

Technology Implementation Management in Law Enforcement: COPLINK System Usability and User Acceptance Evaluations

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Abstract. In this paper, we report on two user-centric evaluation studies of COPLINK, a suite of criminal data mining and knowledge management applications developed at the University of Arizona. Our evaluations concentrate on system usability and user acceptance in the law enforcement setting. Findings from our studies provide insights to digital government systems evaluation and also shed light on how government agencies can design management interventions that foster technology acceptance and use.

1. Introduction

In the rapidly moving field of digital government, investigations of system usability and user acceptance are essential. This paper describes the design and results of two user evaluations of COPLINK (Chen et al., 2003) that address the aforementioned technology implementation issues.

2. Literature Review

System usability and user acceptance have been identified as fundamental challenges to organizational technology adoptions. In a nutshell, usability engineering deals with how well an individual uses the functionalities of a system, using commonly-accepted usability criteria such as learnability, efficiency, memorability, errors, and satisfaction (Nielsen, 1994). On the evaluation front, Gediga et al. (2002) classified usability evaluation techniques into two types: descriptive and predictive. Descriptive techniques aim to describe the status and problems of a system. Predictive evaluation techniques then seek to uncover recommendations for future system development. Multiple instruments have been developed for descriptive usability evaluations, which include QUIS (Chin et al., 1988), SUMI (Kirakowski and Corbett, 1993) and IsoMetrics (Gediga et al., 1999). User technology acceptance, on the other hand, broadly refers to an individual's psychological state with regard to his or her voluntary and intentional use of a technology. An individual's acceptance of a technology can then be sufficiently explained by his/her underlying behavioral intention. Several theories that are anchored on behavioral intention have prevailed. These include the Theory of Planned Behavior—TPB (Ajzen, 1991), the Diffusion of Innovation Theory—DOI (Rogers, 1995), and the Technology Acceptance Model—TAM (Davis, 1989). Judged by its frequent use by prior studies, TAM has emerged as a predominant model for individual technology acceptance and offers a framework upon which extended models can be developed.

3. Usability Evaluation of COPLINK Agent

COPLINK Agent (Chau et al., 2001) is designed to provide information filtering and monitoring functionality for law enforcement personnel. This system also supports knowledge sharing by proactively identifying individual officers working on the same or related cases. Lastly, COPLINK Agent can deliver alert messages through a variety of communication channels that include e-mail, pager, and text messaging. In conjunction with the Tucson Police Department (TPD), we evaluated the effectiveness of a COPLINK Agent prototype in the summer of 2002. Details of our evaluation design and analysis follow.

Research Model and Data Collection: We evaluated the usability of COPLINK Agent by conducting a case study that triangulated multiple data collection methods, including usability a survey questionnaire, a structured interview, and analysis of archival data (e.g. summary of user-provided monitoring tasks and alert messages generated/disseminated by the system). Choices of our evaluation techniques were made

based on the previously identified usability goals. A total of fifteen detectives from TPD's Criminal Investigation Division participated in our evaluation of COPLINK Agent. Each participating officer who received alert messages sent by COPLINK Agent was asked to assess each alert's usefulness. He/she was also asked to provide a subjective rating of the alerts received, together with other relevant contextual information that included case type, search parameters used, reasons for creating a monitoring profile, usefulness of the alert messages received (if any), and follow-up actions taken for particular alerts. To gauge perceived or self-reported user satisfaction, we adopted the QUIS instrument.

Analysis Results and Findings: Overall, the subjects' ratings of the alerts averaged 5.5 on a 7-point scale (with 7 being the most useful). On the short-form of QUIS, subjects' responses averaged 5.5 for 27 items on a 7-point Likert scale (with 7 being the most useful). The positive assessments observed suggested a relatively high user satisfaction. A highly celebrated success story uncovered during our usability evaluation period is as follows: A crime analyst who pilot-tested COPLINK Agent had just added a monitoring task on a particular fraud suspect in the system. One day, she received an alert concerning the targeted suspect, who was reportedly using counterfeit money in a local convenience store. The officer was able to follow up with the case and subsequently obtained the video tape from the store's surveillance system. The alert has since led to two felony charges against this particular criminal on a federal level. Had the crime analyst not received the alert in a timely manner, she would have had to wait for several weeks to see the case report. By then, the critical video tape might have been destroyed because this convenience store keeps surveillance tapes for only 30 days. Overall, the system under evaluation appeared to be quite effective in connecting people together by creating a short and direct network path from detectives to field officers. A detective commented on the alert messages' usefulness, "COPLINK Agent is allowing us to respond to incidents we know are important that the field units perhaps don't realize in a timely manner." Most subjects shared this assessment. As noted by another officer, "COPLINK Agent is good because so many times we complain that we don't get information from the field. This way I know who ran (a query in our database on) someone and can inquire as to why."

4. Analysis of User Acceptance Decision-Making

Creating applications likely to be accepted by target users is critical to harnessing a new technology's potential. In the digital government context, examining individual users' technology acceptance is crucial and can shed light on the areas that require management interventions. In response, we developed and empirically examined a model for explaining law enforcement officers' acceptance of COPLINK.

Research Model and Data Collection: As shown in Figure 1, our research model has its theoretical premises from TPB and TAM. The model suggests that an individual officer's technology acceptance decision can be explained by factors pertaining to the technological, individual, and organizational contexts. Specifically, perceived usefulness, perceived ease of use, and efficiency gain are fundamental determinants of the technological context. Within a law enforcement setting, attitude is critical to the individual context. Subjective norm and availability are important characteristics of the organizational (implementation) context. Most of the constructs specified by the model were adopted from relevant previous research, supplemented by important user and technology characteristics identified through focus group discussions. We then empirically tested our model using a self-administered survey that involved more than 280 police officers. With the assistance of TPD management, questionnaires were distributed through the line of command using email attachments. Our subjects were individual officers from TPD who had been identified as target users of COPLINK and had previously completed the mandatory user training. Of the 411 questionnaires distributed, a total of 283 responses were received, showing a 68.9% response rate. Analysis of the respondents' gender distribution showed an approximate 4-1 ratio in favor of males. On average, the responding officers were 38.4 years of age and had 12.1 years of experience in law enforcement services. Comparative analysis of early versus late respondents showed no significant differences in dimensions such as age and years of experience in law enforcement.

Analysis Results and Findings: We tested our research model using LISREL. Analysis results showed our model exhibiting a reasonable fit to the data; e.g., Comparative Fit Index (CFI) being 0.91, Non-norm Fit Index (NNFI) being 0.89, and Standardized Root Mean Square Residual (SRMSR) being 0.06. We also assessed the model's explanatory power. As shown in Figure 1, our model exhibited satisfactory explanatory utility, accounting for 58% of the variances in intention, 66% of the variances in attitude, and 60% of the variances in perceived usefulness. Individual causal paths: Six of the nine hypothesized causal paths were significant statistically; i.e., p-value 0.05 or lower. As suggested by our analysis results, efficiency gain and subjective norm appeared to be significant determinants of perceived usefulness, which, in turn, showed a significant effect on both attitude and behavioral intention. Perceived ease of use significantly affected attitude, which, nonetheless, was not a significant determinant of intention. Additionally, subjective norm appeared to have a significant effect on intention, but in direct opposition to our hypothesis. The remaining hypothesized paths were not supported by our data; i.e., perceived ease of use on perceived usefulness, availability on intention, and attitude on intention.

Several implications for technology implication management can be drawn from our study. First, our study suggests a prominent core influence path from efficiency gain to perceived usefulness and then to intention to accept. Perceived usefulness may be the single most important driver in individual officers' technology acceptance decision-making. Based on our model testing results, perceived usefulness appears to be the only construct that has a significant direct effect on intention. The observed significance may suggest a tendency of an officer's anchoring his or her technology acceptance decision from a utility perspective. The discussed utility-centric view of technology is supported by the insignificant influence of perceived ease of use on perceived usefulness. Together, our findings suggest that a law enforcement officer is not likely to consider a technology to be useful simply because it is easy to use. Second, subjective norm appears to be an important technology acceptance determinant, judged by its total effect on behavioral intention. According to our analysis, subjective norm has a significant positive effect on individual acceptance decision-making but this effect may be mediated by other factors; e.g., perceived usefulness. Individual officers are likely to take significant referents' opinions into consideration when assessing a technology's usefulness. Nonetheless, such normative beliefs alone may not foster positive acceptance decisions directly. In effect, our analysis shows a negative effect of subjective norm on behavioral intention, significant at the 0.05 level. One possible interpretation is that an officer exhibiting a strong intention to use COPLINK may have developed a negative response to others' desire that he or she should accept the technology, and vice versa. The observed negative effect might be partially attributed to individual autonomy in law enforcement. Third, the influence of attitude on intention may be somewhat significant, as suggested by a p-value between 0.05 and 0.10. Perceived usefulness and perceived ease of use appear to be important determinants of an individual officer's attitude toward COPLINK and together explain a significant portion of the variances in attitude; i.e., 66%. Our finding suggests not to underestimate the importance of individual attitudes. In this vein, administrators and technology providers need to proactively facilitate the cultivation and development of favorable attitudes by individual officers, particularly by means of convincing demonstrations and unambiguous communication of a technology's utility and ease of use.

5. Conclusion and Acknowledgement

In light of the needs for homeland security, effective technology implementation by the concerned agencies is of foremost importance. Our analysis results provide government agencies and technology developers with valuable insights into specific areas and factors that are likely to affect technology usability and acceptance by targeted individual users.

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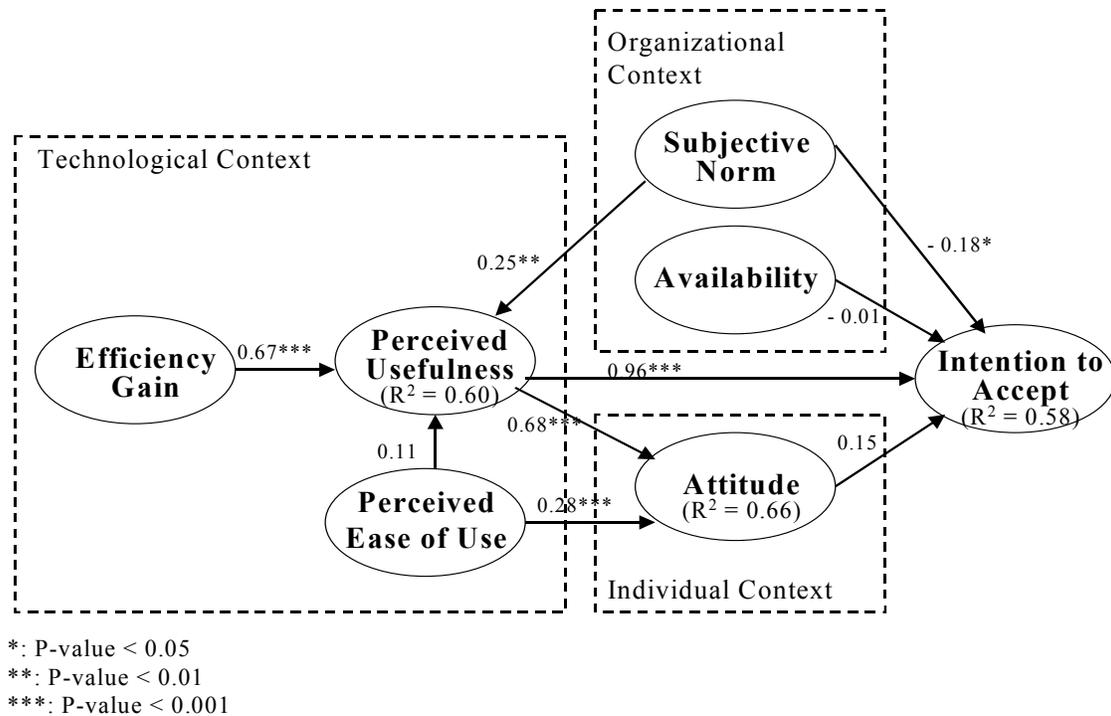


Figure 1: Research Model and Model Testing Results

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