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User Participation and Technology Acceptance: Towards Ex-Ante Acceptance Predictions

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ABSTRACT

The current work is positioned at the point where *technology acceptance* research and *user participation in information systems development* research intersect. More specifically, this paper purports to achieve *three* objectives: (a) explain how technology acceptance determinants can be elicited from users during their participation in the ISD activities, (b) investigate the influence of user participation on these determinants, and (c) investigate if the elicitation of these determinants at early stages of the ISD is predictive of post-implementation usage behavior. To this end, the research recommends adding new categories to the traditional system development stages so as to elicit acceptance determinants. Ten hypotheses are advanced to investigate the ex-ante predictability of acceptance determinants and how user participation impacts them. The proposed model, through its robust theoretical foundation, holds the promise of predicting systems acceptance/rejection at early stages of the development process thereby increasing the likelihood of successful systems development.

Keywords

Technology acceptance models, ISD, user participation, system success.

INTRODUCTION

Industry reports (e.g., Standish Group) reveal that many information systems development (ISD) projects experienced serious delays and cost overruns. Even when finally completed and deployed, many of the newly developed systems failed to meet their intended goals and desired functionality. In many cases, such systems underwent drastic modification resulting in even further delays and cost overruns. In many others, such systems were deemed as failures and abandoned altogether.

Such problems and failure stories raise important questions about user acceptance of newly developed information systems: (a) must organizations wait till the systems are completely developed to assess whether they will be accepted or not? (b) how can organizations elicit and assess acceptance determinants at early phases of the ISD process? (c) in what ways, if any, does user participation in the ISD process influence acceptance determinants? and (d) is the measurement of these determinants at early phases of the ISD process predictive of post-implementation usage behavior?

The current work sets out to answer the aforementioned questions by drawing on *user participation in information systems development* research and *technology acceptance* research. The remainder of this paper is organized as follows: the next section presents the research background. The following section presents theoretical model development and hypotheses. The research summary and direction for future research are presented in the last section.

BACKGROUND

A plethora of studies have been conducted to investigate factors that influence the success/adoption of information systems. These studies can be collapsed into two distinct research streams: (a) research investigating the influence of user participation in the ISD process on systems success, and (b) research investigating the determinants of technology acceptance by the user community. Interestingly though, many studies within the *user participation* stream used the concept of *system acceptance*, the subject matter of the *technology acceptance* stream, as a surrogate measure of system success (e.g., Baroudi, Olson, & Ives, 1986; DeLone & McLean, 1992; Ives & Olson, 1984). Clearly, the two streams of research seem to overlap in that they are concerned with the same outcome criterion: system acceptance.

Evidence from the *user participation* research suggests that users who participate in the ISD process are likely to develop beliefs that a new system is good, important, and personally relevant and that such positive beliefs will lead to system use (Hartwick & Barki, 1994). Evidence from the *technology acceptance* research suggests that users who think that a system will help them attain gains in job performance are likely to have higher intentions to use the system and that such intentions will lead to system use (e.g., Davis, 1989; Venkatesh, Morris, Gordon, & Davis, 2003). Once again, it is clear that these two streams of research are closely related. Nevertheless, very little research has been conducted at their conjuncture. More

specifically, little is currently known about the ways in which user participation in the ISD process impacts users' perceptions of technology acceptance determinants. Furthermore, there is currently a lack of understanding about the stability (or the lack of it) of users' perceptions throughout the various stages of the ISD process and whether eliciting these perceptions at early stages of ISD is predictive of future usage behavior. The current work represents an effort towards filling this gap.

While some authors differentiate between the terms *user participation* and *user involvement*[1], for the purpose of this research, we use the term user participation, as encompassing all types of user involvement in the ISD process, be it hands-on or less direct. And though there have been some conflicting results in studies that investigated the impact of user participation on system success, Harris and Weistroffer (2009), in a comprehensive review of previously published research, concluded that the importance of user participation for system success has indeed been established.

The technology acceptance research has yielded many models (see Venkatesh, et al., 2003 for a review); the most influential of which is the Technology Acceptance Model (TAM) (Davis, 1989). Another prominent model is the Unified Theory of Acceptance and Use of Technology (UTAUT) which integrates elements from eight acceptance models (Venkatesh, et al., 2003). UTAUT posits that there are three direct determinants of intention to use an information system (performance expectancy, effort expectancy, and social influence) and two direct determinants of usage behavior (intention and facilitating conditions)[2]. Not surprisingly, UTAUT has significantly outperformed the eight individual models that it integrates with an adjusted R^2 of 69 percent.

Notwithstanding their parsimony, TAM and UTAUT suffer from a major shortcoming; their ex-post orientation of focusing on assessing post-implementation acceptance. By the time systems are deployed, large amounts of resources (e.g., human, financial, technical, and physical) have already been expended, making it impractical and cost-prohibitive to introduce major changes in systems design and functionality in the event that these systems are not accepted by the user community (Davis & Venkatesh, 2004). Clearly, there is a critical need to make ex-ante predictions about user acceptance. Figure 1 below illustrates the potential of ex-ante technology acceptance predictions. T_1 refers to a point in time where the requirement specifications of a system have been determined and documented but before any program code has been written. T_2 refers to a point in time when a videotaping of interface mock-ups is shown to the users. T_3 represents the traditional point in ISD when usability testing is conducted using a working prototype. T_4 represent a point in time where the actual system has been in operation and where users are supposed to have had hands-on experience with the new system for three months.

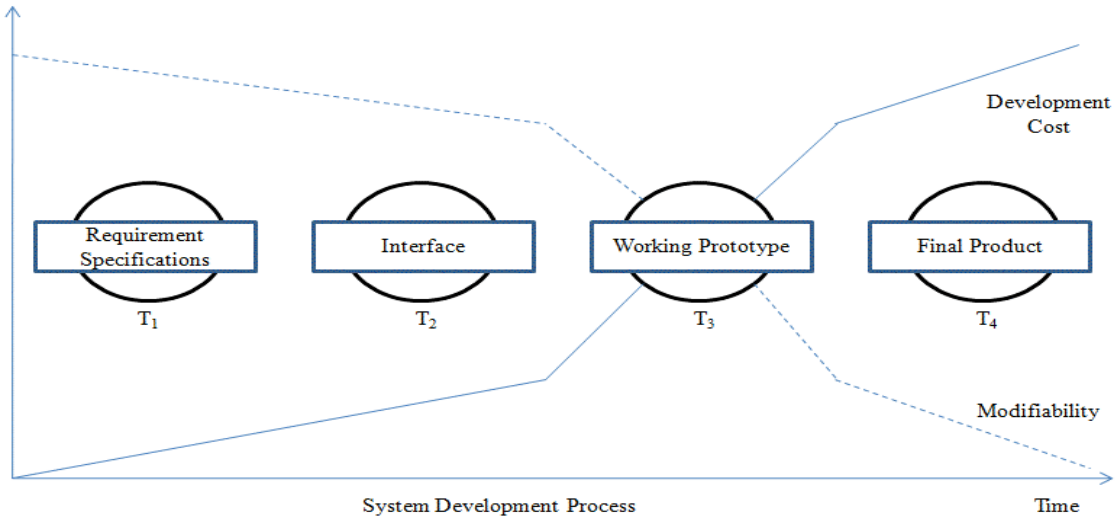

Figure 1: Ex-ante Technology Acceptance Predictions (Adapted from Davis & Venkatesh, 2004)

[1] Barki and Hartwick (1989) suggest that the term user participation should be used "when referring to the behaviors and activities that the target users or their representatives perform in the systems development process," and that the term user involvement "should be used to refer to a subjective psychological state of the individual and defined as the importance and personal relevance that users attach either to a particular system or to IS in general…."

[2] Consistent with Venkatesh et al. (2003), performance expectancy is defined as the degree to which an individual believes that using the system will help him or her to attain gains in job performance. Effort expectancy is defined as the degree of ease associated with the use of the system. Social influence is defined as the degree to which an individual perceives that important others believe he or she should use the new system. Facilitating conditions are defined as the degree to which an individual believes that an organizational (e.g., resources, incentives, etc.) and technical infrastructure (e.g., help desk) exists to support the use of the system.

The current work is different from Davis and Venkatesh (2004)'s study in at least three major ways. First, Davis and Venkatesh (2004) drew on TAM which posits two acceptance determinants whereas the current work draws on UTAUT which posits four acceptance determinants. Second, Davis and Venkatesh (2004) did not assess users' perceptions of acceptance determinants during the ISD process. Instead, they retroactively simulated the progression from a prototype to a final product and assessed users' perceptions after the fact that the users had hands-on experience with an existing system. Therefore, the predictions made in their study are not ex-ante in the actual sense of the word. In contrast, this research purports to elicit users' perceptions of acceptance determinants from users during their *actual* participation in the ISD process which allows for investigating the ex-ante predictability of these determinants. Finally, the current study intends to investigate the influence of user participation on acceptance determinants by assessing and contrasting the perceptions of participating and non-participating users. Davis and Venkatesh (2004) did not distinguish between the two groups of users and thus did not address whether or not user participation has an impact on users' perceptions of acceptance determinants.

THEORETICAL MODEL DEVELOPMENT AND HYPOTHESES

Theoretical Model

This research views user participation in ISD as the vehicle through which users' perceptions can be elicited. In particular, this research suggests that data about acceptance determinants be elicited from users in early stages of the ISD process, specifically at the requirement definition stage and the physical design stage. Data about performance expectancy, social norms, and facilitating conditions can be gathered by running focus groups where participating users are encouraged to talk about their opinions, feelings, and beliefs with respect to each determinant. Such data can be elicited by asking users questions whether they think the system will help them attain gains in job performance, whether they think they should use the system because a superior referent thinks that the system might be useful and thus they should use it, and whether they think that facilitating conditions exist to support using the system. Data about performance expectancy can be gathered by showing the users a videotaping of a mock demonstration of the proposed interface before usability testing.

A critical question that this research purports to answer is whether acceptance determinants, measured at different points throughout the ISD process, are stable over time. If users' perceptions remain stable over the course of the ISD process, then it follows that intentions measured at early stages of the ISD (i.e. T_1 and T_2) will not be significantly different from intentions measured at later stages (i.e. T_3 and T_4). This in turn would translate into early intentions being a good predictor of actual usage behavior (i.e. T_4).

Within the field of social psychology, empirical evidence indicates that when people form perceptions and intentions about a certain behavior, they do so by considering a set of information that is accessible to them at the time these perceptions are made (Schwarz, 2007). Further evidence suggests that any discrepancy between early measured intentions and subsequent behavior is caused by changes in perceptions (Fishbein & Jaccard, 1973). Changes in perceptions, in turn, are caused by either or both of two factors: the exposure to a different set of evaluative information and/or the occurrence of unexpected events (Davidson & Jaccard, 1979). To this end, the shorter the time interval between the measurement of intention and behavior, the lower the probability of exposure to new information and the lower the probability of occurrence of unexpected events; hence the lower the probability of perceptions to change.

Extrapolating to technology acceptance, the aforementioned evidence would suggest that users' perceptions and intentions to use systems will remain fairly stable over time unless a new set of information emerges and/or unexpected situational changes occur. This research contends that at T_1 (i.e. requirement specifications), there is sufficient information about the system functionality, the social influences, and the facilitating conditions, and that this set of information is likely to remain fairly constant in the short term. In light of this position, the current research theorizes that early perceptions, based on information accessible as early as requirement specifications, are not significantly different from perceptions measured at later stages in the ISD process and that early perceptions are good predictors of future intentions and future usage behavior. Consistent with Davis and Venkatesh (2004), this paper expects minimal information about effort expectancy at T_1. Instead, it contends that at T_2 (i.e. interface design), more information becomes available to users so as to form their initial beliefs with respect to effort required to use the new system.

Hypotheses

This research posits that acceptance measures taken at early stages of the ISD process (i.e. at T_1 and T_2) will approximate the prototype acceptance measures (i.e. at T_3), which in turn will approximate the post-implementation acceptance measures (i.e. at T_4).

Performance Expectancy

There exists substantial evidence in information systems research in support of a positive linkage between the *task-technology fit* (TTF) and the impact of IT on individual performance (e.g., Goodhue & Thompson, 1995). Furthermore, empirical evidence suggests that the narrower the gap between systems functionality and job tasks, the higher the performance expectancy (i.e. usefulness) of the systems (Davis, Bagozzi, & Warshaw, 1992). The current research argues that at T_1, user participants have sufficient information about the intended functionality and the information products (e.g. reports) of the new systems. This information, coupled with users' knowledge of the tasks the systems are intended to support, provides a solid foundation for forming users' beliefs and opinions regarding the TTF and the usefulness of the systems. Having taken this position, this research further contends that users need not have a direct hands-on experience with a working prototype in order to form such perceptions as to whether the systems are personally relevant and important to help them attain gains in job performance.

In addition, evidence from social psychology's attitude-behavior theories suggests that outcome expectancy perceptions remain fairly stable over time unless a new set of information emerges or unexpected situational changes occur. In the context of information systems development, information about systems functionality and job tasks is expected to remain relatively stable in the short term. As such, this research posits that performance expectancy, measured at requirement specifications, will not be significantly different from performance expectancy measured at later stages in the ISD and thus will be predictive of subsequent usage behavior. This suggests the following hypothesis:

> ***H1:*** *Performance expectancy based on user exposure to pre-prototype requirements specifications (i.e. at T_1) will be highly predictive of performance expectancy taken after significant hands-on experience with a working prototype having these specifications (i.e. at T_3).*

Research evidence suggests that users who participate in the system development process are likely to formulate beliefs that a new system is good, important, and personally relevant (Hartwick & Barki, 1994). While it seems tempting to expect users who participate in the systems development process to form positive beliefs about the extent to which they think the new systems will enable them to attain job performance, this research refrains from making such a directional prediction. If participant users perceive a system to be in poor fit with the tasks it intends to support, this could cause them to formulate more negative perceptions about its usefulness than non-participant users. This suggests the following hypothesis:

> ***H2:*** *Performance expectancy elicited from users who participated in the system development activities at T_1, T_2, and/or T_3 is significantly different from performance expectancy elicited from users who did not participate.*

Effort Expectancy

Empirical evidence in psychology and organizational behavior suggests that individuals' beliefs about their ability to perform a task are formed based on context-specific information accessed through direct behavioral experience (Bandura, 1982; Doll & Ajzen, 1992; Gist & Mitchell, 1992). In the absence of such direct experience, individuals tend to anchor their beliefs as to how easy or difficult performance of the behavior is to general information and beliefs regarding the target behavior. As they have direct behavioral experience, individuals adjust these perceptions to reflect the new information that became accessible to them through the direct experience (Tversky & Kahneman, 1974).

In information systems research, a central theme has been that users must have direct hands-on experience with a working prototype of a new system before they can provide assessments of systems ease of use. Empirical evidence suggests that in the absence of direct hands-on experience, user perceptions of effort expectancy are anchored to general beliefs regarding computers and systems use (Compeau & Higgins, 1995; Venkatesh & Davis, 1996). Further evidence indicates that as users have a direct hands-on experience with the new systems, the beliefs underlying their perceptions of effort expectancy would be adjusted to reflect the users interactive experience with the system (Venkatesh, 2000). Combined, these pieces of evidence suggest that effort expectancy perceptions are not temporally stable.

In light of the preceding discussion, this research posits that at T_1, participant users possess little, if any, information about the degree of ease associated with the use of the new systems. As more information becomes accessible to them through their exposure to visual interface mock-ups at T_2, they are expected to adjust their effort expectancy perceptions to reflect this new information. While this research recognizes that visual mock-ups lack the richness and dynamicity needed to capture the user interface experience as with interactive prototypes, it posits that such screen mock-ups are sufficient to offer an approximation of this experience. Having taken this position, this research expects effort expectancy perceptions based on visual mock-ups to be somewhat resembling of those based on direct hands-on experience with a working prototype (i.e. T_3). The following hypothesis is proposed.

***H3**: Effort expectancy based on user exposure to a visual interface mock-up (i.e. at T_2) will be moderately predictive of effort expectancy taken after significant hands-on experience with a working prototype (i.e. at T_3).*

As mentioned earlier, at T_1 there exists minimal information about the degree of ease associated with the use of the new systems. Therefore, participant and non-participant users alike are expected to anchor their perceptions about effort expectancy to their general beliefs regarding computers and systems use. At T_2, *participant* users, having been exposed to a mock demonstration of the new system, are expected to adjust their effort expectancy perceptions to reflect the new information resulting from this exposure. Non-participant users, however, are expected to continue to anchor their self-efficacy perceptions to general beliefs regarding computers and systems. The same thing can be said about T_3 when participant users have hands-on experience with a working prototype. Based on this, this research argues that at T_2 and T_3, participative users will have different levels of effort expectancy from non-participant users. At T_4, non-participant users, having used the new system for three months, are expected to adjust their effort expectancy beliefs to reflect their direct experience. Thus, their perceptions about effort expectancy are expected to have converged with those of participant users. This suggests the following hypotheses:

***H4a:** Effort expectancy elicited from users who participated in the requirement specifications (i.e. at T_1) is not significantly different from effort expectancy elicited from users who did not participate in the requirement specifications.*

***H4b:** Effort expectancy elicited from users who were exposed to a mock presentation of the proposed interface (i.e. at T_2) and/or had a hands-on experience with a working prototype (i.e. at T_3) is significantly different from effort expectancy elicited from users who did not participate in these activities, respectively.*

***H4c:** At T_4, effort expectancy elicited from users who participated in the systems development activities at T_1, T_2, and/or T_3 is not significantly different from effort expectancy elicited from users who did not participate in these activities.*

Social Influences

Within the field of psychology, a dominant view has been that the effect of social pressures on individuals' intentions to act is stable in the absence of direct experience (Doll & Ajzen, 1992). Consistent with this view, evidence from information systems research indicates that the effect of social influences on individuals' intentions to use the systems is stable prior to sustained systems usage (Thompson, Higgins, & Howell, 1994; Venkatesh & Davis, 2000). In a study to investigate the impact of user participation on system use, Hartwick and Barki (1994) found pre-ISD subjective norms to be predictive of pre-ISD intentions which in turn were found to predict post-ISD system use. This finding lends further support to the temporal stability of social influences in the absence of direct experience. In light of these findings, the current research argues that as early as T_1, there exists sufficient information to describe the social influences surrounding the workplace environment in general and the system development environment in particular. More importantly, it contends that in the context of information systems development, there is no reason to believe that the type of participative behavior, prior to sustained usage, would influence the accessibility or stability of social influences. The following is posited:

***H5:** Social influences measured at user exposure to pre-prototype requirements specifications (i.e. at T_1) will be highly predictive of social influences measured after significant hands-on experience with a working prototype having these specifications (i.e. at T_3).*

In addition to the previous argument, this research argues that whether they participated in the ISD activities or not, target users are likely to develop similar beliefs regarding the degree to which they perceive that important others believe they should use the new systems. With quite similar beliefs underlying their perceptions of the importance of the opinions of others, participant and non-participant users are expected to be equally inclined to accept or reject the new systems. We propose the following:

***H6:** Social influences measures elicited from users who participated in the system development process activities at T_1, T_2, and/or T_3 are not significantly different from social influences measures elicited from users who did not participate.*

Facilitating Conditions

Evidence from psychological literature suggests that a behavior may not occur if objective conditions in the environment impede it or make it hard to perform and that is irrespective of how high intentions are (Triandis, 1980). In the context of technology acceptance, there exists evidence to suggest that the facilitating conditions have a direct impact on systems use;

rather than on intentions (Thompson, et al., 1994; Venkatesh, et al., 2003) and that many aspects of the facilitating conditions are situation and context-specific (Thompson, Higgins, & Howell, 1991) as opposed to system-specific. This latter finding implies that users' perceptions of the facilitating conditions are anchored to contextualized beliefs regarding the existence (absence) of organizational and /or technological enablers (barriers) to systems use in the implementation environment. To this end, the current work argues that users need not have a direct hands-on experience in order to form their perceptions of the facilitating conditions and that the type of participative behavior has very little, if any, influence on the temporal stability of these conditions. Moreover, this research contends that as early as T_1, target users possess sufficient information about the facilitating or prohibiting conditions surrounding the organizational and the technical support environment. All this leads to the conjecture that perceptions of the facilitating conditions, measured at requirement specifications, are not significantly different from those measured at later stages in the ISD process and thus are predictive of subsequent usage behavior. This suggests the following hypothesis:

H7: *Facilitating conditions measured at user exposure to pre-prototype requirements specifications (i.e. at T_1) will be highly predictive of facilitating conditions measured after significant hands-on experience with a working prototype having these specifications (i.e. at T_3).*

Acknowledging the situational and temporally stable nature of the facilitating conditions, this research expects participant and non-participant users to develop similar beliefs regarding the degree to which they perceive that organizational and technical conditions exist to support or impede the use of the new systems. With their perceptions anchored to similar beliefs, participant and non-participant users are expected to be equally inclined to accept or reject the new systems. The following hypothesis is posited.

H8: *Facilitating conditions measures elicited from users who participated in the system development process activities at T_1, T_2, and/or T_3 are not significantly different from facilitating conditions measures elicited from users who did not participate.*

Behavioral Intention

UTAUT posits that behavioral intention to use a system is a function of performance expectancy, effort expectancy, and social influences. Numerous studies within the technology acceptance research found performance expectancy (perceived usefulness in TAM) to be the strongest determinant of behavioral intention (e.g., Davis, 1989; Venkatesh, et al., 2003). Drawing on this finding, and the availability of information about performance expectancy and social influences at early stages of the ISD process, we posit that users do not need to have a direct hands-on experience with a working prototype to formulate their beliefs and perceptions regarding these two determinants. Given that user perceptions of performance expectancy and social norms are expected to remain relatively stable over time, we expect that behavioral intention, formed based on these perceptions, to be temporally stable as well. Thus, we posit that behavioral intention to us a system, measured at T_1 (i.e. requirement specifications), will not be significantly different from behavioral intention to use measured at later stages of ISD and thus will be predictive of subsequent usage behavior. We propose the following:

H9: *Behavioral intention taken at user exposure to pre-prototype requirements specifications (i.e. at T_1) will be highly predictive of behavioral intention taken after significant hands-on experience with a working prototype having these specifications (i.e. at T_3).*

In the preceding discussions, we expected users who participate in the ISD process to form beliefs and perceptions regarding effort expectancy and social influences that are not significantly different from those formed by non-participant users. While it seems tempting to expect both user groups (i.e. participant and non-participant users) to have similar intentions to use the new systems, the difference in their perceptions of performance expectancy (see H2) should not be discounted especially that performance expectancy is the single most important determinant of behavior intention. The following competing hypotheses are posited:

H10a: *Behavioral intention measures elicited from users who participated in the system development activities at T_1, T_2, and/or T_3 are not significantly different from behavioral intention measures elicited from users who did not participate.*

H10b: *Behavioral intention measures elicited from users who participated in the system development activities at T_1, T_2, and/or T_3 are significantly different from behavioral intention measures elicited from users who did not participate.*

SUMMARY AND CONCLUSION

We began this research by noting that despite the apparent overlap between user participation and technology acceptance streams, very little research has been conducted at their conjuncture. More specifically, there has been no comprehensive effort to investigate the ways in which user participation in ISD impacts users' perceptions of acceptance determinants and whether eliciting these perceptions at early stages of the ISD process is predictive of future usage behavior. The purpose of this paper has been to fill these gaps in the literature.

This research is still in an early stage. We plan to empirically investigate the 10 hypotheses set forth herein. Upon its completion, this research will contribute to the current body of knowledge in two major ways. First, it provides a way for researchers to understand the influence of user participation on acceptance determinants. Second, once the ex-ante predictability of technology acceptance has been validated, it provides practitioners (managers and developers) with a much needed tool to assess the likelihood of acceptance for new systems early in the ISD process and well before significant resources (time, money, effort) have been expanded. Equipped with a plausible prediction of future usage behavior, managers can decide whether or not to go ahead with the project. If the project is to be pursued, managers can proactively design interventions to generate positive perceptions towards the new system and thus increase the likelihood of its acceptance.

In the end, it is our hope that the discussion and ideas presented in this paper will simulate interest and research incorporating acceptance determinants into the ISD process.

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