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Abstract

Though IT usage has been identified as a significant construct, significant gaps remain in our understanding of how IT is used by different organizational members. In this paper, we examine the key organizational, external environmental, and IT-related factors that influence IT usage in organizations across management and non-management levels. Based on data from over 500 functional managers, we examine the factors that are associated with IT usage among management and non-management personnel. Our findings indicate that formalized firms that face high competitive pressures have higher levels of IT usage among both management and non-management personnel. Moreover, firms that insource IT and those that nurture a positive organizational attitude towards IT tend to have greater levels of IT usage. The analysis, results, and its implications for research and practice are presented.

Keywords: IT usage, organization hierarchical levels, IT implementation, IT adoption

Introduction

Advancements in information technology (IT) have dramatically reduced the cost of business transactions and significantly increased the operational efficiency of businesses for the past few decades. Thus, it is not surprising that U.S. businesses' investments in IT have increased by more than 40% from 1970 to 1996 (The Economist 1996). There is also significant evidence on the positive business impacts of IT on the business processes and the overall performance of firm. Specifically, IT has often played a key role in increasing effectiveness, controlling costs, coordinating different activities and processes and enhancing the competitive advantage of firms (Ives and Jarvenpaa 1991).

Researchers studying the organizational impacts of IT have identified IT usage as a key construct influencing the business value generated from IT (Devaraj and Kohli 2003). IT usage simply refers to the use of information technologies and systems by organizational members to improve their work processes. While the importance of IT usage has been acknowledged and well understood (DeLone and McLean 1992, Huber 1990, Davis 1989, Moore and Benbasat 1991), significant gaps remain in our knowledge on IT usage. Despite the decade long research on this topic, how to improve and enhance the IT usage across the organization remains a key concern of IT managers and executives. Multiple approaches and multiple terms have been used to examine this construct, leading to some confusion and somewhat ambivalent results. Scholars have used several terms such as `assimilation', 'diffusion', and 'systems usage' to refer to different facets of IT usage. Moreover, most of the prior studies view IT usage from the perspective of IT executives, rather than the end-users or functional executives. Further, studies have not

specifically differentiated between IT use among management and non-management personnel in organizations. Our study is an attempt to address these gaps.

Drawing upon several streams of research on organization innovation, IT adoption and diffusion and implementation, this study focuses on IT usage by organizational members across different organizational hierarchical levels. We focus on *who* uses IT across different levels of firm hierarchy and also *how* information technology is being used. We also identify pertinent factors from the organization, external environment and the information-technology environment that are likely to affect IT usage among different levels of organizational hierarchy. The fundamental research question underlying our study is: *What are the key organizational, external environmental, and IT-related factors that influence IT usage in organizations across management and non-management levels?*

Conceptual Foundations and Hypotheses

The study of factors influencing IT implementation and adoption in organizations has been widely explored in MIS research (Grover 1993, Damanpour 1991, Rogers 1995, Fichman 2001). Collectively, these studies have identified a wide range of factors such as organizational environment, IT policy factors, environmental factors, support factors that have shown to be influential in the adoption and implementation of IT in organizations. IT usage is generally thought of as post-adoption or post-implementation of IT applications and factors that affect adoption may differ from usage. In particular, Karahanna et al. (1999) found different factors were associated with potential adopters and continued users of Windows. However, to some extent, factors that influence innovation adoption of IT in organizations will still be relevant in the study of IT usage (Fichman 2000). Rather than develop a comprehensive model incorporating an exhaustive set of factors, our aim is to develop a parsimonious model including a set of *key* variables that are highly relevant and vital. Specifically, we concentrate on organizational, external environmental, and IT-related factors because a) organizational factor was found to be the major determinant of organization innovation (Damanpour 1991) b) external environmental factor is especially important in recent years due to the connectivity capabilities of new technologies (Fichman 2000) c) IT-related factor such as "computing climate" was found to influence IT use (Kraemer et al. 1989).

Conceptualization of IT usage

IT usage has been assessed using a range of measures and multiple methods. Many studies examined the frequency of usage of a particular type of IT application (Davis 1989, Raymond 1985, DeLone and McLean 2003). One major drawback of this approach is that the measures do not take into account the vast array of IT applications with different functionalities that exist in many organizations today. Hence, the focus of these studies and the knowledge gained has largely been centered around a particular kind of technology application. While some other studies have adopted a broader notion of IT usage to include different types of organization's operational and strategic activities, these studies generally concentrated on very specific users (e.g. IT management), or specific types of organization (Boynton et al. 1994). Thus, there is a critical need to examine IT usage across different types of organization in different industries, different functional users, different organization hierarchical levels and functionalities. We, therefore, adopt Ives and Jarvenpaa (1991)'s notion of IT usage by operationally defining it as application of information technology to a wide range of organization functionalities. Further, we propose that IT usage could be better understood by focusing on the functionalities of *how* IT is being used in a firm. Such a proposal is inline with DeLone and McLean (2003)'s suggestion of examining the functionality of the system when studying system usage. Thus, we conceptualize IT usage as a range that consists of four levels as shown in Figure.1. These four levels focus on: end-user system development, analysis, information processing and administrative purposes. At the lowest level, IT is used for simple back office tasks and administrative purposes. At the next level, IT is dominantly used for information processing purposes. This involves using IT to retrieve and process different kinds of information for performing some operational tasks. The next level represents analysis, where IT is being used to analyze data and solve organizational problems, or address specific managerial decision making situations. The top level represents end-user system development, the highest level of IT usage where end-users are able to develop and deploy applications by themselves. It should be noted that each higher level of IT usage encompasses IT usage at all lower levels. The hierarchical level of IT usage mirrors the skill-sets of end-users in organizations. Specifically, end-users who are able to develop end-user systems (i.e. the highest level) are assumed to have the fundamental skills for all the lower levels. Such a conceptualization reflects the diverse and extensive functionalities of IT applications used within a firm and across firms in different industries.
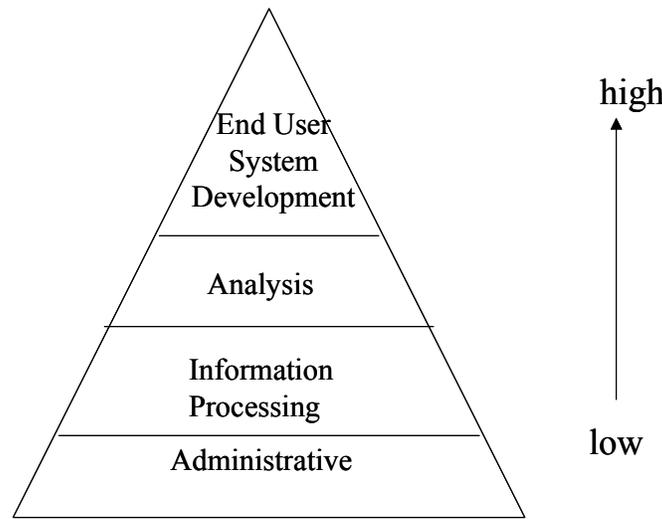
Figure 1. Conceptualizing IT Usage

Research Model

The research model for our study is shown in Figure 2. The research model consists of four broad sets of constructs – IT usage, organizational factors, environmental factors, and IT-related factors. In evaluating IT usage, we further analyze the degree of IT usage across management and non-management level.
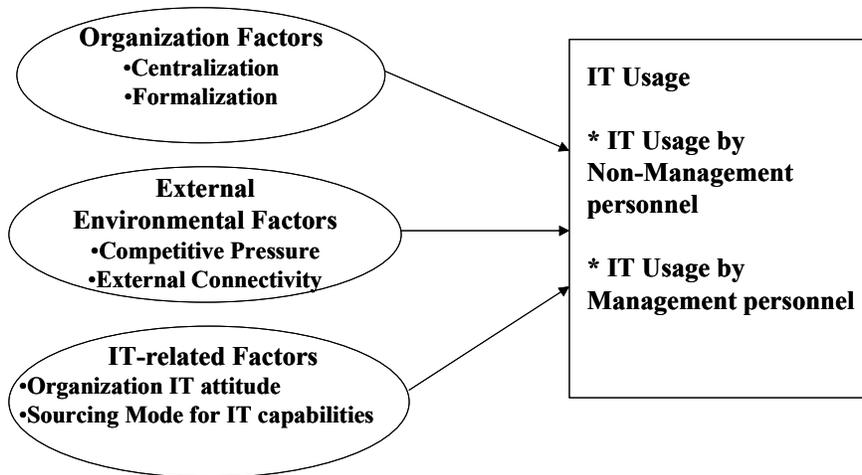

Figure 2. Conceptual Model

Organizational Factors

Organization structure has been a central construct in study of IT diffusion and implementation. Several researchers have operationalized organization structure in terms of centralization and formalization. Centralization refers to the concentration of power or decision-making authority in an organization and it encompasses participation in decision-making and authority hierarchy (Hage and Aiken 1967, Grover 1993). In centralized organizations, decision-making is typically concentrated at the top level of hierarchy while in decentralized structures decision-making is distributed across different hierarchical levels. Studies on IT adoption have shown that IT adoption has a negative association with centralization (Zmud 1982, Grover 1993, Boynton

et. al 1994). In addition, researchers have found that IT is able to facilitate the dissemination and sharing of information throughout the organization and thus IT has the potential to enable transfer of control and delegation of decision authority (Currie 1996). Hence, in centralized structures, we expect IT usage to be low, as we anticipate low delegation of decision authority and dissemination of information.

> *H1a:*   Centralization will be negatively associated with IT usage.

Formalization, which refers to the existence of clear procedures, norms and formal processes for carrying out organizational tasks, has been found to be negatively associated with innovation adoption (Moch and Morse 1977, Zmud 1982). However, other researchers argue that a highly formalized process that creates a structured environment would be useful for systems planning and information processing (Sabherwal and King 1995). We argue that written procedures and more formal environment will eliminate any ambiguities, and would facilitate IT usage. Moreover, formal organizations are likely to stipulate specific procedures and processing for different information processing related activities. These are likely to promote the use of IT by both management and non-management personnel.

> *H1b:*   Formalization will be positively associated with IT usage.

External Environmental Factors

Organizations that are facing growing complexity and uncertainty in the external environment will require increased information processing and decision-making needs (Huber 1984, Malhotra 1993). The ability to respond to the competitive environment is critical to many organizations and thus many scholars have also strongly advocated the need for organizations to respond to environmental pressures (Ghoshal et al. 1994). In particular, information technologies are increasingly pertinent to organizations in responding to these needs from the competitive environment (Nohria and Berkley 1994). In fact, many past studies have advocated that IT plays an important role in helping organizations to cope with environmental uncertainty (Miller et al. 1991). Specifically, increased uncertainty and instability in the environment will drive organizations to use IT to acquire information necessary to respond to competitive pressures. Hence,

> *H2a:*   Competitive pressure will be positively associated with IT usage.

In addition, firms are likely to form a variety of partnerships and alliances with other businesses to compete in a competitive environment (Drucker 1988). Alliances with external business partners would require sophisticated IT to manage interdependencies (King and Sethi 1999). Thus, using IT to be electronically connected with business partners is becoming the indispensable mean to conduct business (Hart and Saunders 1998). As such, we will expect that extensive external connectivity will drive firms to use more IT.

> *H2b:*   Extensive external connectivity will be positively associated with IT usage.

IT-Related Factors

Organizational climate, psychological climate, role of IT, and IT management climate are variables that have commonly been studied to measure individual or organization attitude toward the adoption of a specific information system (Ein Dor and Segev 1978, Kraemer et al 1989, Boynton 1994, Premkumar and Ramamurthy 1995). As shown by these studies, attitudes at all levels (individual, managerial, and organizational) have a major influence over how IT is adopted and used organizations. In our study, we use the term organization IT attitude to refer to a firm's proactiveness in preparing for technology usage and exploitation. It reflects on the "preparedness" or "readiness" of the firm to embrace, use, utilize and exploit IT. We argue that firms with more positive organizational IT attitude will induce workers and management to embrace new technologies and will be more proactive in promoting IT usage.

> *H3a*:   Organizational IT attitude will be positively associated with IT usage.

IT plays a critical role in facilitating or enabling the introduction of new products and services and the improvement of operational or managerial work processes in many organizations. King and Grover (1991) have provided evidence that high IT capability is associated with high IT usage that is positively related with increase competitive advantages. Specifically, IT capabilities refer

to the combination specific IT resources (investments, skills, etc) (Bharadwaj 2000, Grant 1995). Traditionally, the source of IT capabilities has been from in-house IT/IS department (internal sourcing mode). Increasingly, many organizations, however, have opted to outsource their IS/IT function so that they can refocus on the core activities of the firm (Loh and Venkatraman 1992) (external sourcing mode). Internal sourcing mode is likely to stimulate higher management and user involvement with IT activities and functions. In organizations that outsource IT, the involvement of non-IT personnel in IT related activities is likely to be low. Studies have found that organizations with a dedicated IT group investigating emerging IT cope more extensively than do those without one (Benamati and Lederer 2001) and small businesses with in-house IT departments have higher success with IT implementations than those with outsourced IT departments (DeLone 1988).

> **H3b**:   Internal IT sourcing mode will be positively associated with IT usage.

Research Methodology

Data Collection

Data for this study was collected as a part of larger research study that focused on gathering data from large scale of organizations of their business practices. The data used in our study is a part of the data from 1996-97 National Organizations Survey conducted by Minnesota Center for Survey Research. The survey was conducted from June 10, 1996, to June 13, 1997. Stratified random sampling was used to sample from approximately 15 million organizations in Dun and Bradstreet's Information Services data file. Data were collected through telephone interviews and questionnaire-survey. The combined completion rate for both telephone and questionnaires is 54.6%. Overall, there were 1002 organizations that responded to the study. As the focus of this paper is to examine IT usage in organizations, organizations that did not provide any information on these items were omitted from our study. After removing these organizations from the original dataset, we were left with 515 organizations.

The demographic characteristics of the sample are shown in Table 1. The respondents were reasonably evenly distributed across industry groups, sales revenue levels and employee sizes.

Measurement

The research variables were measured using multi-item indicators. Most of the variables except for - sourcing mode for IT capabilities and Organization IT attitude were measured using a 5 point Likert-type scale. Sourcing mode for IT capabilities was measured using a 7 point Likert-type scale and organization IT attitude was measured using a 3 point Likert-type scale.

Data on IT usage was captured for three broad sets of employees – core employees, clerical staff and managers. The data on core employees and clerical staff were treated together to represent data on non-management personnel and the data on managers reflected the IT usage by management personnel.

Four items related to the level at which hiring decision, performance evaluation decision, products and services decisions and production targets and schedules decisions are made were used to measure centralization. Three items indicating the existence of number of formal documents, teams and committees, measure formalization. Three items were used to measure competitive pressure. These three items were related to the amount of competition in the main market, in the main in foreign organizations and whether the competition has increased. Three items indicating the connectivity with suppliers and customers measure external connectivity. Sourcing mode for IT capabilities was measured by the extent of IT capabilities supported by in-house IT personnel. Organization IT attitude was measured by the extent of organization training to cope with changes in technology. We examined IT usage across management and non-management levels. Four levels of IT usage were used - end-user system development, analysis, information processing and administrative purposes.

Data Analyses and Results

Validity and Reliability Testing

Prior to statistical testing, principal component factor analysis with varimax rotation was used to test the validity of our constructs and measures. Except for one item in External connectivity and one in competitive pressure, all the other items loaded as expected. The results of our factor analysis are shown in Table 2.

Table 1. Sample Characteristics

		Frequency	Percentage
1.	**Firm's Revenue in Million $**		
	Less than 50 million	117	22.72
	Less than 100 million	7	1.36
	100-399 million	20	3.88
	400 –999 million	9	1.75
	1000 – 1999 million	3	0.58
	2000 – 4999 million	4	0.78
	Above 5000 million	8	1.55
	Missing, NA, etc	347	67.38
	Total	515	100
2.	**Number of full-time employees**		
	1-9	34	6.6
	10-49	105	20.3
	50-99	51	9.90
	100-499	137	26.60
	500-999	51	9.90
	1000-1999	44	8.54
	More than 2000	78	15.15
	Missing, NA, etc	15	2.91
	Total	515	100
3.	**Industry Group**		
	Mining and Heavy Construction	16	3.11
	Non-durable manufacturing	44	8.54
	Durable manufacturing	69	13.40
	Transportation, communication and utilities	29	5.63
	Wholesale & Retail trade	76	14.76
	Finance-related	29	5.63
	Services	212	41.17
	Others	40	7.77
	Total	515	100
4.	**Title of Respondent**		
	HR Director	184	35.73
	Other Director	119	23.11
	Owner	95	18.45
	Staff Support	100	19.42
	Training Staff	6	1.17
	Others	11	2.14
	Total	515	100

Table 2. Factor Analysis Results

Items	Component			
	1	2	3	4
CENT1	**0.74**	-0.03	-0.13	-0.21
CENT2	**0.80**	-0.06	-0.01	-0.05
CENT3	**0.65**	-0.03	0.01	0.02
CENT4	**0.75**	-0.04	0.14	0.10
FORM1	-0.27	**0.55**	-0.05	-0.20
FORM2	0.05	**0.77**	-0.06	0.06
FORM3	-0.01	**0.76**	0.19	0.07
COMP1	0.02	-0.03	0.03	**0.82**
COMP2	-0.10	0.03	0.11	**0.79**
CONN1	0.05	-0.02	**0.81**	0.08
CONN2	-0.03	0.08	**0.82**	0.05

CENT = Centralization, FORM=Formalization, CONN=External Connectivity, COMP=Competitive Pressure

The reliability constructs were assessed using Cronbach's Alpha. The results exhibited acceptable alpha values for the given sample size. The correlations matrix of the independent variables is provided in Table 3.

Table 3. Correlation Matrix

	CENT	FORM	COMP	CONN	ITATT	ITCAP
Centralization (CENT)	1.00					
Formalization (FORM)	-0.13**	1.00				
Competitive Pressure (COMP)	-0.08	0.00	1.00			
External Connectivity (CONN)	0.01	0.07	0.18**	1.00		
Organization IT attitude (ITATT)	0.03	0.15**	-0.04	0.03	1.00	
Sourcing Mode for IT capabilities (ITCAP)	-0.10*	0.11*	-0.01	-0.04	0.11*	1.00

** significant at 1% level
* significant at 5% level

Statistical Analyses

Descriptive statistics of the data is shown in table 4 below. Statistical analyses were carried out using least squares regression on three models. The first model examined the associations between overall IT usage and the independent variables. The second and third model assessed the associations between independent variables and IT usage of non-management and management personnel respectively. Table 5 shows the regression models used to test the hypotheses.

Table 4. Descriptive Statistics

Variables	Min	Max	Mean	S.D
Centralization	2.00	5.00	3.78	.71
Formalization	1.33	5.00	3.71	.87
Competitive Pressure	1.00	5.00	3.55	.85
External Connectivity	1.00	5.00	3.94	.81
Organization IT attitude	1.00	3.00	2.23	.56
Sourcing Mode for IT Capabilities	1.00	7.00	4.68	2.60
IT usage	1.00	5.00	3.56	.89

Table 5. Regression Models

Model 1	IT Usage $_{Overall}$ = f(CENT, FORM, COMP, CONN, IT_ATT, IT_CAP)
Model 1a	IT Usage $_{Non\text{-}management\ personnel}$ = f(CENT, FORM, COMP, CONN, IT_ATT, IT_CAP)
Model 1b	IT Usage $_{Management\ personnel}$ = f(CENT, FORM, COMP, CONN, IT_ATT, IT_CAP)

CENT = Centralization, FORM=Formalization, CONN=External Connectivity, COMP=Competitive Pressure, IT_ATT= Organization IT attitude, IT CAP= Sourcing Mode for IT capabilities

Table 6. Regression Results

	Model 1			Model 1a			Model 1b		
	Coeffs	t-value	Sig.	Coeffs	t-value	Sig.	Coeffs	t-value	Sig.
Organization									
Centralization	-0.03	-0.74	0.46	0	-0.02	0.99	-0.07	-1.59	0.11
Formalization	0.33	8	0.00**	0.3	7.01	0.00**	0.27	6.28	0.00**
External Environment									
Competitive Pressure	0.08	1.96	0.05*	0.1	2.34	0.02*	0.02	0.49	0.62
External Connectivity	-0.02	-0.41	0.68	0.01	0.32	0.75	-0.07	-1.54	0.13
IT Factor									
Organization IT attitude	0.11	2.62	0.01*	0.09	2.09	0.04*	0.1	2.28	0.02*
Sourcing Mode for IT Capabilities	0.15	3.7	0.00**	0.13	3.13	0.00**	0.13	3.19	0.00**
Adjusted R^2			0.17			0.13			0.12
F-Stats			18.09**			13.75**			12.43**

Note: * $p < 0.05$; ** $p < 0.01$

The regression results of model 1 showed that formalization, competitive pressure, sourcing mode for IT capabilities and organization IT attitude were significant in predicting the usage of IT for both management and non-management personnel. However, centralization and external connectivity were not significant. The results also indicated that formalization, competition, IT capabilities and organization IT attitude were positively associated with IT usage thus supporting hypotheses H1b, 2a, 3a, and 3b. In addition, the results also showed that centralization, and external connectivity were negatively associated with IT usage but were not significant and so rejecting hypotheses 1a and 2b.

Further analysis on the IT usage across non-management level (i.e. model 1a) and management level (i.e. model 1b) were done. There are some differences in the regression results. First, centralization and external connectivity were not significant in model 1a. Even though these two variables were also not significant in model 1b, the association was opposite in signs. Second, competitive pressure which was significant in model 1a was not significant in model 1b. The differences in results indicate that different factors have different impacts on the degree of IT usage at different hierarchical levels. The result of the hypotheses testing is summarized in table 7.

Table 7. Hypotheses Testing Results

Hypotheses	Results
H1a: Centralization will be negatively associated with IT usage.	Not Supported
H1b: Formalization will be positively associated with IT usage.	Supported
H2a: Competitive environment will be positively associated with IT usage.	Supported
H2b: Extensive external connectivity will be positively associated with IT usage.	Not Supported
H3a: Organization IT attitude will be positively associated with IT usage	Supported
H3b: Internal IT sourcing mode will be positively associated with IT usage.	Supported

Discussions, Conclusions and Implications

In this paper, we examine the key organizational, external environmental, and IT-related factors that influence IT usage in organizations across management and non-management personnel. Based on data from over 500 functional managers, we examine the factors that are associated with IT usage among management and non-management personnel.

We found formalization to be significantly and positively associated with IT usage. This relationship was true even for both management and non-management sub-samples. Though centralization was negatively related to IT usage in all the three regression models, it was not statistically significant. Among the environmental factors, we found competitive pressure to be a significant predictor for overall IT usage, and for IT usage by non-management personnel. This is surprising as one would normally expect higher levels of IT usage by management personnel in competitive settings as they are directly involved in strategic activities and key decision processes. A reason for this finding could be that highly competitive pressure drives firms to use more IT to streamline their operational processes and automate workflows, which will have more impact on the non-management levels than at the management level. Our results did not indicate any significant association between external connectivity and IT usage. One possible explanation is that the external connectivity is largely driven by the industry in which a firm operates. Firms in industries that require extensive external electronic connectivity might have higher IT usage. However, our sample included firms from diverse set of industries that had different needs for external connectivity.

The two IT-related variables, sourcing mode for IT capabilities and IT attitude emerged significant in all the three models. The significance of IT attitude in both management level and non-management supports the finding of prior literature on the impact of management on IT assimilation and IT diffusion (Armstrong and Sambamurthy 1999, Keen 1991). The sourcing mode for IT capabilities was a highly significant variable in determining IT usage. The finding in this study supports our hypothesis that organizations with internal IT support have higher IT usage than organizations which rely on external IT support. Apparently, the presence of in-house IT support will stimulate higher IT usage. This results support existing literature that in-house IT operations is associated with higher levels of user satisfaction and computer systems utilization for small businesses (Raymond 1985, DeLone 1988). The outsourcing market has grown tremendously following the footstep of Kodak successful IT outsourcing decision in 1989 (Lacity and Willcocks 1998). However, not much is known about the gains (or losses) from IT outsourcing versus in-house IT. Specifically, IS outsourcing literature have mainly highlighted the benefits of outsourcing and other aspects of outsourcing such as partnership, and contracts (Ang and Straub 1998, Lacity and Willcocks 1998).

We believe our research has made some important contributions. First, we have distinguished between the usage of IT between management and non-management personnel, to understand the differential impacts of contextual factors affecting IT usage by these two distinct sets of end-users. Second, unlike prior research studies that have largely used IT executive-perspective to understand IT implementation and usage, we have used functional executives. In fact, it is these functional executives who could provide more accurate information on IT usage as they directly use IT. We have captured the contextual factors and the IT usage as is perceived by the functional end-users. Third, our analyses are based on a fairly larger dataset (over 500) of real-world functional users, which we believe would provide richer knowledge on the phenomenon studied.

The findings of our study have several important implications for practice. First, our study has thrown light on formalization, an influential variable in determining the IT usage. Managers should make every possible effort to ensure high levels of formalization so that IT usage is promoted. Organizations looking into promoting IT should aim to set up work procedures, teams, and committees. Second, higher level of organizational readiness to promote IT usage is also recommended. It is important to do the groundwork to train different sets of users so that they get comfortable in using and exploiting technologies and systems. Such

efforts could stimulate and make the functional end-users use more IT and improve their overall productivity. Third, organizations outsourcing their IT capabilities should carefully review their tactics to make sure that functional end-users are not alienated.

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