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ABSTRACT

Understanding post adoption behavior has emerged as an important issue in IS research. Organizations have invested in a plethora of information systems (IS) and enriching the usage of these systems can provide organizations with immense benefits. Prior research has examined factors that lead to continued usage of IS, which is critical. But comprehending usage behavior in the context of effectively using the installed system has not received much attention. This study proposes post adoption usage as a broader concept constituting feature level usage of IS, integration of IS in the work system, and exploration of new uses of IS. To validate the post adoption usage constructs, data (N = 1032) was collected in the context of a web based Student Information System used by students to manage their academic work. The newly developed conceptual structure and measures for post adoption usage exhibit strong psychometric properties. Implications are drawn for future

Keywords

Post Adoption Usage, IT Assimilation, Scale Development, IT Implementation

INTRODUCTION

Organizations have invested in plethora of Information Systems (IS). As the maturity of IS in organizations has increased, interest in examining post adoption usage phenomenon has also grown. Research on innovation diffusion offers insights on the different stages of IT implementation within organizations. At the post adoption stage, users experience the technology and start to develop different interaction patterns. Although, prior research offers insights into various aspects that characterize post adoption usage, limited attention has been directed towards offering a comprehensive conceptualization and an effective metric for post adoption usage. In this study, we integrate prior literature and we expound upon the conceptual structure and offer a measurement approach for post adoption usage.

LITERATURE REVIEW

At the post adoption stage, information systems are infused within the organization and become an integral part of the work system. Exposure to the IS results in accumulation of experience with the diverse features that the IS has to offer. Research on examining usage has conceptualized it as the frequency of interaction with the IS in general and in some case the frequency and extent to which IS is used for specific activities. Research studies in examining web usage behavior have also used web server logs to measure usage patterns. Although a multitude of approach have been taken, it is interesting to observe that a comprehensive conceptualization of post adoption usage in the context of the stages of IS implementation is lacking.

Review of past research shows that frequency of usage and breadth of feature use are the two primary approaches that have been used to capture post adoption IS usage (Leidner and Elam, 1994; Massetti and Zmud, 1996; Devraj and Kohli, 2003). Massetti and Zmud (1996) in the context of EDI systems relate these two concepts with volume and diversity of EDI usage. Volume relates to the extent to which a particular document is exchanged between two parties through the electronic medium. Diversity measures the number of documents that are exchanged through the electronic medium. Although examining frequency and breadth offers interesting insights into usage behavior, they are limited in capturing the extent to which users assimilated IS into their daily practices as well as explore new uses to IS.

Saga and Zmud (1994) propose that extended use, integrative use, and emergent use are likely behavioral modes the users may pursue at the post adoption stage. They further propose that these concepts can be used as dependent variables in studies examining the post adoption usage phenomenon. Jasperson, Carter, and Zmud (2005) suggest that current IT applications are underutilized and offer a research model on post-adoptive IT use behaviors. Building on this previous literature, we propose extended use, integrative use, and exploratory use as the three dimensions of post adoption usage.

Extended Use

Extended use, which accumulatively captures the concept of both frequency and breadth of IS, relates to the extent to which the users are leveraging the different features of the IS. After IS become available to users, they interact with the various feature that the IS has to offer and develop different patterns of use. Leidner and Elam (1994) in the context of Executive Information Systems (EIS) propose usage as the frequency with which the executives use the EIS. Similarly, Devraj and Kohli (2003) use frequency of accessing reports and computer resources for assessing IS usage. Thus, the frequency with which the different features of the IS are used reflects the user's IS usage preference and is a critical aspect of post adoption usage behavior.

Integrative Use

Integrative use captures the assimilation of IS into the work practices of the user. In other words, IS becomes an integral component of how users perform their tasks and view IS as critical in task accomplishment. Armstrong and Sambamurthy (1999) propose that IS assimilation in an organization captures not only the infusion of IS into business activities but also how well the IS supports the conduct of these activities. We define integrative use as the extent to which the users are able to effectively integrate the IS into their work systems.

Exploratory Use

The users may also embark upon exploring new uses of the IS within their work environment. Ahuja and Thatcher (2005) propose the concept of trying to innovate with IT and define it as the user's goal of finding new uses of existing workplace information technologies. Experience with an IS can trigger user's cognitions regarding how IS can be used in novel ways. We define exploratory use as the extent to which the user makes an active effort in finding new uses of the IS within their work environment.

Cumulatively, post adoption usage is proposed as consisting of the three dimensions highlighted above: extended use, integrative use, and exploratory use. Next we elaborate on the research method and the measure development process.

RESEARCH METHODOLOGY

The study was conducted in the context of a Student Information System (SIS). The system has been developed by the university and offers the students various types of functionalities to support their academic work. SIS is introduced to students when they enroll into the university. SIS usage for the students, although encouraged, is completely voluntary.

Scale Development

A new instrument was developed and validated for measuring post adoption usage of IS. Table 1 provides the list of items for the constructs.

The development of the instrument for post adoption usage of IS involved four stages. At the first stage, a thorough review of literature was undertaken for comprehending the conceptual structure of the construct and subsequent item creation. In the second stage, six students who have been using the system for some time participated in a focus group on examining the use of the system within their work environment. The main objective of the focus group was to conduct an initial refinement of the items and further comprehend the concept of post adoption usage. The inputs provided by the participants of the focus group were used to modify the items. The next was a q-sorting exercise wherein six judges sorted the items based on definitions provided to them. Modifications were made to the items based on the results of the sorting exercise and the suggestions provided by the judges.

Constructs	Items
Extended Use	**Please indicate the extent to which you accomplish the following tasks by using Student Information System (SIS)?** Registration for courses (add/drop) Access my grades Access my transcript View Class Schedule
Integrative Use	• I effectively use SIS to support my academic work • SOS has become an integral part of how I perform my academic tasks • I am able to integrate SIS into my academic work
Exploratory Use	• I explore how I can use SIS to manage my academic tasks • I explore new uses of SIS • I explore how SIS can better support my academic needs

Table 1. Construct Items

Finally, a large scale data collection was conducted to validate the constructs. Data was collected from the students by administering the questionnaire in different classes. The participation in the research study was completely voluntary and this was emphasized before the distribution of the questionnaire in every class. A primary objective in the data collection process was to get representation of students from all the five major colleges in the university. The data collection effort yielded 1032 responses. Table 2 provides the profile of the subjects. Eighty six percent of the subjects had more than 7 years of experience in using the computer and ninety five percent had more than 4 years of Internet usage experience. The gender distribution was fairly equal with 53% females and 47% males.

Gender	
Male	47%
Female	53%
College Affiliation	
Business	45%
Engineering	10%
Liberal Arts	28%
Fine Arts	4%
Education/Health Science	13%
Computer and (Internet) Usage Experience	
1-3 Years	2% (5%)
4-6 Years	11% (28%)
7-9 Years	23% (39%)
10-12 Years	26% (21%)
13 & More Years	36% (7%)

Table 2. Sample Profile

Construct Validity Analysis

Agarwal and Prasad (1999) suggest using both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) for assessing construct validity. They argue that EFA falls within the classical approaches for examining construct validity, while CFA is part of the contemporary approaches. Exploratory factor analysis was done by employing principal components extraction with varimax (orthogonal) rotation on items consisting of extended use, integrative use, and exploratory use. The varimax rotation was preferred because it makes the distinction between factors clearer than an oblique (non-orthogonal) rotation. In our study, we assume the measured variables will be indicators of three different factors, so an orthogonal rotational will be most appropriate.

The analysis revealed the existence of 3 factors as predicted (see Table 3). The loadings ranged from 0.64 to 0.85. High loadings of the items on the latent construct provides evidence of convergent validity, while minimal evidence of cross

loading supports that the latent factors are indeed distinct from each other establishing discrimnant validity. Cronbach's alpha was used to assess the reliability. Table 4 shows that the values are above the generally acceptable guideline of 0.70 for multi-item scales (Nunnally, 1978).

	1	2	3
Extended Use1	**0.67**	0.28	-0.20
Extended Use1	**0.75**	0.16	0.18
Extended Use1	**0.83**	0.02	0.17
Extended Use1	**0.81**	0.14	0.17
Integrative Use 1	0.27	**0.74**	0.31
Integrative Use 1	0.17	**0.82**	0.29
Integrative Use 1	0.13	**0.85**	0.25
Exploratory Use 1	0.12	0.48	**0.64**
Exploratory Use 2	0.11	0.21	**0.85**
Exploratory Use 3	0.12	0.44	**0.70**

Table 3. Results of the Factor Analysis

	Mean	Alpha	Extended Use	Integrative	Exploratory
Extended Use	3.79	0.79	0.72		
Integrative Use	3.08	0.86	0.42	0.83	
Exploratory Use	2.82	0.80	0.34	0.68	0.76

Table 4. Descriptive Statistics and Correlations

CALIS procedure in SAS was used for CFA. This procedure was only used to assess the measurement properties of post adoption usage. The indices for overall model fit from the CALIS procedure provide evidence that the data fits the model. The fits indices shown in Figure 1 meet the recommended guidelines, providing support for the hypothesized structure of the latent constructs (Sharma, 1996). Convergent validity was examined through composite reliability. Composite reliability of 0.80, 0.86, and 0.80 for extended use, integrative use, and exploratory use respectively is above the recommended guideline of 0.70 (Sharma, 1996).
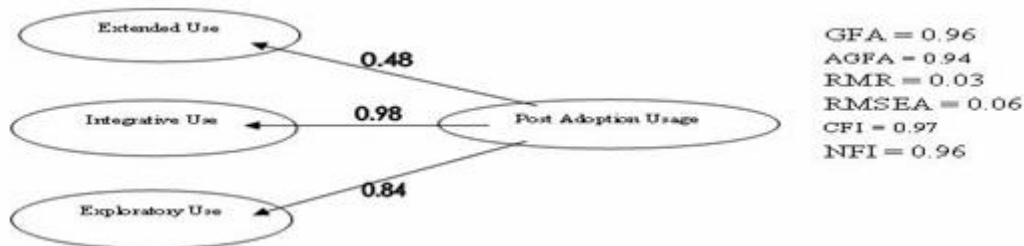

Figure 1: CALIS Measurement Model

Results from the CALIS procedure were used to assess discriminant validity. Discriminant validity was assessed at two levels. First, we undertook the analysis to examine whether each first order constructs are distinct. Fornell and Lacker (1981) suggest that discriminant validity is established if the square root of average variance extracted (AVE) for individual construct is greater than the correlation of that construct with other constructs. Table 4 (diagonal elements show AVE) shows that this condition is met in all cases. The loadings, composite reliability, and average variance extract based on CALIS procedure is shown in Table 5. Overall, the newly developed measure shows excellent psychometric properties.

Items	Loading	Composite Reliability
Extended Use1	0.55	0.80
Extended Use1	0.73	
Extended Use1	0.76	
Extended Use1	0.78	
Integrative Use 1	0.78	0.86
Integrative Use 1	0.85	
Integrative Use 1	0.84	
Exploratory Use 1	0.77	0.80
Exploratory Use 2	0.70	
Exploratory Use 3	0.79	

Table 5. Factor Loadings and Composite Reliability

CONCLUSION

As information technology application gain maturity in organizations, understanding post adoption usage becomes a critical issue. Organizations are pondering over how to effectively leverage the installed base of IS. This study offers a conceptual framework and a measurement approach for post adoption usage of information technology. The measurement approach offered in this study can be helpful to managers in effectively gauging the post adoption usage of IS within organizations. The three different perspectives offered in the study can provide insights on user behavior as it relates to comprehensively using an IS: feature level use of IS, intermingling of IS and how people work, and exploratory endeavors in finding new uses of the IS. The results of our study can be valuable for researchers examining the post adoption usage phenomenon. Future research can study the effect of user experience on post adoption usage and whether length of usage triggers certain types of usage. Other variables may also be used to assess the effectiveness of initiatives that are targeted at different facets of post adoption usage. Finally, the newly developed post adoption usage construct can be integrated into the Technology Acceptance Model and empirically tested.

REFERENCES

1. Agarwal, R., & Prasad, J., (1998) A conceptual and operational definition of personal innovativeness in the domain of information technology, *Information Systems Research*, 9, 2, 204-215.

2. Ahuja, M. K., and Thatcher, J. B., (2005) Moving beyond intentions and toward the theory of trying: Effects of work environment and gender on post-adoptive information technology use, *MIS Quarterly*. 29, 3, 427-459.

3. Armstrong, C., & Sambamurthy, V., (1999) Information technology assimilation in firms: The influence of senior leadership and IT infrastructures, *Information Systems Research*, 1, 4, 304-327.

4. Devaraj, S., Kohli, R., (2003) Performance impacts of information technology: Is actual usage the missing link?, *Management Science,* 49, 3, 273-289.

5. Fornell, C., and Larcker, D. F., (1981) Evaluating structural equation models with unobservable variables and measurement error, *Journal of Marketing Research*, 18(February), 39-50.

6. Jasperson, J., Cater, P. E., & Zmud, R. W. (2005) A comprehensive conceptualization of post-adoptive behavior associated with information technology enabled work systems, *MIS Quarterly.* 29, 3, 525-557.

7. Leidner, D. E., and Elam, J. J., (1994) Executive information systems: Their impact on executive decision making, *Journal of Management Information Systems*, Fall/Winter, 139-156.

8. Massetti, B., & Zmud, B., (1996) Measuring the extent of EDI usage in complex organizations: Strategies and illustrative examples, *MIS Quarterly*, September 1996, 331-345.

9. Nunnally, J. C. (1978) *Psychometric theory*, (2nd Ed.) New York: McGraw Hill.

10. Saga, V., and Zmud, R.W., (1994) The nature and determinants of IT acceptance, routinization, and infusion, in *Diffusion, Transfer, and Implementation of Information Technology*, L. Levine (ed.), North Holland, New York, 67-86.

11. Sharma, S (1996) *Applied multivariate techniques*, New York: John Wiley & Sons.