggested that all three management approaches namely, top-down, coalition, and negotiation would be needed at different stages of ERP implementation. Yet another factor pertains to knowledge transfer and internalization of ERP knowledge. Organizations' capability to adapt to new roles, develop the required types of knowledge, and introduce a new knowledge structure (Lee and Lee, 2000; Wang *et al.*, 2007), as well as organizations' competency in creation, retention, transfer, and application of knowledge (Sedera and Gable, 2010) are important to the success of ERP implementation. This discussion is summarized in Table I.

As is evident from this discussion, previous studies on ERP implementation have examined several success factors. Despite this substantial body of research, we could

Category	Success factor	Related studies
Top management support	Use of steering committee comprising of top management	Legare (2002), Somers and Nelson (2001)
	Effort orchestration of multiple change leaders	Martin and Huq (2007)
	Commitment to financial and technological resources	Dong (2001), Somers and Nelson (2001)
Change management	Top management communication on ERP system benefits	Kansal (2007), Zabjek *et al.* (2009), Somers and Nelson (2001)
	Inter-departmental communication	Akkermans and Helden (2002), Zabjek *et al.* (2009), Somers and Nelson (2001)
	Clarity on goals and objectives of ERP implementation	Kansal (2007)
	Organizational consensus	Bradford and Florin (2003), Gargeya and Brady (2005)
	User training	Somers and Nelson (2001)
	Organizational readiness to change	Bosilj-Vuksic and Spremić (2005), Gargeya and Brady (2005), Motwani *et al.* (2002)
Conflict management	Differences in political agendas of dominant groups inside the organization	Boersma and Kingma (2005)
	Management approach to resolve conflicts	Ward *et al.* (2005)
ERP knowledge internalization	Organization's learning capabilities	Lee and Lee (2000), Wang *et al.* (2007), Sedera and Gable (2010)

Table I.
Prominent success factors discussed in the literature

not locate a study, barring Ifinedo (2007) that has linked centralization to the success of ERP implementation. Based on a study of 44 organizations in Finland and Estonia, Ifinedo (2007) found a significant relationship between structure and ERP system success. Structure in this study was considered as a single construct comprising of centralization, specialization, and formalization. The study did not seek to explore the distinct influence of centralization on ERP success.

Our study is positioned in this research gap. In this paper, we focus specifically on the influence that centralization has on ERP implementation success. Centralization is the degree to which power and control in a system are concentrated in the hands of relatively few individuals (Rogers, 1983) and reflects the organization's internal power distribution with respect to decision-making mechanisms. A greater degree of centralization indicates pronounced hierarchical structures in the organization, while a lower degree indicates a greater level of dispersion of decision-making processes (John and Martin, 1984). As such, centralization represents a formal communication channel among organizational members (Jansen *et al.*, 2006; Jaskyte, 2011). Centralization has been discussed in previous research as an important factor influencing organizational innovation, including technological innovation (Damanpour, 1991; Pierce and Delbecq, 1977; Rogers, 1983). By examining the specific role in the success of ERP implementation in organizations, our study is expected to add significantly to current understanding on ERP implementation.

2.2 ERP implementation as organizational innovation

In its essence, ERP implementation is a form of organizational innovation. Formally, organizational innovation is defined as the generation, acceptance and implementation of new processes, products, or services for the first time within an organizational setting with an intention of bringing in changes in the organizational processes, for better outcomes (West, 2000). It involves a given organization's strategic effort at doing something new and relevant, regardless of whether other industries or organizations have already proceeded through that process.

Going by the definition, ERP implementation can be considered an organizational innovation since it involves setting up a new integrated IS in the organization. It usually drives massive organizational change resulting from shifting existing business processes to those that represent best practices implicit within the ERP system (Bingi *et al.*, 1999; Davenport, 1998). Such changes encompass many principal areas including strategy, technology, culture, management systems, human resources, and structure (Al-Mashari, 2002). Finally, as with any organizational innovation, ERP implementation is intended to drive better outcomes.

In general, organizational innovation comprises of three phases, namely, initiation, adoption, and implementation (Rogers, 1983; Zmud, 1982). The first two phases involve conceptualizing a change idea and then enacting the decision-making processes that provide the mandate and resources for change. The final phase, implementation, involves installing the adopted idea into a sustained recognizable behavior pattern within the organization (Pierce and Delbecq, 1977). The current study's focus is on the implementation phase, in the specific context of ERP systems.

Theoretical frameworks such as the technology acceptance model (Davis, 1989) and its versions, the theory of reasoned action (Fishbein and Ajzen, 1975, 1980), the theory of planned behavior (Ajzen, 1991) and the unified theory of acceptance and use of technology (Venkatesh *et al.*, 2003) have been used to study the adoption of IS innovations. However, these were developed to explain technology-related behaviors of

individual users. In the present study, we are concerned with the acceptance and use of an IS by organizations, hence we chose to invoke theory pertaining to organizational innovation. Organizational innovation theory has been acknowledged by earlier IS researchers (Fichman, 1992; Swanson, 1994; Zmud, 1982) to be a stable framework to understand and compare processes pertaining to technologies such as ERP systems.

Accordingly, we draw upon organizational innovation literature to first characterize implementation success in terms of the ERP's acceptance and use and then to build the research model for the study. We now proceed to discuss the study constructs.

3. Study constructs

In this section, we discuss the four key study constructs, two each representing ERP implementation success and centralization, respectively.

3.1 ERP implementation success

Owing to varying theoretical perspectives that studies are grounded in, the literature on ERP reveals considerable variation in the conceptualization of ERP implementation success (Esteves and Bohorquez, 2007; Esteves and Pastor, 2001; Ram and Corkindale, 2014). For example, Hong and Kim (2002), conceptualized it using a project management perspective and measured it in terms of deviation from expected project goals such as cost overrun, schedule overrun, system performance deficit, and failure to achieve expected benefits, while Zhang *et al.* (2005) adapted the DeLone and McLean ISs success model to the ERP context and defined it in terms of user satisfaction, individual impact, organizational impact, and intended business process improvement.

As in the present study, ERP implementation is recognized as a form of organizational innovation, we examined IS studies that adopted an innovation perspective to conceptualize implementation success. It has been suggested in these studies that the measures of innovation success need to be specific to the nature of the innovation and the phase of the innovation process (Fichman, 1992, 2004; Sharma and Yetton, 2003). In the case of IS implementation, user acceptance of the IS and use of the IS have been used often as proxies for implementation success (Davis, 1993; Dillon, 2001; Lucas *et al.*, 1990). Accordingly, user acceptance of the ERP initiative and use of the ERP system are considered as proxies for implementation success in this study:

(1) User acceptance (which we denote as "ACP") is defined as the demonstrable willingness within a user group to employ IS for the tasks it is designed to support (Abdinnour and Saeed, 2015; Dillon, 2001). Acceptance is an important indicator of success in the case of ERP systems since the time lag between the adoption decision and the installation of the system for use involves several crucial activities such as preparation of the business process blue print, configuration of the ERP system, and user training. These activities require active involvement of employees across departments along with managerial support. Indeed, user resistance has been a major problem in ERP implementation (e.g. Nah *et al.*, 2001; Somers and Nelson, 2001). On the other hand, users with positive attitudes toward organizational change induced by the IS such as ERP would get involved with the relevant activities and contribute to the success of the implementation (Kwahk, 2006).

(2) Use (which we denote as "USE") of the ERP system represents the behavioral outcome of the implementation. The implementation phase of organizational innovation involves inclusion and absorption of the innovation into

organizational processes and preparation of innovation for general use (Kamal, 2006; Matta *et al.*, 2012). It includes acceptance and the use of the innovation by the organization and its employees. In the case of ERP implementation, the new system induces a significant change in work behavior in terms of changed business processes as well as changed interface with the IS (Martin and Huq, 2007; Robey *et al.*, 2002). The activities during this phase such as imparting user training and communicating its benefits are oriented toward gaining employees' appropriate and committed use of the ERP system (Klein and Sorra, 1996; Robey *et al.*, 2002). Hence, the actual use of the ERP system is an appropriate measure of implementation success.

In summary, Figure 1 depicts the twofold characterization of ERP implementation success used in the current study.

3.2 Centralization

Drawing upon previous research (Andrews *et al.*, 2009; Carter and Cullen, 1984; Dewar *et al.*, 1980; Krasman, 2011), we characterized centralization in terms of two dimensions, namely, participation in decision making and hierarchy of authority:

(1) Participation in decision making: participation in decision making denotes decentralization, represents how much the occupants of various organizational positions participate in organization-wide decisions such as the hiring and promotion of personnel, the adoption of new policies and the institution of new services (Krasman, 2011). Broadly speaking, these are decisions about the allocation of organizational resources such as manpower and money and are among the most basic kinds of decisions an organization makes. Such decisions affect the organization as a whole and are essentially related to the organization's policies. In the present study, we use policy-related centralization (PRC) to denote lower levels of participation in decision making.

(2) Hierarchy of authority: hierarchy of authority refers to the concentration of decision-making mechanisms with respect to the decisions on performance of tasks associated with organizational positions (Krasman, 2011). In organizational set-ups with lower levels of hierarchy of authority, employees are allowed to make their own work decisions with little reliance upon super-ordinates (Krasman, 2011). In contrast, if all work decisions must be referred to the occupant of the position immediately superior in the chain of command, there is a greater level of hierarchy of authority. In sum, hierarchy of authority measures the degree of freedom in work-related decisions and we label it as work-related centralization (WRC). We conceptualize centralization in terms of PRC and WRC, as summarized in Figure 2.

Next, we present the study's hypotheses, along with supporting arguments.

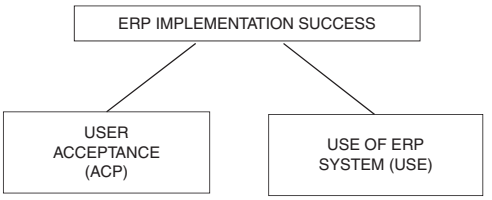

Figure 1.
Proxies for implementation success

4. Hypotheses

The hypotheses of the study are developed in this section.

4.1 PRC and ERP implementation success

Greater centralization in policy-level decision making can inhibit information flows among employees, who are affected by policy-level decisions, including those decisions pertaining to innovation processes such as ERP implementation. In contrast, involving more employees can facilitate better inputs to the decision-making processes and comprehensively solve informational conflicts. This in turn will increase receptivity for innovation initiatives (Heller *et al.*, 1998; Jansen *et al.*, 2006) and inspire employees to act as liaisons between the senior management and other organizational members, thereby broadening organizational communication channels (Cardinal, 2001). Consequently, the levels of awareness about different aspects of the ERP will be greater in organizations where employees' participation in policy-related decision making is more (Damanpour, 1991). Absence of such awareness, which can result from greater PRC, can lead to developing negative attitudes toward the ERP initiative and therefore, would have a negative impact on user acceptance. Hence, we hypothesize:

H1. PRC is negatively related to ACP.

Next, we argue that this negative relationship between PRC and ACP is stronger in larger organizations, or in other words, that organization size moderates the PRC-ACP relation. As an organization becomes larger, its complexity and the administrative burden on the top management increase (Zeffane, 1989). Costs pertaining to information gathering and communication also increase (Moch, 1976). In this situation, having less centralization at the policy level by having more and diverse people participate in the decision making can be favorable (Glisson and Martin, 1980; Zeffane, 1989). When more people participate in decision making, they can act as information agents to other organizational members, thus facilitating a better acceptance of the decisions pertaining to innovation initiatives (Germain, 1996). On the other hand, if the organization does not encourage employee participation in strategic decisions as it grows larger, users' acceptance of initiatives such as ERP implementation can become more difficult to achieve:

H2. The negative relation between PRC and ACP is stronger in larger organizations.

Finally, we argue that PRC and USE are negatively related. Greater levels of participation in policy-related decision making can generate a greater sense of ego-involvement and commitment toward facilitating the processes that drive the implementation (Jansen *et al.*, 2006; Pierce and Delbecq, 1977). A participatory environment signals to members that their input is valued and welcomed, which in turn leads to increased openness and flexibility to change that is favorable for successful implementation (Damanpour, 1991; Jaskyte, 2011; Zmud, 1982). Organizations with

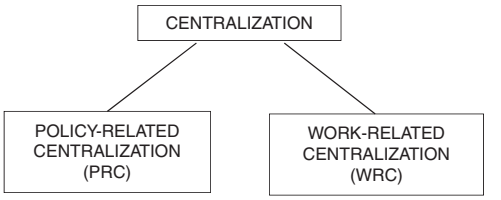

Figure 2.
Types of centralization

lower levels of PRC enable greater information sharing and interaction within groups (Heller *et al.*, 1998). It is more likely that these groups will work through difficulties associated with introduction of innovations and benefit from participation. Information and opinions about innovation and the implementation process are worked out more comprehensively ensuring more effective outcomes (Heller *et al.*, 1998). Therefore, employees in organizations with lower levels of PRC would tend to be more open to incorporate the ERP in their work processes and to become part of integrative problem-solving pertaining to the use of ERP rather than resentful onlookers, sharpshooting from the outside. Hence, we hypothesize:

H3. PRC is negatively related to USE.

4.2 WRC and ERP implementation success

We argue that unlike PRC, WRC influences ACP positively. As mentioned earlier, WRC represents the extent to which organizational members refer to their immediate superiors for work-related decisions. WRC induces a sense of obligatory compliance to the decisions imposed by seniors especially in observable task execution (John and Martin, 1984). As employees are more used to referring to their superiors for work-related decisions in organizations with greater levels of WRC, it is less likely that they will offer resistance to implementation activities. In other words, they are more likely to accept the implementation. Such acceptance is more likely to emanate from an obligation to cooperate than internal motivation to get involved with the implementation. Hence:

H4. WRC is positively related to ACP.

Even as WRC leads to lesser user resistance to the innovation, it can also constrain employees' sense of control over their work, reduce their non-routine problem-solving capabilities and diminish the likelihood that they will seek innovative and new exploratory solutions (Atuahene-Gima, 2003). As a result, employees are more likely to feel constrained in seeking innovative ways of using the ERP system in their work processes and not use the ERP system to its full potential. In a culture that fosters subordinates referring frequently to superiors for work-related decisions, employees are more likely to limit the use of their ERP system to the levels of task compliance. Thus, the actual use of the ERP system is likely to decrease with increased WRC. Hence:

H5. WRC is negatively related to USE.

4.3 ACP and USE

We next argue that ACP and USE are positively related with each other. The use of an IS, which is a behavior, is closely related to the acceptance of the system, which is an attitude (Lucas *et al.*, 1990). If the organizational members develop positive attitudes toward the ERP system, they are more likely to get involved with the business blue printing and other configuration activities. With greater levels of process related inputs from the organizational members the configured system is more likely to meet the expectations of the users, subsequently leading to greater use of the system. Hence, we hypothesize:

H6. ACP is positively related to USE.

The research model with the hypothesized relations is depicted in Figure 3.

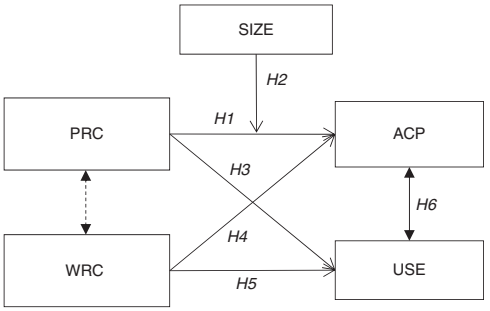

Figure 3.
Research model

5. Methodology

In this section, the methodology used in the study is presented, which broadly includes descriptions on the study's sample, measurement items used for the constructs, data collection, and data analysis.

5.1 Sample and data collection

A quantitative cross-sectional survey methodology was adopted to test the hypotheses. The study population was defined to consist of organizations that had implemented an ERP system and used it for at least two years. ERP implementations typically involve a time lag before the system stabilizes and is consistently used (Ahituv *et al.*, 2002; Davenport, 1998). Firms that had home-grown ERP systems were kept out of the present study's scope, for the reasons of homogeneity and comparability.

Data were collected using a structured questionnaire. The respondents for the survey were senior managers who were involved with the ERP implementation project in their respective organizations. An exhaustive list of companies that have implemented ERP system packages was not readily available at the time of data collection. Hence, the vendors of ERP packages, namely, SAP, Oracle, and Microsoft Navison were consulted to identify the organizations that implemented ERP packages, in conjunction with other information sources such as technology magazines and newsletters. By this process, we gathered contact details of 100 respondents and sent structured questionnaires to them either through an e-mail containing the link to the questionnaire's online version, through post, or by personal hand-delivery. We received a total of 53 responses. Two questionnaires were partially filled and were therefore, not considered for the study. The usable sample had 51 responses, and represented a diversity of firms from eight different sectors as shown in Table II (based on the Industry Classification Benchmark). The profiles of the people who responded to the questionnaire are presented in Table III.

5.2 Measurement scales

The items for measuring the centralization constructs were derived from a survey of literature. PRC was measured using three items derived from the scales used by Jansen *et al.* (2006), Krasman (2011), and Jaskyte (2011), while WRC was measured using two items derived from the scale used by Krasman (2011). Organizational size was measured by the number of full-time employees working in the organizations at the time of ERP implementation, in line with previous studies that measured it (Smith *et al.*, 2005; Tanriverdi, 2005).

S. No.	Sector	No. of responses
1.	Oil and gas (oil and gas producers, services, distribution, and so on)	3
2.	Basic materials (chemicals, industrial metals, mining, and so on)	9
3.	Industrials(construction and materials, aerospace and defense, general industrials, electronic and electrical equipment, and so on)	20
4.	Consumer goods (automobile and parts, food producers, household goods, tobacco, personal goods, and so on)	7
5.	Healthcare (healthcare equipment and services, pharmaceuticals and biotechnology, food and drug retailers, general retailers)	4
6.	Consumer services (media, travel and leisure, telecommunications, and so on)	3
7.	Utilities (electricity, water, gas, and so on)	4
8.	Technology (software and computer services, technology hardware, and so on)	1
Total		51

Note: [a]Based on the Industry Classification Benchmark (ICB, www.icbenchmark.com)

Table II. Sector-wise[a] composition of data

S. No.	Job position of the respondent	No. of responses
1.	CTO, CEO, CFO, VP, executive director, and so on	10
2.	IT manager, chief IT manager, senior IT manager, general manager IT, and so on	28
3.	Deputy IT manager, deputy general manager, assistant manager, and so on	11
4.	Others such as chief engineer, divisional engineer	2
Total		51

Table III. Respondent profile-wise composition of data

Items for ACP and USE were derived from Lucas *et al.* (1990) and were modified to the ERP implementation context using the inputs of an expert committee comprising one project manager of an ERP implementation project, one ERP consultant, and two professors in the ISs and management strategy areas of a business school in India. Items used for all constructs are shown in Table IV and were measured using a five-point Likert scale, anchoring from "strongly disagree" to "strongly agree."

The constructs were tested for construct reliability and validity using partial least squares (PLS) models, and found to possess the desired levels of both these psychometric properties. Harman's one-factor test, a widely used method, was conducted to check for the presence of common method variance that may threaten the internal validity (Podsakoff and Organ, 1986). According to this approach, common method variance exists if a single dominant factor accounts for majority of covariance in the dependent and independent variables. The results of exploratory factor analysis as shown in Table V did not reveal any dominant factor, thus ruling out presence of common method bias in the sample.

5.3 Data analysis

The presence of latent variables in the research model warranted the use of a structural equation modeling (SEM) technique for data analysis. PLS path analysis was chosen as the suitable technique, for three reasons. First, the study's objectives were oriented toward theory development rather than theory testing, wherein two types of centralization are explored for their relevance in the context of ERP system implementation.

Construct	Source(s)
Policy-related centralization (PRC)	
How frequently do you usually, participate in the formulation of rules and procedures related to your department?	Derived from the scales used by Jansen *et al.* (2006), Krasman (2011), and Jaskyte (2011)
How frequently do you usually, participate in the decisions on activities related to your department?	
How strong is the practice of consulting an employee, in the matters related to promotion of his/her subordinates?	
Work-related centralization (WRC)	
There can be little action taken here, in our organization, until a senior manager approves a decision	Derived from the scale used by Krasman (2011)
In general, employees in our organization need to consult their seniors often, while performing their job responsibilities	
Organizational size (SIZE)	
Number of employees in our organization at the time of implementation of ERP systems	Smith *et al.* (2005), Tanriverdi (2005)
User acceptance (ACP)	
Overall, the decisional processes among the managers during the implementation did not involve major conflict of interests	Derived from Lucas *et al.* (1990) and were modified to using the inputs of the expert committee
The employees were resistant while implementing the ERP system	
Use of ERP system (USE)	
Overall, the employees in our organization use all the features that were incorporated in the ERP system	Derived from Lucas *et al.* (1990) and were modified to using the inputs of the expert committee
As a safety measure to avoid discrepancies due to lack of users' acquaintance with the ERP system, our organization maintains a parallel book keeping system (e.g. in paper files, or some other computer applications)	
Presently, the ERP system is an integral part of the day-to-day functioning of our organization	

Table IV.
Questionnaire items

Covariance-based SEM (CBSEM) techniques are suitable when the objectives are oriented more toward theory testing, whereas PLS path analysis, which is a component-based SEM technique, is suitable for both theory development and testing (Gefen *et al.*, 2000, 2011; Chin, 2010). The second reason was the sample size of the present study, which was not very large. Unlike CBSEM techniques, PLS path analysis allows for hypotheses testing under conditions of non-normality and small to medium samples (Khalifa and Shen, 2008; Urbach and Ahlemann, 2010). The sample size of the present study (51) adequately meets that prescribed for a PLS-SEM model, which is ten-times the largest number of predictors for any dependent latent variable (Gefen *et al.*, 2000; Urbach and Ahlemann, 2010). In the study's model, the number of predictors does not exceed 2 for any latent variable. The third reason was that PLS path analysis allows for testing the moderating effect of organization size using the product-indicator approach.

Total variance explained						
	Initial eigenvalues			Extraction sums of squared loadings		
Components	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1.	2.504	22.763	22.763	2.504	22.763	22.763
2.	2.055	18.683	41.446			
3.	1.563	14.210	55.656			
4.	1.212	11.014	66.670			
5.	1.012	9.199	75.869			
6.	0.751	6.829	82.698			
7.	0.603	5.485	88.183			
8.	0.408	3.713	91.896			
9.	0.388	3.526	95.423			
10.	0.289	2.625	98.048			
11.	0.215	1.952	100.000			

Note: Extraction method: principal component analysis

Table V.
Harman's one-factor test

PLS path analysis includes both measurement model and structural model validations. Measurement model validation involves assessing the reliability and validity of the items measuring the latent constructs and structural model validation involves assessing relations among the theoretical constructs. The analysis was conducted using SmartPLS version 2.0.

5.4 Measurement model validation

All the constructs in the research model are reflective. The measurement model for these constructs was assessed for internal consistency, convergent validity, and discriminant validity. The analysis of the measurement is shown in Table VI. The composite reliability scores of all constructs exceeded the threshold of 0.70, indicating internal consistency (Hair *et al.*, 2013). The AVE scores for the constructs were much higher than the generally accepted cut-off value of 0.5, demonstrating convergent validity. In addition, all items measuring the constructs were significant at the 99 percent level with loadings above 0.70, providing further evidence for convergent validity (Urbach and Ahlemann, 2010). Table VII shows the discriminant validity statistics. The square roots of the AVE scores (diagonal elements) were all higher than the correlations among the constructs, establishing discriminant validity as per the Fornell and Larckers criterion. Table VIII indicates that all items loaded higher on their respective constructs than on others, providing additional support for discriminant validity.

5.5 Structural model validation

Validating the structural model involves assessing the relationships between the latent constructs. While doing PLS-SEM, the structural model is evaluated by means of the

Latent construct	Items	CR[a]	AVE[b]
PRC	3	0.8289	0.6187
WRC	2	0.7758	0.6381
ACP	2	0.8326	0.7174
USE	3	0.7451	0.5012

Notes: [a]Threshold minimum value for CR is 0.70. [b]Threshold minimum value for AVE is 0.50

Table VI.
General statistics of measurement model

coefficient of determination (R^2), the path coefficients and their levels of significance (indicated by the *t*-statistic), and the Stone-Geisser test criterion (Q^2), also referred to as the *Q*-statistic. Unlike other SEM methods that are covariance based, PLS-SEM is a variance-based method and hence, does not provide goodness-of-fit measures (Urbach and Ahlemann, 2010).

The results of the structural model validation are presented in Figure 4, Tables IX and X. The R^2 values for ACP and USE are 0.099 and 0.319, respectively (Figure 4), indicating that PRC and WRC together explain 9.9 and 31.9 percent of the variance in these constructs, respectively. The *t*-statistics obtained from the bootstrapping re-sampling procedure indicated that the hypotheses *H1*, *H4*, *H5*, and *H6* are supported.

The predictive relevance of the model, which shows how well the model can be re-constructed with the help of the model parameters, is assessed with the Stone-Geisser statistic (Q^2). The Q^2 value is calculated using a blindfolding procedure. In SmartPLS, the Q^2-statistic for exogenous constructs is represented by the

Latent construct	Acceptance	Use	WRC	PRC
ACP	*(0.847)*			
USE	0.3791	*(0.708)*		
WRC	0.1618	−0.341	*(0.7988)*	
PRC	−0.2307	−0.1105	0.2033	*(0.7866)*

Table VII. Cross correlation matrix

Note: Square root of AVE shown in the diagonal

Indicator/construct	WRC	PRC	ACP	USE
WRC1	*0.6815 (3.797)***	−0.1862	−0.0014	−0.1982
WRC2	*0.9009 (6.649)***	−0.1549	0.2120	−0.3274
PRC1	0.0756	*0.7698 (4.886)***	−0.2169	−0.1016
PRC2	0.2281	*0.8563 (5.655)***	−0.1325	−0.0813
PRC3	0.1659	*0.7282 (5.161)***	−0.1973	−0.0790
ACP1	0.0756	−0.0760	*0.7160 (6.509)***	0.1760
ACP2	0.1715	−0.2572	*0.9603 (33.455)***	0.4022
USE1	−0.2618	0.0267	0.3090	*0.7178 (7.935)***
USE2	−0.25047	−0.0342	0.0465	*0.6668 (7.127)***
USE3	−0.2124	−0.2188	0.3462	*0.7224 (6.92)***

Table VIII. Indicator loadings

Notes: Bootstrapping $n = 1{,}000$. **Significant at $p = 0.01$

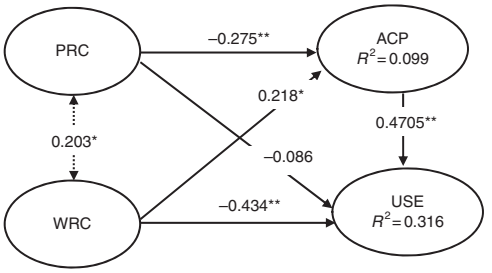

Figure 4. Main effects of the PLS model

"cross-validated communality" measure and that for endogenous constructs is represented by "cross-validated redundancy" (Hair *et al.*, 2013). A model has predictive relevance if Q^2 is greater than 0 for all the latent constructs. The present model fulfills this condition (Table X).

5.6 Moderating effect of size

For validating the moderation (or interaction) effect of size, we used the PLS product-indicator method. This involves assessing the structural model by including the relation between SIZE and ACP along with the interaction term between SIZE and PRC. In the interaction model, we entered SIZE as the natural logarithm of the number of employees keeping in view the large range of its values (i.e. 43-70,000) as done by previous researchers (Smith *et al.*, 2005; Tanriverdi, 2005).

To test moderating effect in PLS, effect size (f^2) is calculated using the formula:

$$f^2 = \frac{R^2_{AB} - R^2_A}{1 - R^2_{AB}}$$

where R^2_{AB} is the R^2 of the model with moderator, R^2_A is the R^2 of the model without moderator.

The results presented in Figure 5 and Table XI indicate that the R^2 of ACP has increased from 0.099 to 0.227 in the presence of size, demonstrating a medium effect. The path coefficient and *t*-statistic of the product term as shown in Table XII indicate that SIZE has a significant moderating effect on the relation between PRC and ACP, thereby supporting *H2*. Table XIII presents in summary the hypotheses that were supported and not supported by the data.

6. Discussion and research synthesis

A stream of research (e.g. Ouchi, 1980; Goodsell, 2004) holds that in large bureaucracies centralization promotes efficient and effective functioning. Particularly when the focus is

Paths	Path coefficient	*t*-statistics (|O/STERR|)
PRC → ACP	−0.2750	*2.327***
PRC → USE	−0.0861	1.087
WRC → ACP	0.2177	*1.830**
WRC → USE	−0.4344	*4.420***
ACP → USE	0.4692	*5.695***
PRC → WRC	0.203	*2.046**

Notes: Bootstrapping $n = 1{,}000$. *,**Significant at $p = 0.05$ and $p = 0.01$, respectively

Table IX. Path coefficients and *t*-statistics for main model

Latent construct	Q^2
USE	0.163
ACP	0.138
PRC	0.607
WRC	0.638

Note: Q^2 must be greater than 0, to be acceptable

Table X. Stone-Geisser statistic (Q^2)

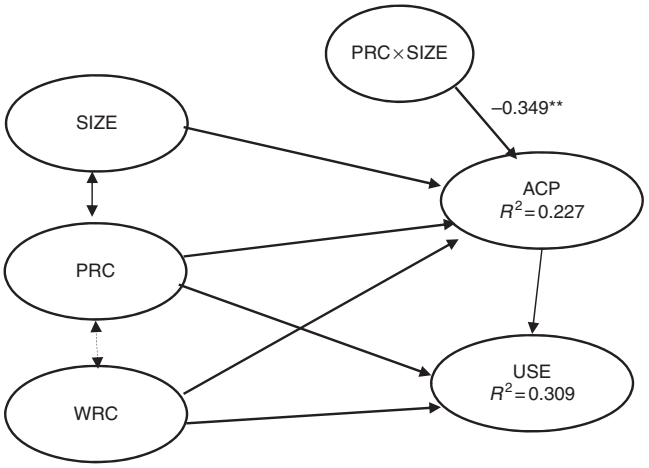

Figure 5.
Interacting effects of the PLS model

R^2 without moderation	R^2 with moderation	Effect size (f^2)
0.099	0.227	0.1656

Table XI.
Effect size of moderation

Note: f^2 thresholds of 0.020, 0.150, and 0.350 indicate low, medium, and large effects, respectively
Source: Urbach and Ahlemann (2010)

Paths	Path coefficient	*t*-statistics (|O/STERR|)
PRC × SIZE → ACP	−0.349	*3.154***
PRC → ACP	−0.183	*1.927**
PRC → USE	−0.082	1.044
WRC → ACP	0.207	*1.936**
WRC → USE	−0.431	*4.654***
ACP → USE	0.459	*5.240***
PRC → WRC	0.203	*2.017***
SIZE → ACP	−0.066	1.078

Table XII.
Path coefficients and *t*-statistics for interaction model

Notes: Bootstrapping $n = 1{,}000$. *,**Significant at $p = 0.05$ and $p = 0.01$, respectively

Hypothesis	Statement	Result
H1	PRC is negatively related to ACP	Supported
H2	The negative relation between PRC and ACP is stronger in larger organizations	Supported
H3	PRC is negatively related to USE	Not supported
H4	WRC is positively related to ACP	Supported
H5	WRC is negatively related to USE	Supported
H6	ACP is positively related to USE	Supported

Table XIII.
Summary of hypotheses supported/not supported in the study

on efficiency, stability, and maintaining the status quo, centralization is beneficial. However, centralization may not be beneficial, or may even be detrimental, when there is change and adaptation. Andrews *et al.* (2009) discussed both types of situations – those where centralization is beneficial as well as those where it is not. They argued that when there is a potential increase in goal ambiguity, centralization may be particularly conducive to maintaining stable service priorities. In such contexts, centralization can increase efficiency by reducing the "inconsistencies" sometimes associated with decentralized decision making, especially intra-organizational communication and office administration costs. However, in "prospector" organizations, less centralization is better. Prospectors are organizations that almost continually search for market opportunities, regularly experiment with potential responses to emerging environmental trends and deal with uncertainty and change more frequently.

This resonates with our findings. We examined the influence of two dimensions of centralization one referring to policy-level decisions and the other to work-level decisions on user acceptance and use of the ERP system. We found that a decentralized organizational set-up is favorable for the success of ERP implementation, which being an organizational innovation, is all about change and adaptation.

6.1 Practical implications

Our study supports the importance of involving employees across departments in policy-level decision making in ERP implementation. Employee participation can enable better communication and processing of diverse information and perspectives. In turn, this can favor reaching better consensus (Jansen *et al.*, 2006) with employees responding more favorably to policy-level decisions, eventually resulting in better acceptance of an ERP system. Policy-level centralization, however, does not seem to have any significant relation with the use of the ERP system which, is a work-level phenomenon. On the contrary, we note that WRC has a significant relation with the use of the ERP system. Perhaps, this can be taken to indicate that decentralization at the work level has greater implications for ERP use than decentralization at the policy level, consistent with the suggestion of Blauner (1964) that operation-level employees in an organization would be more concerned about control over their immediate work processes than they are with control over managerial policy.

Going further, our findings also suggest that WRC positively influences acceptance, but negatively influences use. This means that greater decentralization in work-related decisions would lead to a lower acceptance of the ERP (an undesirable outcome) and to a greater use of the ERP (a desirable outcome), presenting a dilemma on whether organizations should promote or discourage work-related decentralization, while implementing ERP systems. One way to resolve this dilemma could be to consider the earlier discussion that lowering centralization at the policy level can also help increase user acceptance. Thus, organizations can consider simultaneously increasing employees' participation in decision making as well as decreasing the hierarchy of authority in work-related decisions in order to drive both increased acceptance and use of the ERP. Taken collectively, the study's findings suggest that decreased centralization at both the policy and the work levels could lead to better exploitation of the potential of the ERP system, over the long run.

The presence of significant interaction effect of the organizational size on PRC – ERP system use relation implies that the role of employees' participation in organizational decision making becomes more important as the organization grows bigger. As size increases, delegating decision making to more people can ease the administrative burden

of the top management and reduce the distortion of information as it moves to lower level organizational members. Thereby, it can enhance the openness of users to ERP implementation. Larger organizations, thus, would benefit by having greater levels of employee participation in ERP related decisions, than smaller ones.

6.2 Research implications

Centralization as a part of the organizational structure was found to be significantly influencing the ERP implementation success by Ifinedo (2007). The findings of our study reinforce the significant influence of centralization on ERP implementation success. Further, our study delineates the distinct influence of two forms of centralization on the ERP implementation success. It upholds earlier theoretical propositions that decentralization, which represents structural looseness and is a characteristic of organic organizations, promotes innovation implementation in general (Burns and Stalker, 1961; Thompson, 1965). Grover and Goslar (1993) found a negative association between centralization and the number of distinct telecommunication technologies being evaluated by business firms in the USA. Rothwell (1994) noted that greater empowerment of managers at lower levels (reduced centralization) can reduce the number of approvals required and a reduction in hierarchy would reduce approval delays. The resulting reduction in communication complexity and improved decision making would enhance the efficiency of innovation. According to Slappendel (1996), centralization is a deterrent during innovation initiation since people with power can block attempts to introduce change. As a result, opportunities for circulation of ideas and emergence of conflict that can stimulate change are limited in a centralized set-up. Jansen *et al.* (2006) found that centralization has a negative impact on the implementation of process innovations, especially those that are associated with radical change. Overall, our findings reinforce the observations of research set around innovation.

7. Conclusion, limitations, and directions for future research

Klein and Sorra (1996, p. 1056) noted, "[…] although cross-organizational studies of the determinants of innovation adoption are abundant […] cross-organizational studies of innovation implementation are extremely rare […]" Though this observation was made in 1996, our review of the literature revealed that hardly any work in the ensuing years has addressed this gap empirically. This is notwithstanding the fact that a lot of literature on ERP has mentioned and discussed factors that are critical to implementation success.

Set against this backdrop, our study, which follows a cross-organizational design, makes an incremental contribution to the literature by turning the spotlight on relationships between centralization, a component of organization structure and the success of ERP implementation. It points to the greater benefits of decentralization in organizations in general, and policy-level decentralization in larger organizations in particular. A practical implication of our study is that organizations that are about to embark on the ERP journey will do well to reflect upon their current levels of centralization at both policy and work levels, and make necessary adjustments to ensure smooth and successful implementation.

The present study focusses on implementation of on-premise packaged ERP solutions. The number of organizations considering SaaS-based on-demand ERP solutions, especially small and medium enterprises, is increasing (Bagchi, 2013). It is quite possible that our conclusions hold in the context of these cloud-based solutions as well. This is because any ERP implementation necessarily involves activities such as mapping the desired scenarios of the business processes, identifying the gaps between

the desired business process scenarios and those offered by the ERP solution, business process re-engineering, configuring the ERP solution, and user training. Further, the constructs examined by the study (the two types of centralization, user acceptance and use) as well as the arguments used to build our hypotheses, are not specific to, and do not emerge from, any particular form of ERP. Future studies can aim to validate the conclusions of the present study in the context of cloud-based ERP.

The present study has its limitations. In order to ensure a certain extent of model parsimony, differences among ERP application packages used across organizations have not been factored into the study. In reality, there might be some differences in their features such as functionality, cost, and maintenance effort that can influence the implementation process. The second limitation concerns sample size being somewhat small, owing itself partly to our level of analysis being the organization and the fact that the population of ERP implementing companies is itself not very large in India. However, we ensured that the psychometric properties of our models are satisfactory. The third limitation is that the present study was conducted on Indian companies that have implemented ERP systems. The results might be sensitive to the cultural aspects of the country, and therefore need to be validated with organizations in countries with different cultural contexts. Given these limitations, the findings of this study may be generalized only with some caution.

Future studies can extend our work in several possible directions. Repeating our study with a larger sample size can help refine and confirm our findings. Having a larger sample size might help test the same relationships industry or sector-wise and facilitate finer interpretations of our results. The influences of other structural dimensions such as formalization specialization can be explored in relation to ERP implementation as well as those of other organizational factors. Models that can test for the interaction effects of contingent factors such as size, culture, and industry on these dimensions can help refine our understanding and move toward a more comprehensive theory. Another unresolved question pertains to the existence of reverse causality in the relationships – do organizations that have implemented ERP, experience structural transformations in the immediate few years, post-implementation? Such a study might require a longitudinal design but can reveal interesting and relevant insights into the dynamics of ERP in organizations.

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