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Missing in Action: The Information System Artifact in Information Systems Adoption and Use

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ABSTRACT

Despite considerable research on information systems adoption and use by individuals, little is known about how the information system (IS) artifact itself affects adoption and use. Prior research has generally treated the IS artifact as a "blackbox" such that it remained peripheral to the central questions asked regarding adoption and use. This paper presents a feature-centric "IS artifact rating" scheme and shows one way in which to unravel the blackbox of the IS artifact and examine its effect on adoption and use. Implications for research and practice are also presented.

INTRODUCTION

Understanding the adoption and use of information systems have received considerable attention over the past few decades from theory and practice. A rich body of extant literature has examined the adoption and use of a wide variety of IS artifacts including decision support systems, expert systems, executive information systems, group support systems, and communication systems. Nevertheless, prior theories of adoption and use have generally not distinguished meaningfully between the various types of IS artifacts. Virtually all IS artifacts have been considered equal, and adoption and use of such artifacts treated similarly. However, IS artifacts possess inherent differences, chief being the features or functionalities they provide

users. Such differences in IS artifacts may be salient explanatory variables of adoption and use. This paper presents a model of adoption and use that integrates differences in IS artifacts.

INFORMATION SYSTEMS ADOPTION AND USE

Adoption and use of information systems by individuals in organizations have received considerable research attention over time. Researchers have employed a variety of dependent variables to explain individuals' adoption and use of information systems. These include intention to adopt (Karahanna et al., 1999), adoption (Keil et al., 1995), acceptance (Chau, 1996), intention to use (Venkatesh and Davis, 2000), and usage (Szajna, 1996; Moon and Kim, 2001).

Prior literature has examined a variety of information systems such as decision support systems (Sanders and Courtney, 1985), executive information systems (Bergeron et al., 1995), software packages (Venkatesh and Davis, 1996), database management systems (Grover and Teng, 1992), email (Szajna, 1996), operating systems (Karahanna et al., 1999), group support systems (Chin and Gopal, 1995), personal computers (Igbaria et al., 1997), and expert systems (Guimaraes et al., 1996) in organizational settings.

Despite the diversity of information systems in practice, prior literature has generally considered all information systems equal. This can be illustrated through the following two relatively simple observations.

- **Multiple information systems examined using similar theories/ models**. Prior research has examined different information systems using the same theories or models[1]. For instance, the Technology Acceptance Model (TAM) has been used to examine email systems (Straub

[1] This is by no means an exhaustive list of theories on adoption and use. Interested readers are encouraged to consult Venkatesh et al. (2003) for an excellent review of several theories of adoption and use.

et al., 1997), personal digital assistants (Yi et al. 2006), WWW (Moon and Kim, 2001), ERP systems (Hwang, 2005), and internet (Shih, 2004). This can be seen in studies involving other theories as well – including the Theory of Planned Behavior (TPB; Morris et al., 2005; Hardgrave and Johnson, 2003), the Diffusion of Innovations Model (DoI; Agarwal and Prasad, 1998; Chin and Gopal, 1995), the Task Technology Fit Model (TTF; Goodhue and Thompson, 1995; Dishaw and Strong, 1999), and the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2003).

- **Multiple theories/ models examined similar information systems**. Prior research has examined similar information systems using different theories or models. For instance, email systems have been examined using TAM (Davis, 1989) and Social Information Processing Theory (Fulk, 1993). Similarly, microcomputers and personal computers have been examined using the Model of PC Utilization (MPCU; Igbaria, 1992) and TAM (Igbaria et al., 1997). Computer aided software engineering (CASE) tools have been examined using TAM (Chau, 1996) as well as DoI (Sultan and Chan, 2000). The same pattern can be observed in prior studies involving other technologies as well – including DSS (Barki and Huff, 1985; Bergeron et al., 1995), and WWW (Moon and Kim, 2001; Agarwal and Prasad, 1997).

The foregoing provides some clues on how the adoption and use literatures have generally viewed information systems – as substitutable or replaceable entities across different theories or models, and sometimes, even across studies. In one sense, such substitutability is helpful to determine the generalizability of various theories and models across different settings involving different information systems. However, gains in generalizability are offset by losses in specificity since an important part of the adoption story – the IS artifact – is often overlooked or

shortchanged. Certainly not all information systems are created equal; there are usually considerable differences between different types of information systems. For instance, an email system is very different from a spreadsheet system in their capabilities; the former is primarily aimed at communication between parties whereas the latter is aimed at manipulating data.

To illustrate further, TAM, for instance, does not consider the capabilities or the differences in capabilities of information systems in explaining adoption and use – TAM argues that individuals will adopt or use them as long as the systems are useful and easy to use (Davis, 1989), whether it be an email system or a spreadsheet system. Similar observations can be made about other theories as well. The Theory of Reasoned Action (TRA), for instance, posits that individual attitudes and subjective norms explain individual behavior (Fishbein and Ajzen, 1975) whereas TPB argues that individual attitudes, subjective norms, and behavioral control explain individual behavior (Ajzen, 1991). Other theories such as UTAUT argue that facilitating conditions and social influence are also important factors in explaining individual behavior (Venkatesh et al., 2003).

Collectively, the many theories and models of individual adoption and use present different classes of antecedents. These include innovation attributes such as perceived usefulness, perceived ease of use, relative advantage, complexity, compatibility, trialability, observability, and system quality (Davis, 1989; DeLone and McLean, 1992; Rogers, 1995); individual characteristics such as playfulness, innovativeness, self-efficacy, and attitudes (Agarwal and Prasad, 1997; Compeau and Higgins, 1995; Taylor and Todd, 1995; Webster and Martocchio, 1992); task characteristics such as newness, difficulty, variety, and routineness (Igbaria, 1990; Guimaraes et al., 1992; Raymond and Bergeron, 1992; Sanders and Courtney, 1985); and

contextual factors such as top management support, facilitating conditions, voluntariness, and task-fit (Agarwal and Prasad, 1997; Igbaria et al., 1995; Karahanna et al., 1999; Goodhue and Thompson, 1995; Venkatesh et al., 2003).

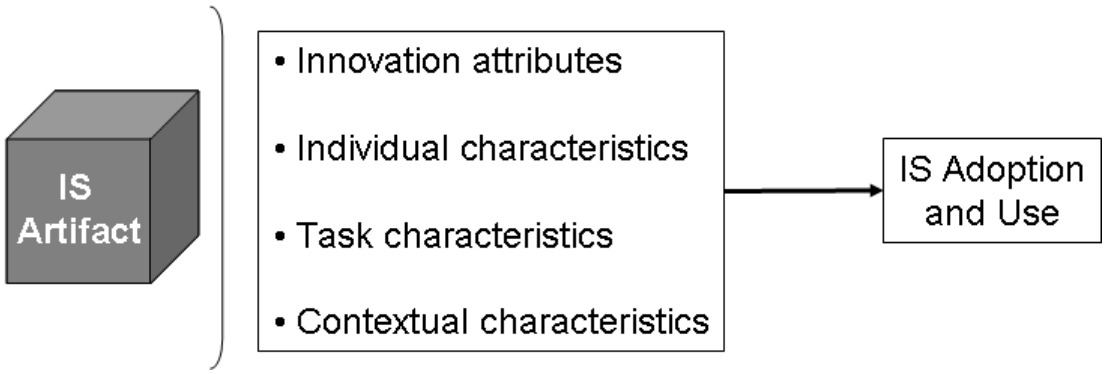

Figure 1. The extant "blackbox" view of information systems artifacts

None of these different classes of antecedents directly deal with information systems and their inherent capabilities. Individual attributes, for instance, represent the characteristics of the individual. Task characteristics refer to the activities performed by the individual using information systems. Contextual factors describe the environment in which the individual is situated. Innovation attributes represent aspects of information systems, and would seem to deal with information systems. However, these variables merely represent an individual's subjective interpretations rather than the objective capabilities of information systems. Thus, it is possible to conclude that information systems artifacts have been treated as "blackboxes" and have not figured directly in extant explanations of adoption and use. Figure 1 presents the extant view of research on information systems adoption and use.

MISSING IN ACTION: THE *INFORMATION SYSTEM ARTIFACT*

To more directly incorporate the IS artifact in theorizing information systems adoption and use, it becomes necessary to unravel the "blackbox" representing the IS artifact. What is contained by the blackbox? This question can be answered in multiple ways. One possible answer is that the blackbox represents the actual information system artifact (e.g. Microsoft Frontpage, Corel Presentations, etc.) being adopted by individuals. Another possibility is to associate a particular type of information system (e.g. word processing systems, spreadsheets, etc.) being adopted by individuals. In either case, the set of features or capabilities (e.g. Jasperson et al. 2005) can be used to operationalize the blackbox. However, these approaches allow for only a subset of the variety of information systems to be addressed.

Feature/ Function/ Capability	**Rating (select one)**
To communicate securely with other individuals or parties	No – Low – Medium – High
To prepare a report or document	No – Low – Medium – High
To send a form letter to multiple individuals or parties	No – Low – Medium – High
To create an image or picture	No – Low – Medium – High
To run some ad-hoc queries on existing data	No – Low – Medium – High
To collaborate with other individuals or parties on the same document	No – Low – Medium – High
To prepare a presentation or slideshow	No – Low – Medium – High
To obtain periodic reports of specific types on existing data	No – Low – Medium – High
To create a movie	No – Low – Medium – High
To perform a what-if analysis of various scenarios	No – Low – Medium – High
To publish a web page	No – Low – Medium – High
To generate complex graphic designs and illustrations	No – Low – Medium – High

Table 1. Illustrative set of features in information system artifacts

An alternative approach may be to allow the blackbox to represent the set of all features or capabilities for all types of information systems (See Table 1, which contains an illustrative set of features or capabilities possessed by information systems artifacts; this is not an exhaustive list of all features. An exhaustive list of such "objective" features of the IS artifacts may be compiled by reviewing academic and practitioner literature on information systems.)

A feature list, as illustrated in Table 1, can be used to evaluate different IS artifacts or different types of IS artifacts using a single instrument. The IS artifacts may be evaluated for each feature on a scale such as "low," "medium," and "high." (It may be possible to use another scale with more variability if desired.) Using numerical equivalents for the three scale values, a combined overall rating may be computed of each IS artifact under examination. This overall rating may be known as the "**IS artifact rating**." The artifact rating represents the extent to which an IS artifact provides all possible features or capabilities for individuals to accomplish their tasks. Based on the rating scale shown on Table 1, the artifact rating would be higher for IS artifacts that got rated "high" on a majority of features than the ones that received "low" on a majority of features. Table 2 shows an example of how this rating scheme may be used to evaluate different IS artifacts.

Feature/ Function/ Capability	**Rating (for an email system)**	**Rating (for a database system)**	**Rating (for a custom system)**
To communicate securely with other individuals or parties	High	No	High
To prepare a report or document	No	High	Medium
To send a form letter to multiple individuals or parties	Medium	No	High
To create an image or picture	No	No	No
To run some ad-hoc queries on existing data	No	High	High
To collaborate with other individuals or parties on the same document	No	No	High
To prepare a presentation or slideshow	No	No	No
To obtain periodic reports of specific types on existing data	No	High	High
To create a movie	No	No	No
To perform a what-if analysis of various scenarios	No	Medium	High
To publish a web page	No	Medium	Medium
To generate complex graphic designs and illustrations	No	No	No

Table 2. Hypothetical ratings for selected information system artifacts

All else being equal, the IS artifact rating would exhibit a positive relationship to information systems adoption and use. The reasoning for this proposition is as follows. Under ideal conditions, it is not difficult to imagine a single IS artifact providing all possible features, and serving as an all-purpose tool for individuals. Such an integrated all-purpose artifact would enable individuals to carry out all their context-specific tasks. For instance, an organization may implement an in-house solution to support all activities such as document creation, reporting, querying, communication, collaboration, etc., especially when all such activities are related to the primary responsibilities of individuals. In such a scenario, individuals may not have to rely on other systems. Furthermore, if such an integrated all-purpose IS artifact were indeed available, individuals are more likely to adopt and use such a system to accomplish their tasks. This can be attributed to two inter-related reasons. First, they would not need to adopt and use new systems since the integrated all-purpose artifact would be sufficient for their needs. Second, they do not have to spend resources learning new systems. Thus, an integrated all-purpose system, indicated by a higher IS artifact rating, is more likely to be adopted and used by individuals.

Proposition: *Ceteris paribus, the IS artifact rating is positively related to information systems adoption and use*.

Table 2 may be used to illustrate this point. Assuming numerical values of 0 (for No), 1 (for Low), 3 (for Medium), and 5 (High), the “IS artifact rating” measures for the three artifacts on Table 2 would be 8 for the email system, 21 for the database system, and 36 for the custom system. According to the proposition above, users are more likely to adopt and use the custom system since its rating is higher than the other two systems (due to the superior capabilities provided by the custom system). This scheme enables the IS artifact to be more directly

considered in theorizing information systems adoption and use, by actually incorporating the capabilities of IS artifacts that are available to users. Figure 2 presents this alternate view of dealing with IS artifacts in understanding adoption and use.

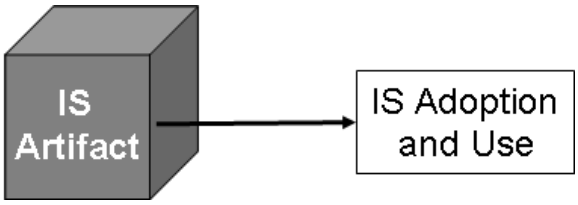

Figure 2. The proposed view of information systems artifacts

IMPLICATIONS

This research has two broad implications for research and practice. First, the IS artifact rating relies heavily on the enumeration of features and capabilities of IS artifacts. Table 1 lists only an illustrative set of features. Future research would be required to finalize the list of features that may be used to obtain the IS artifact ratings. Second, the IS artifact rating is expected to be positively related to information systems adoption and use. While such expectations are based on *ceteris paribus* considerations, the impact of the artifact rating is also likely to be affected by contingencies such as voluntariness of the adoption context, non-availability of comparable systems, etc. Future research should also examine contingent explanations of artifact rating in information systems adoption and use.

CONCLUSION

In contrast to extant views of the IS artifact as a blackbox, the paper argues for a more direct treatment of the IS artifact in research on information systems adoption and use. By opening the blackbox of the IS artifact, the paper proposes “IS artifact rating” as a measure of the features

and capabilities of the IS artifact. The measure relies on the enumeration of all features and capabilities provided by IS artifacts such that any IS artifact can be rated using the same measure. This allows the IS artifact to be more directly incorporated in theorizing information systems adoption and use.

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