Examining User Acceptance of COPLINK Technologies by Law Enforcement Officers: A Survey Study

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Abstract

This study purports to develop and empirically examine a model for explaining technology acceptance decisions by individual law enforcement officers. Specifically, we describe the research model and hypotheses, detail our study design, and highlight important results from a pretest study that included 42 detectives and police officers from the Tucson Police Department (TPD). Based on the pretest results, our survey instrument exhibited satisfactory validity and reliability. A large-scale empirical examination of the proposed model is currently under way, targeting several hundred police officers and detectives at TPD. Results expected from this large-scale survey will contribute to technology acceptance/adoption research, particularly in law enforcement settings. In addition, findings anticipated from the study will also shed lights on the probable areas that hinder technology acceptance/use, thus providing a necessary foundation upon which effective implementation management strategies and organization intervention mechanisms can be developed to foster technology acceptance and use by individual law enforcement personnel.

1. Introduction

The COPLINK project was initiated and undertaken by the Artificial Intelligence Lab at the University of Arizona in collaboration with the Tucson Police Department (TPD). The overarching goal is to develop and deploy regional law enforcement information sharing and investigative technologies. Initially funded by NIJ and subsequently supported by the National Science Foundation (NSF) through its Digital Government Initiative, the COPLINK project currently delivers two distinct but complementary applications for law enforcement officers: COPLINK Connect and Detect. COPLINK Connect enables detectives and police officers to access data in other jurisdictions or government entities, regardless of geographic dispersion or system heterogeneity. COPLINK Detect extends the capabilities of Connect by supporting individual officer's analysis of sophisticated criminal links and networks, using integrated and shared data. As the project advances, a large-scale technology deployment in TPD and other jurisdictions in the state of Arizona and Texas are currently underway, making technology implementation management increasingly critical. In response, we examine the acceptance of COPLINK by individual law enforcement officers immediately upon their completion of the COPLINK training. Synthesizing relevant previous technology acceptance/adoption research and the unique characteristics of the target law-enforcement settings, we have developed a model that explains and therefore predicts individual officer's technology acceptance decisions.

The theoretical premises of our model are established using several prevalent intention-based theories, including the Theory of Planned Behavior (Ajzen, 1991) and the Technology Acceptance Model (Davis, 1989). Consistent with the findings from prior research, our model encompasses several dimensions crucial to individual law enforcement officer's acceptance of COPLINK; i.e. the technological, social, and implementation contexts. Our analysis of the technological context focuses on the identification of key technology-related factors and their determinants; e.g., the technology's usefulness, ease of use,

interface quality, and connectivity to external data sources. The locus of the social context analysis is examining the prevailing sources of social influences on individual's technology acceptance decisions; e.g., supervisors and peers. We investigate the implementation context by examining an adopter organization's internal conditions that are likely to significantly affect individual technology acceptance; e.g., computing equipment availability, training, and in-house technical support.

2. Literature Review

The Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB) are two prevalent theories for explaining an individual's technology acceptance/adoption decision. Both models were adapted from the Theory of Reason Actions (TRA) (Fishbein and Ajzen, 1975), which suggest that an individual's beliefs influence his or her attitude, which joins subjective norms in shaping the behavior intention that ultimately guides or dictates the actual behavior. The direct causal link from behavioral intention to actual behavior is theoretically justified and has accumulated ample empirical support.

TAM (Davis, 1989) is specifically designed to explain or predict the individual-level technology acceptance, across a wide range of computing technologies and user groups. According to TAM, an individual's technology acceptance/adoption decision is determined by his or her behavior intention which is largely underpinned by his or her attitude toward the technology. In particular, TAM theorizes that attitude is determined by beliefs towards a technology's usefulness and ease of use, as perceived by an individual. Perceived usefulness refers to an individual's perception that using a particular technology will increase his or her job performance. Perceived ease of use, on the other hand, refers to the degree to which an individual expects his or her use of the technology to be free of effort. A review of previous studies suggests that TAM has emerged to be a dominant model for individual technology acceptance/adoption, with fairly strong empirical support. Nonetheless, several recent studies that used the TAM as a theoretical foundation or framework suggest the need for extending the TAM model by incorporating additional constructs (i.e., factors) for improved explanatory utilities.

Similarly, TPB (Ajzen, 1991) posits that actual behavior is determined by intention which, in turn, can be explained by attitude, subjective norms, and perceived behavior control. TPB extends from TRA by including perceived behavior control to account for situations where an individual lacks the control, capability or resources necessary for performing the behavior under examination. Specifically, perceived behavior control refers to an individual's perception of his or her degree of control over a target behavior. Understandably, an individual endowed with sufficient control, capability, opportunities or resources is likely to form a positive or favorable attitude toward accepting/adopting the technology under discussion. In contrast to TAM's designated technology orientation, TPB is general and has been applied to explain a wide array of human behaviors. From a technology acceptance perspective, effective applications of the TPB may require model modification or extension.

Sharing the common attitude-intention-behavior thread, TAM and TPB are largely compatible and their respective explanatory/predictive power may be augmented by including relevant constructs from other theories or models. For instance, the TAM2 model proposed by Venkatesh and Davis (Venkatesh and Davis, 2000) extends the original TAM by incorporating subjective norms and cognitive instrumental processes in the model. A recent study by Mathieson et al. (Mathieson, et al., 2001) extended TAM by including perceived user resources in their model specification. Broadly, perceived user resources denotes the particular personal or organizational barriers an individual perceives regarding his or her use of a technology and hence can be viewed as a specialized subset of PBC (from the TPB). Similarly, Taylor and Todd (Taylor and Todd, 1995) have proposed a decomposed TPB model which contains detailed constructs operationalized for technology acceptance/use. A review of the relevant literature suggests that constructs from different theories or models, when adequately integrated, may provide a more detailed explanation to individual technology acceptance decision-making in various organization or implementation settings.

3. Research Model

Our research model integrates the constructs from TAM and TPB and is specifically tailored for law-enforcement settings. As shown in Figure 1, the model is fairly comprehensive, consisting of 20 constructs (i.e., factors) pertaining to the technological, the social, and the implementation contexts. The following describes the model details and our research hypotheses.

Technological Context: Anchoring at TAM constructs, the technological context is primarily consists of perceived usefulness and perceived ease of use of COPLINK. Based on findings from interviews with multiple law enforcement officers, we have identified important determinants of perceived usefulness and perceived ease of use, including job relevance, output quality, result demonstrability, external data exchange, efficiency gains, and self-efficacy. Most of these determinants are consistent with those reported by prior studies. For instance, Venkatesh and Davis (Venkatesh and Davis, 2000) have suggested job relevance and output quality to be important determinants of perceived usefulness. In our case, job relevance refers to an individual law enforcement officer's perception of the degree to which COPLINK is applicable to his or her job. Output quality means an individual law enforcement officer's perception of his or her task performance directly resulting from the use of COPLINK. Venkatesh and Davis (Venkatesh and Davis, 1996) also discussed the importance of efficiency gains in individual's constructing perceptions about a technology's usefulness. Basically, efficiency gain refers to the degree an officer perceives his or her efficiency improves through the use of COPLINK. In addition, Moore and Benbasat (Moore and Benbasat, 1991) explicitly singled out result demonstrability to be a critical factor for information technology adoption by individuals. In our case, result demonstrability refers to an individual law enforcement officer's perception of the tangibility of the results from using COPLINK.

Based on the unique characteristics of law enforcement settings, additional constructs have also been identified to be important determinants of perceived usefulness. For example, we included in our model a new construct, external data exchange, which refers to a law enforcement officer's perception regarding his or her access to information from relevant external sources via the use of COPLINK. Compatibility is also relevant in our context (Chau and Hu, 2001) and refers to the degree to which COPLINK is perceived by an individual law enforcement officer to be consistent with the existing value and/or his or her past experiences and needs (Rogers, 1995). Furthermore, self-efficacy may also significantly affect an individual's perception about a technology' usefulness. By and large, self-efficacy refers to an individual law enforcement officer's self-judgment of his or her capability for using COPLINK (Campeau and Higgins, 1995). Therefore, we test the following hypotheses.

H1 *The level of job relevance of COPLINK as perceived by a police officer will positively affect his or her perceived usefulness of COPLINK.*

H2 *The level of output quality of COPLINK as perceived by a police officer will positively affect his or her perceived usefulness of COPLINK.*

H3 *The level of result demonstrability of COPLINK as perceived by a police officer will positively affect his or her perceived usefulness of COPLINK.*

H4 *The level of compatibility of COPLINK as perceived by a police officer will positively affect his or her perceived usefulness of COPLINK.*

H5 *The level of external data exchange of COPLINK as perceived by a police officer will positively affect his or her perceived usefulness of COPLINK.*

H6 *The level of efficiency gain of COPLINK as perceived by a police officer will positively affect his or her perceived usefulness of COPLINK.*

H7 *The level of self-efficacy of using COPLINK as perceived by a police officer will positively affect his or her perceived usefulness of COPLINK.*

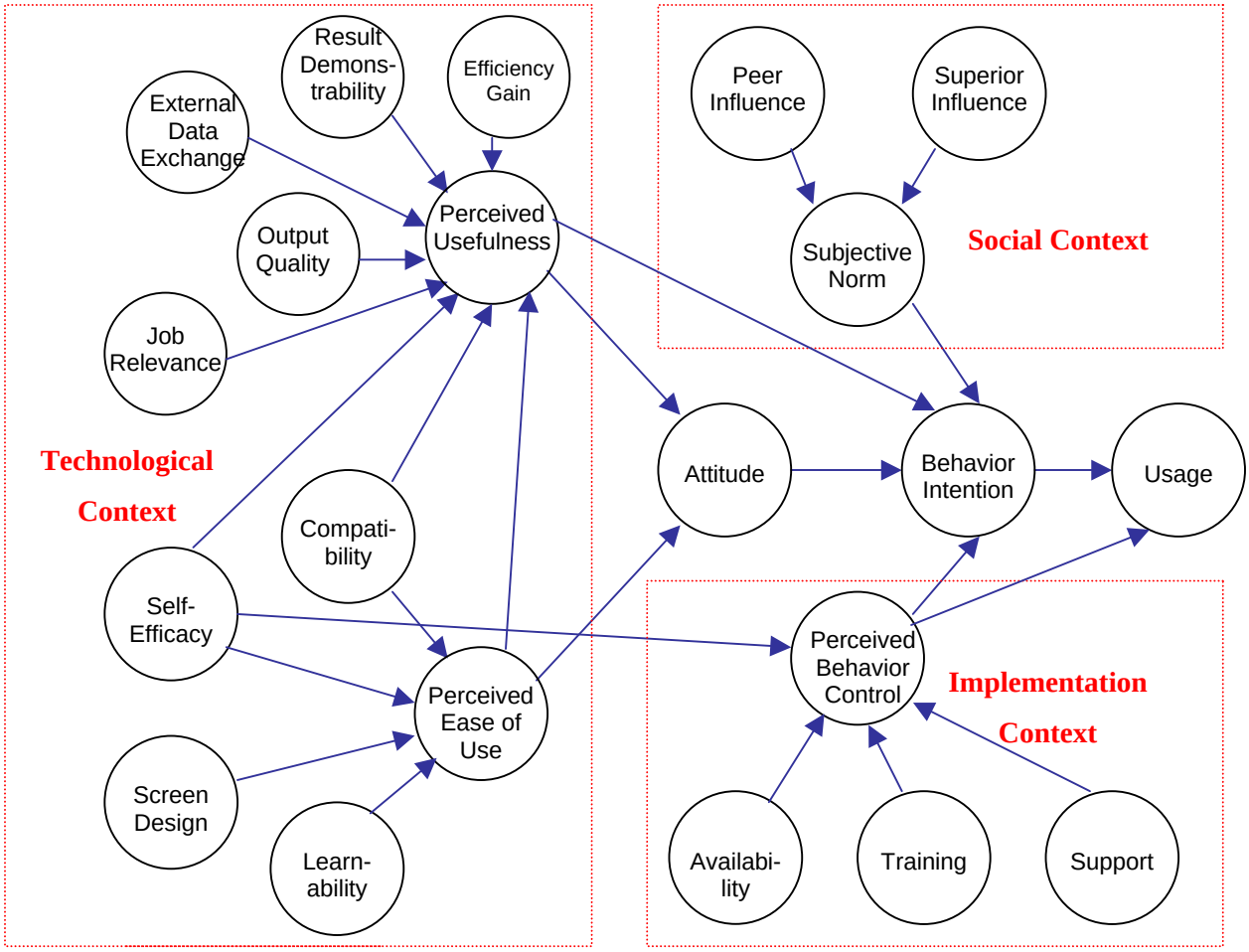

Figure 1: Research Model

As a group, law enforcement officers may not be particularly technologically savvy and thus are likely to be concerned about issues related to a technology's ease-of-use and usability. The usability of COPLINK was examined in our previous investigations (Hauck, et al., 2001); however, the linkage between usability and technology acceptance had not been evaluated systematically. Dillon and Morris (Dillon and Morris, 1998) discussed the technology usability-acceptance/adoption gap and advocated their P3 model. A recent study by Hong, et al. (Hong, et al., 2001) suggested that screen design was a prevailing system characteristic and had significant effects on a technology's ease of use as perceived by individual users. Learnability (Lin, et al., 1997) is also relevant to perceived ease of use and refers to the attributes of a technology that bear on an individual user's effort for learning its operations or applications. Findings from several recent empirical studies also suggest computer self-efficacy to be a key determinant of perceived ease of use; e.g., Venkatesh and Davis (Venkatesh and Davis, 1996). Lastly, it has also been shown that compatibility of the adopting technology with respect to current work practices can affect perceived ease of use (Chau and Hu, 2001). Hence, our model includes the following hypotheses.

H8 *The level of screen design quality of COPLINK as perceived by a police officer will positively affect his or her perceived ease of use of COPLINK.*

H9 *The level of interface learnability of COPLINK as perceived by a police officer will positively affect his or her perceived ease of use of COPLINK.*

H10 *The level of self-efficacy of using COPLINK as perceived by a police officer will positively affect his or her perceived ease of use of COPLINK.*

H11 *The level of compatibility of COPLINK as perceived by a police officer will positively affect his or her perceived ease of use of COPLINK.*

The Implementation Context: According to TPB, perceived behavior control refers to an individual law enforcement officer's perceptions of the presence or absence of requisite resources, opportunities and facilitating condition necessary for using COPLINK (Ajzen, 1991). As suggested by Mathieson, et al. (Mathieson, et al., 2001), the particular support and training available to a prospective user may have significant effects on his or her perception about technology control. In addition, the availability of computers for accessing COPLINK is also important, especially when considering the need for timely information access and sharing in police officers' tasks. Hence, we test the following hypotheses.

H12 *The level of perceived behavior control as perceived by a police officer will positively affect the intensity of his or her behavioral intention towards accepting COPLINK.*

H13 *The level of support as perceived by a police officer will positively affect the intensity of his or her perceived behavior control towards accepting COPLINK.*

H14 *The level of training as perceived by a police officer will positively affect the intensity of his or her perceived behavior control towards accepting COPLINK.*

H15 *The level of availability as perceived by a police officer will positively affect the intensity of his or her perceived behavior control towards accepting COPLINK.*

The Social Context: The social context describes the external influences produced by a social system (e.g., a law enforcement agency) that may significantly affect individual officers' technology acceptance decision-making. In our case, subject norms are important and generally refer to an individual officer's perception of relevant others' opinions on whether or not he or she should use COPLINK (Fishbein and Ajzen, 1975). In a typical law enforcement agency, individual officers operate around a defined chain of command that is deeply entrenched in their task performance, coordination and collaboration. At the same time, individual officers often team up for task planning, execution and contingency management and therefore may have developed a relatively strong bond with their colleagues. Hence, external influences on individual technology acceptance conceivably may come from different sources, particularly superiors and peers. Taylor and Todd (Taylor and Todd, 1995) have suggested differentiating the influences from supervisors and those from peers. In our context, superior influence refers to an individual law enforcement officer's perception of his or her supervisor's opinions on whether or not he or she should use COPLINK. Peer influences refer to an individual law enforcement officer's perception of his or her peer's opinions on whether or not he or she should use COPLINK. Thus, we test the following hypotheses.

H16 *The level of subjective norm as perceived by a police officer will positively affect the intensity of his or her behavioral intention to accept COPLINK.*

H17 *The level of peer influence as perceived by a police officer will positively affect the intensity of his or her perceived subjective norm towards accepting COPLINK.*

H18 *The level of superior influence as perceived by a police officer will positively affect the intensity of his or her perceived subjective norm towards accepting COPLINK.*

4. Research Design and Pretest Results

Our primary research methodology is a self-administered survey. Qualified subjects are individual officers at TPD who are target users of COPLINK and have recently completed the COPLINK training. We concentrated on technology acceptance which broadly refers to an individual's psychological state with regard to his or her voluntary or intended use of the technology under evaluation. In particular, we measured technology acceptance using individual police officer's intentions to use COPLINK. Choice of intention over actual usage for measuring technology acceptance is theoretically justifiable and practical, considering our target subjects have just completed COPLINK training and their immediate challenge in managing their experimentation with the technology and subsequent technology utilization.

The question items used to operationalize the constructs included in our model were primarily adapted from relevant literature, with minor wording changes appropriate for COPLINK and the target law enforcement setting. Specifically, items on perceived usefulness and ease of use were adapted from David (Davis, 1989), and Venkatesh and Davis (Venkatesh and Davis, 2000); items on compatibility and social influences were from Taylor and Todd (Taylor and Todd, 1995); and items on perceived behavior control were obtained from Mathieson (Mathieson, et al., 2001) and Taylor and Todd (Taylor and Todd, 1995). All items were measured using a seven-point Likert-type scale, with "strongly agree" on one end and "strongly disagree" at the other. To ensure desired balance and reduce potential monotonous responses, half of the question items were negated and all the questions were randomized in the final survey instrument.

The validity of an instrument may not be persistent across different technologies and user groups (Straub, 1989). We first examined our survey instrument's content validity which was evaluated at face value by three officers from different divisions in TPD. Upon establishing satisfactory content validity, the instrument was further examined using a pretest study that involved another 42 officers varying in ranks and divisions. Analysis of the pretest subjects showed a 70-30 ratio in gender distribution in favor of males; the majority of them were detectives from the TPD's Criminal Investigative Division (57%), followed by the police officers from the Field Operations Divisions (38%) and then the civilian crime analysts in other divisions (5%). Many of the pretest subjects had a 4-year college degree (37%), followed by those with an associate's degrees (34%) and then those with a high school diploma (29%). On average, these officers were 42.9 years in age and had 15.8 years of experience in law enforcement services. Most subjects (53%) used computers routinely at work and at home.

Based on responses from this pre-test group, the instrument's reliability was evaluated using Cronbach's alpha. A total of 16 of the 20 constructs showed an alpha value close to or greater than 0.70; thus suggesting the instrument appeared to exhibit an acceptable level of reliability. The remaining constructs showed an alpha value not distant from the 0.7 threshold suggested by Nunnally (Nunnally, 1978). In addition, we also performed exploratory factor analysis to examine the instrument's convergent and discriminant validity. Results were largely satisfactory, as suggested by the considerably higher loading between or among items that measured the same construct than those for measuring other factors.

5. Summary

As various IT applications specifically designed for law enforcement tasks and operations continue to be rapidly developed and implemented, investigations of technology acceptance/adoption decision-making by individual officers have become increasingly critical. The technology upgrade at the TPD is a case in point. In addition to deploying COPLINK solutions, TPD is currently engaged in numerous IT improvement projects that include the implementation of an Automated Field Reporting System (AFRS) and building wireless LAN's around its substations. These projects and others demand effective management of technology implementation. Established upon relevant technology acceptance/adoption theories, our model aims to explain and predict an individual law enforcement officer's acceptance of COPLINK technology. Results expected from the large-scale empirical study will contribute to technology acceptance/adoption research, particularly in law enforcement settings. At the same time, findings anticipated from the study will also identify probable barriers to technology acceptance/use, thus providing a necessary foundation upon which effective intervention strategies can be designed and implemented to overcome such barriers. For example, the management should consider placing a high priority on demonstrating and communicating the COPLINK output quality to target users during the implementation process, when perceived usefulness has been identified to be a significant factor for individual acceptance decisions and when Output Quality has been singled out as a key determinant for perceived usefulness.

A large-scale empirical evaluation of the proposed model is currently underway, targeting several hundred police officers and detectives at TPD. We expect to complete the data collection in early May

and will present important findings from this empirical study at the dg.o2002 National Conference for Digital Government Research.

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