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Abstract

Technology Acceptance Model (TAM) has been extensively studied in the MIS area. Like other theories, TAM has its limitations. First, it assumes only voluntary acts of users. Second, it addresses technology use only in the individual level. The purpose of this paper is then to discuss various theories from different areas (i.e., organizational theory, marketing, and strategy) to suggest that some existing theories would have theoretical and practical usefulness in explaining technology use. Drawing on the Astley and Van de Ven (1983)'s framework, this paper categorizes some selected theories into four categories based on two dimensions: organizational/individual levels and the extent of voluntarism/determinism in technology acceptance and discuss some implications of each of these categories for future MIS research.

Introduction

Many studies on the use of technology have focused on the analysis of individual-level phenomenon; for example, Technology Acceptance Model (TAM) has widely been adopted to predict user's acceptance of certain information systems or technology. Although TAM has showed a strong predictive power (Venkatesh and Davis, 2000), its assumption that technology users would voluntarily accept a specific technology is not always held. Technology users may sometimes use certain technology even if they do not have positive attitudes toward the technology. It is not hard to imagine a situation where team's decision to use the technology or organizational policies may dominate individuals' attitudes or preference. It is also possible that users may not be able to use a certain technology, because they do not have access to the resources necessary for using the technology. For example, while stock trading over the Internet has become common in the United States, people in some underdeveloped countries in Africa would not be able to use the same technology because of lack of infrastructure for the technology.

While these examples clearly show that the acceptance of, and therefore the use of, a specific technology is more than an individual's discretion, theories addressing those contextual or situational factors have rarely been incorporated into the literature of technology acceptance. This paper is prepared to provide a preliminary theoretical framework that can address these factors by reviewing some theories that come from other disciplines yet have ample implications for future research on technology acceptance/use. In reviewing those theories, we focus on two dimensions: organizational/individual level (level of analysis) and the extent of voluntarism/determinism in technology acceptance. As will be discussed, TAM literature has focused only on voluntary technology acceptance at the individual level.

This paper is organized as following. First, the literature on TAM is reviewed. Second, the framework that categorizes theories based on the level of analysis and the extent of voluntarism/ determinism is presented. Third, interactions across levels of analysis are discussed. Finally, conclusions are made.

Current Literature on Technology Acceptance Model

TAM has been widely used to explain why users accept and use a certain information system or technology. TAM is rooted back to a prominent marketing theory, namely Theory of Reasoned Action (Fishbein & Ajzen, 1975). TRA focuses on behavioral issues of consumers. TRA posits that *actual behavior* is determined by an *intention* to perform such a behavior. The intention

is a function of *attitude* toward such a behavior and *subjective norms*. Attitude, in turn, is influenced by *salient beliefs* and *evaluation of outcomes*, while subjective norms are influenced by *normative beliefs* and *motivation to comply*.

Davis (1989) and Davis, Bagozzi, and Warshaw (1989) used TRA to explain user acceptance of information systems. However, TAM differs from TRA in that TAM eliminates subjective norms and adding two constructs that are treated as salient beliefs (i.e., perceived usefulness and perceived ease of use). TAM has been studied extensively and used to explain why certain information systems are adopted. For example, TAM has been employed in predicting web usage (Lederer et al., 2000), microcomputer usage (Igbaria et al., 1995), e-mail usage (Szajna, 1996; Gefen & Straub, 1997), and computing resource center (Taylor & Todd, 1995). In seeking the answers for the question, this body of literature focused on a certain type of information systems used that was resulted from voluntary acts of users. In other words, the users were allowed to choose to (or not to) use the information systems.

In spite of the difference, TAM inherits the limitations of TRA in explaining technology acceptance. Both theories assume a voluntary act of a user (or consumer in TRA). However, this assumption may not hold, when some external forces, such as forces from top management, industries, laws, have significant influence on the users' behavior. When use of a certain type of information systems is mandatory, users' attitude toward the systems may not matter as much as TAM predicts (Jackson et al., 1997; Venkatesh & Davis, 2000).

Another limitation of TAM is that it only addresses information system usage at an individual level. It omits the fact that technology usage may be determined by organizational policies, strategies, and/or social norms. Zammuto and O'Conner (1992) and Daft (1998) agreed that organizational structures, strategies, and technology used must be co-aligned, and if an organization fails to do so, it will result in a poor organizational performance. If this is a case, then users may be required to use only the system that aligned well with organizational structures and strategies, regardless of the users' attitude toward the system. Therefore, one should not ignore the role of organizational strategies and structures that affects individuals' impacts the technology usage. The later section will discuss theories that can be used to explain the technology usage different levels of unit of analysis.

A Framework of Theories Capable of Explaining Technology Use

Acknowledging the limitations of TAM mentioned in the above section, herein alternative theories explaining the technology use are discussed. Based on Astley and Van de Ven (1983)'s framework, the theories can be categorized into four types (see Figure 1).

Astley and Van de Ven's framework is based on two dimensions, namely the level of organizational analysis and the extent of determinism/voluntarism of human nature. The focal point of their framework is an individual organization; therefore, the levels of analysis in the framework are organizational and inter-organizational levels (the terms they used for the levels of analysis were 'micro' and 'macro' levels, respectively).

However, to fit with the context of technology use, this paper makes an adjustment to the framework by substituting an individual for an organization as an analysis unit. Two dimensions are used to categorize the theories: organizational/individual levels of unit of analysis and deterministic/voluntaristic assumptions of the theories. To study technology usage, one should examine both individual and organizational impacts on the usage. An individual decision to use a system is important to the extent that the individual is allowed to freely choose to (or not to) use the system. On the other hand, an organizational impact on a system and technology usage is also important in that it encourages (or, in some cases, forces) or restrains the use of a certain technology to secure the co-alignment of strategy, structure, and technology to achieve a higher organizational performance.

The *deterministic view* is based on the general system theory, which stresses the need to identify a system boundary (Bertalanffy, 1951). Once the boundary is identified, one can distinguish the externality vis-à-vis internality. The deterministic view assumes that a system behavior is caused by forces beyond a system boundary—externality. In other words, the system is reactive to adapt to its environment. In contrast, the *voluntaristic view* suggests that the general system theory may not be applied to an organization because of the following reasons. First, general system theory's explanatory power is limited only to a naturally occurred system. However, an organization is not a naturally occurred system, but contrived by human (Katz & Kahn, 1966). Second, an organizational movement is not always determined by external forces. Rather, an organization can sometimes take a proactive action.

The combination of these dimensions establishes four categories as shown in the figure 1. Although we acknowledge that classifying various perspectives into dichotomous categories may be an oversimplification and that the demarcation among the

categorizes is not actually as clear as it sounds (Astley & Van de Ven, 1983), it is our intention that this categorization can help researchers to recognize some gaps missing from the current TAM literature.
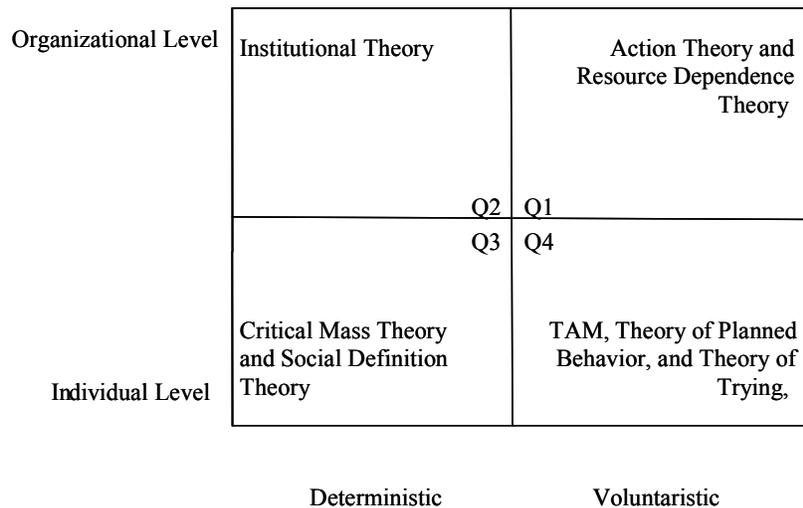
Organizational Level	Institutional Theory	Action Theory and Resource Dependence Theory
	Q2 Q1	
	Q3 Q4	
Individual Level	Critical Mass Theory and Social Definition Theory	TAM, Theory of Planned Behavior, and Theory of Trying,

Deterministic   Voluntaristic

Figure 1. A Framework of Theories Capable of Explaining System and Technology Usage

Q1: Voluntarism and Organizational-Level Unit of Analysis

In this quadrant, an organization takes a proactive action by adopting a technology, which is expected to bring a strategic advantage to the organization. Theories in this quadrant disagree with the system approach, which views that a system is determined by its environment. Rather, they maintain that environment can be changed and manipulated by an organization to achieve its goals (Pfeffer & Salancik, 1978; Astley &Van de Ven, 1983). Two theories fall within this quadrant: action theory and resource dependence theory.

Action Theory
Action theory was based on an "action of frame of reference" (Silverman, 1970). This theory is opposite to the system approach in that it views organizational decisions as voluntary actions. The premise of this theory is that "organizations are continuously constructed, sustained, and changed by actors' definitions of the situation—the subjective meanings and interpretations that actors impute to their worlds as they negotiate and enact their organizational surroundings" (Child, 1972; Astley and Van de Ven, 1983).

Action theory can be applied to the context of technology use. An organization may decide to use a certain technology as its strategic weapon to manipulate its environment such as customers, competitors, and suppliers. For example, several large insurance companies have used a customer-oriented financial-planning support system, which was a system to provide information in a rapid manner to fit with the rapidly changing environments. This system became a barrier to entry to the industry, blocking new competitors to enter the market (Porter, 1979).

Resource Dependence Theory
Resource dependence theory was inspired by the fact that any organization tries to avoid uncertainty (Daft, 1998). The theory asserts, "organizations depend on the environment but strive to acquire control over resources to minimize their dependence" (Pfeffer & Salancik, 1978; Ulrich & Barney, 1984). This theory proposes two strategies to overcome the vulnerability to other organizations: *resource* and *power* strategies. Resource strategies suggest that an organization can avoid dependence on a resource by adapting the interdependent relationships. For example, instead of having a supplier-customer relationship a company can consider merging or signing contracts or agreements in order to reduce the uncertainty and to control the resource. Power strategies suggest that independent large companies (such as Wal-mart, GE, Procter and Gamble) have bargaining power over small companies. It has a greater bargaining power on prices over the manufacturers that want to distribute their products through Wal-mart than small retailers.

This theory can also explain technology use in organizations. A real-life example that can illustrate the practicality of resource dependence theory is the reservation system owned by American Airlines. In the late 1980s, the company tried to build its core competence over other competitors to reduce uncertainty by implementing its own sophisticated computerized reservation system, called SABRE. SABRE system supports more than 109,000 terminals at more than 25,000 locations in fifty countries, providing fares and schedules for 665 airlines, and handling more than 60 million transactions a day (Applegate et al., 1999: pp. 120). Smaller airlines that could not afford time and money to build such a sophisticated computerized reservation system expressed their desires to join partnerships with American Airlines and, thus, were becoming dependent on SABRE system. Therefore, their technology uses were forced by their competitor's strategy rather than a voluntary choice of users (Applegte, McFarlan, & McKenney, 1999).

Q2: Determinism and Organizational-Level Unit of Analysis

In this quadrant, an organizational action is viewed as being determined by its environment. That is, an organization takes a reactive action in order to adapt to changing environments. Although there is only one theory that falls into this category (i.e., the institutional theory), this theory has widely been used to explain why organizations adopt the forms that they do (Hall, 1987).

Institutional Theory

Institutional theory attempts to explain why organizations take the forms that they do and expects that organizations in the same industry would be getting homogenous through their attempts to reduce environmental uncertainty (Hall, 1987). The homogeneity of organizations is called "institutional isomorphism." While Scott (1987) suggests that various forces may lead to the institutional isomorphism, DiMaggio and Powell (1983) argued that coercive forces, mimicking successful organizations, and normative pressures are the most significant driving forces. Coercive forces are the forces from environments such as government regulations and cultural expectations, which can impose a certain type of values, norms, rules, and procedures on organizations (Hall, 1987). Alternatively, an organization may try to avoid uncertainty by imitating other companies facing (or having faced) the same situation. Finally, normative pressures can lead to institutional isomorphism, because the normative pressures, which reside in an organization, cause personnel in organizations in the same field to think alike through professional experience and education. Consequently, organizational forms, determined by personnel in the organizations, are then becoming more homogeneous due to the homogeneity of the ideas belonged to people in the same trade and professional associations.

In the context of technology use, companies may adopt a certain technology, just because they follow other companies in the same field (mimicking). When American Airline's SABRE system was turned out successful, United Airlines mimicked the strategy by building its own computerized reservation system—called APOLLO—just six months after SABRE had been launched (Applegate, McFarlan, & McKenney, 1999).

Q3: Determinism and Individual-Level Unit of Analysis

This quadrant includes those theories that stress the importance of social impact on individuals' actions. Two theories that have recently been employed in the MIS area are critical mass theory and social definition theory. These theories assume that individuals' behaviors are determined not only by their own beliefs and attitudes, but also by their peers, colleagues, society they live in, and the like.

Critical Mass Theory

While TAM assumes that an individual's technology use would by and large depend on his or her own decision, critical mass theory proposes a different explanation that since using technologies involve more than one person in terms of the result of the use as well as the use itself, an individual's technology use would be determined by the collective behaviors of the community to which an individual belongs (Markus, 1994). This theory maintains that a community's access to the resources necessary for technology use is as important as individuals' access (Allen, 1988; Markus, 1987, 1994). For example, when an organization uses IBM PC compatible computers organization-wide, an individual in the organization would not want to use Apple computer because of the compatibility issue, even if he or she were a strong supporter of Apple computer.

Social Definition Theory

Similar to the critical mass theory, social definition theory stresses the importance of the impact of social factors on individuals' behaviors (see Barley, 1986; Orlikowski and Robey, 1991; Poole & DeSanctis, 1992 for examples). Unlike the critical mass theory

focusing on communities' collective accessibility to a technology, however, this theory focuses on communities' acceptance of a specific technology based on the norms and beliefs. Social definition theory states that "members of social units (e.g., cultures, such as nations or organizations) are believed to develop shared beliefs about what a technology is good for in the process of using it" (Barley, 1986; Markus, 1994). Therefore, the appropriateness is judged by the social organization, not by individuals.

In the context of technology use, social definition theory would suggest that no matter what users' attitude toward a technology would be, the technology use is rather determined by the appropriateness of such a technology as viewed by the social actors working in the same organization. For example, the use of a group decision support system may not be viewed as appropriate in high power-distance culture because the anonymity feature of the system reduces the importance of the leader of a team (Watson, et al., 1994).

Q4: Voluntarism and Individual-Level Unit of Analysis

Theories in this quadrant have been studied quite extensively in the MIS area, particularly through the Technology Acceptance Model. Other theories, such as theory of planned behavior (TPB) and theory of trying, are extended from TRA. Since TAM has already been explained in the earlier section, this section only explains the remaining two theories.

Theory of Planned Behavior
TPB also predicts individuals' behaviors. However, it differs from TAM in that TPB adds another predictor to behavioral intentions, that is, perceived behavioral control. Perceived behavioral controls (PBC) reflect perceptions of internal and external constraints on behavior (Ajzen, 1991). PBC is a function of self-efficacy and facilitating conditions (Ajzen, 1991; Taylor & Todd, 1995). Self-efficacy affects PBC in such a way that it determines an individual's self-confidence in performing a certain behavior. Facilitating conditions reflect the availability of resources needed to perform a behavior. In the context of system and technology usage, facilitating conditions can be in forms of resource or technology facilitating conditions (Taylor & Todd, 1995). For example, a user may not use a certain technology either because he/she does not have an access to the technology (resource facilitating condition) or because he/she does not have the skill to use the technology (self-efficacy).

Theory of Trying
Although this theory is also an extension of TRA and its predictive power has been tested in the marketing area (Bentler & Speckart, 1979; Bagozzi, 1981, Bagozzi & Warshaw, 1990), it has not been applied much in the MIS area. Theory of trying stresses the importance of the past experience of actual technology use that none of TRA, TPB, and TAM explicitly considers. The theory proposes that *frequency of past behavior* determines behavioral intentions to use a technology and actual behaviors. As for the frequency of past behavior, Bagozzi and Warshaw (1990) asserted that people are not always mindful in performing a behavior. Abelson (1976) and Langer (1976) stated that common behaviors are often mindless and that people's performance is likely determined by automated scripts formed through past behaviors.

The frequency of past behavior can be applied to the context of technology use. For example, users who have used a specific e-mail system very frequently are quite likely to continue using the email system anywise, regardless of their attitudes towards the system, because this approach requires much less cognitive resources to handle given environmental stimuli (Fiske & Taylor, 1991; Tetlock, 1992) than trying a new email system.

Discussion

Interactions Across Levels of Analysis

Although each quadrant is discussed separately for the sake of discussion, these categories may not clearly be split up. Rather, they are all interconnected and dynamically affecting one another. Interactions across different units of analysis in the context of technology use cannot be overlooked. Organizational-level decisions can influence individuals' actions and vice versa. Structuration theory in the context of technology use, introduced by Orlikowski, Yates, Okamura, & Fujimoto (1995), can be used to explain how these interactions may occur. They asserted that technology-use mediation structured users' use of technology by "influencing their interpretations and interactions, by changing the institutional context of use, and by modifying the technology itself." A technology-use mediation is defined as (Orlikowski et al, 1995):

> …deliberate, ongoing, and organizationally-sanctioned intervention within the context of use that helps to adapt a new communication technology to that context, modifies the context as appropriate to accommodate use of the technology, and facilitates the ongoing effectiveness of the technology over time…

In the same vein, institutional properties of an organization (e.g., division of labor, policies, and work processes) also influence individuals' technology use. They also found mediating activities, which intervened the interaction between individuals' technology use and institutional properties of technology use; they were *namely establishment, reinforcement, adjustment, and episodic change*.

By *establishing*, mediators propose a technology that would work well for a certain activities. Then, they promote the technology use by persuading management to adopt the technology as a standard operating procedure. Once the technology has been established, mediators can *reinforce* the technology use by helping users incorporate the technology, providing advice, and maintaining the operation of the new technology use. *Adjustment* involves refining particular uses of technology and altering some usage rules to promote the uses. Finally, an *episodic change* deals with redesigning of the system and technology usage and modification of institutional properties of the organization to facilitate the change in technology use.

However, the impact of organizational strategies is missing in Orlikowski et al.'s model. Their study focused mainly on the technology use resulted by the interaction between institutional properties and individual uses. With the aforementioned framework proposing that technology use is determined by multiple factors across different levels of analysis (both organizational and individual forces), this paper suggests that the theories in quadrant 1 and 2 should be incorporated into the body of technology acceptance and use literature so as to get a more complete understanding of the phenomenon.

Conclusion

This paper has introduced a number of theories that can be employed in future research on technology acceptance and use. Theories are categorized based on two dimensions: the level of analysis and the assumption of the theories (deterministic vs. voluntaristic). In doing so, this paper has focused on showing that technology use is not determined by a single source, but by several factors. Moreover, these factors are likely to interact across levels of analysis. Past literature on the technology-structuration theory focused on the relationships among institutional properties, individual actions, and technology. Nevertheless, a strategic movement of an organization—another source that determines technology use in an organization—is ignored in the technology-structuration model. Theories such as action theory, resource dependence theory, and institutional theory can be used to predict the technology use for a strategic purpose.

Theories discussed above can make important conceptual contributions to MIS future researchers. The framework introduces theories from marketing and organizational theories arenas and suggests that factors influencing technology use are in both organizational and individual levels. Although individuals' uses of technology has been studied quite massively in the MIS area, future studies that delving into the organizational level of analysis and studying the fit among these three factors that may have an effect on the technology use will expand our understanding the phenomenon of technology acceptance and use.

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