Impact of Mobile Computing Terminals in Police Work

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A major metropolitan police department in the Northeast recently began using mobile-computing terminals (MCTs). This research explores how MCTs have improved critical factors that affect the work environment of the officers in the department, particularly related to deterrence and job satisfaction. A model for investigation is developed and tested using a survey instrument administered to officers using the MCTs. We find that MCTs have enabled better communication among officers and have increased the availability of information, both of which are found to have a significant positive impact on the officers’ job satisfaction. Savings in time from plate checks are found to have a significant impact on deterrence. However, though the availability of information from MCTs has a positive impact on deterrence, the relationship is not very significant.

mobile computing terminals, law enforcement, communication, information, time, deterrence, job satisfaction

The authors acknowledge the assistance of Pam Beal of the Center for Management Development and Captain Gerald Schoenle and Chief of Staff Kevin Comerford of the Buffalo Police Department for their assistance and feedback in this research. The research was partly supported by a grant from the Department of Justice. The research of H. R. Rao was also supported in part by National Science Foundation Grant No. 990735. We would like to thank the editor and the referees for their extensive comments which have significantly improved the article.

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1. INTRODUCTION

The concept of mobile computing involves the use of the Internet and Intranets for communicating and computing while on the move. Typically, mobile hosts are reduced versions of multipurpose computers, with small memory, relatively slower processors, and low-power batteries, and communicate over low-bandwidth wireless communication links. Developments in mobile computing, such as the rapid growth of mobile computing devices and expansion of mobile networks, are enabling the creation of a number of e-commerce applications. The Cellular Telecommunications and Internet Association (CTIA) predicts that due to the aggressive deployment of high-speed services, mobile data will reach nearly 60% of the U.S. population by 2007, up from its current 2% [1]. The Gartner group predicts that 40% of business–consumer e-commerce will come from smart phones and the CTIA expects that wireless phones, pagers, and modems will surpass PCs as the most popular Internet access devices.

The impact of mobile computing applications is being felt in a number of industries [2]. For example, mobile inventory management applications that track the location of goods and services are expected to help companies improve delivery times. For example, United Parcel Service recently invested approximately $100 million to upgrade their wireless systems to manage the movement of goods in warehouses. The utility of these applications may be gauged from the fact that the company expects the $100 million investment to pay for itself within 16 months [3]. Mobile distance education is one of the promising applications of mobile computing, and universities have begun implementing mobile infrastructures to help students get access to academic databases anywhere on campus [4]. On a more advanced scale, product-locating applications are being developed to help consumers locate nearby vendors of specific products and to even enable these vendors to compete on a real-time basis for a consumer’s business [2].

Many government organizations are also beginning to use mobile computing to improve service. Among the leading users of mobile computing technologies in the government are police and criminal justice organizations, since many of them need mobile information to facilitate code enforcement [5], and recently the use of computers has become essential to police agencies. In the context of police organizations, mobile computing terminals (MCTs) are being used for getting mobile access to federal, state, and county records related to auto registrations, summons, warrants of arrest, and on-line offense-reporting systems [6].

The introduction of mobile computing in an organization introduces both technological and business issues. Technological issues include communication, computing, and information architectures that enable people with disparate systems to communicate and perform tasks without any interruption while on the move. Organizational and business issues include changes in organizational structures and processes, increased customization of information and products, and substitution or modification of traditional job descriptions. In the police context, this includes the availability of real-time information on licenses and registrations, summons, and warrants of arrest in contrast to the earlier system, when information had to be obtained using a cumbersome procedure based on radio dispatch, resulting in unacceptably high latency in decision making. As a result, patrol officers are now able to perform many of the tasks for which they were once dependent upon radio dispatch
and desk clerks. Dependence on a major communication medium, that is, radio operators, has also been virtually eliminated for communication among officers. The traditional means of communication between 911 operators and patrol officers has also been affected, as the priority of calls can be directly signaled to patrol officers.

This research looks at some of the business issues involved in introducing mobile computers in police organizations and focuses on their deterrent effect on offenders and the impact of MCTs on the job satisfaction of patrol officers. The contributions of this research are as follows. The study evaluates the impact of MCTs on the deterrence exercised by law-enforcement officers and on their job satisfaction using a survey instrument developed for the research. It develops a framework for the research by building upon research in three different streams of work including deterrence, technology use, and job satisfaction. Given the rapid expansion in mobile commerce, research in specific application areas is likely to provide valuable insights into factors that will enable the use of mobile computing. This research looks at mobile computing in the service setting of police work. It is one of the first efforts to study the impacts of mobile computing terminals in police work. Further, the analysis of the statistics obtained from the department shows that MCTs have made a considerable impact on the redeployment of officers. Some interesting observations may be drawn from the research. MCTs have enabled better communication, which is found to have a significant positive impact on the officers’ job satisfaction and the deterrence exercised by them. In addition, MCTs have increased the availability of information that is found to have a large positive impact on the officers’ job satisfaction. Savings in time from plate checks are found to have a significant impact on deterrence. The results show that the COPS MORE program has been successful to a significant extent. Following the framework of information systems (IS) research suggested by Orlikowski and Iacono [7] this research would be classified under the tool and proxy views of information technology (IT).

The rest of this article is organized as follows. In the next section, we present the background and related research. In Section 3, we develop our hypotheses. Section 4 presents the research methodology. Section 5 focuses on the results of the study. Conclusions, implications, and suggestions for further research are in Section 6.

2. BACKGROUND AND RELATED RESEARCH

2.1 Background

In 1995 the U.S. federal government initiated the COPS MORE program [8], with the aim of deploying an additional 1,000,000 cops on the streets. An important part of the program was the use of computers to augment and redeploy the resources of police departments across the country so that there was an effective increase in the number of officers available for police work on the streets. Much of the redeployment comes from the use of laptop computers in patrol cars, which are now being used as redeployment equivalents. These computers, called MCTs, have been very well received by the departments.

Before the installation of the MCTs, officers in New York State, for example, sent the New York State plate identification number over the police radio for plate verification. The control center, after verifying the number with the officer,
transmitted the request through its computer to the state headquarters at Albany for in-state vehicles. The reply was transmitted back to the officer by radio. This process had many obvious limitations. Transfer of information over radio required repeated voice checks to confirm the information. This took up a lot of time from the busy staff at the control desk, and officers never made cold checks, to avoid annoying the control desk.

In accordance with the federal scheme, the department began to equip a majority of its patrol cars with MCTs, which are specially ordered laptop computers built to withstand the rigors of patrol work. At the time of this study, the computers were being used to conduct plate and license checks. The plate-checking process using the MCTs is described in Figure 1. Officers can now make a request using their own laptops. The request is sent through the departmental server to the state headquarters and the details of the vehicle are retrieved in about 20 s without any intervention from the control center. This allows officers to act on their own initiative.

As part of the study, the time saved by officers in performing regular tasks was estimated by measuring the actual time taken by the officers in performing three regular activities—conducting plate checks, issuing summons, and executing warrants of arrest. The figures are shown in Table 1. As can be seen from the table, in a force with a total of 649 patrol officers, the time saved as a result of using the MCTs was equivalent to the work performed by approximately 68 officers, or approximately 10% of the patrol strength. Therefore, the use of MCTs significantly augments the capabilities of the force.

2.2 Related Research

This research examines some of the issues associated with the introduction of a specific technology in an application domain. Prior research in information systems has examined aspects of using specific technologies in various organization
contexts. For example, Cox and Rich [9] looked at some of the issues associated
with the use of telephone shopping when it was first introduced in the 1960s.
Straub [10] found that two aspects of Japanese culture—uncertainty avoidance
and complex written language symbols—predispose Japanese knowledge work-
ers against using e-mail, but in favor of using faxes. In their study of the benefits
of IT use, Mukhopadhyay et al. [11] found that Chrysler Corp. and its suppliers
saved approximately $60 per vehicle by using electronic data interchange (EDI).
However, current research on the impacts of information systems on law
enforcement activities is very sparse. To create the framework for this research, we
build upon the ideas and constructs introduced in three different streams of work:
(a) research on the police in the area of deterrence [12–17], (b) research on tech-
nology use [18–20], and (c) studies of job satisfaction [21, 22]. Based on the theo-
retical framework, we also interviewed officers who had used MCTs, to identify
the primary impacts of MCTs as perceived by end users and to verify and enhance
the framework.

Previous research suggests that the characteristics of a technology are an
important factor in influencing its use and deployment [18]. Three critical charac-
teristics that are relevant to MCTs are considered in the research—time, commu-
nication, and information. Time relates to the savings in time achieved in
performing regular activities. Communication and information are related to the
improvements in communication and the availability of information to the
officers by using MCTs. Two variables that may define the work environment of
the officers are their job satisfaction and the deterrence exercised by them on law
violators [17, 22].

2.2.1 Communication. Communication has been defined as including all the
processes by which one mind may affect another [23]. The communication prob-
lem has been viewed as consisting of three distinct stages: (a) how accurately the
symbols of communication can be transmitted, (b) how precisely the transmitted
symbols convey the desired meaning, and, most importantly for this article, (c) how effectively the received meaning affects conduct in the desired way.

The technical issues (level 1) are concerned with the accuracy of transmission of
the symbols of communication from sender to receiver. The semantic issues (level 2)
are concerned with the satisfactory approximation in interpretation of communica-
tion by the receiver as compared with the intended meaning of the sender. The
effectiveness issues (level 3) are concerned with the success with which the meaning
conveyed to the receiver leads to the desired conduct on their part. It is therefore

<table>
<thead>
<tr>
<th>Task</th>
<th>Pre-MCT</th>
<th>Post-MCT</th>
<th>Redeployment Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(number per year)</td>
<td>(number per year)</td>
<td>(officers per year)</td>
</tr>
<tr>
<td>Plate checks</td>
<td>177,833</td>
<td>260,001</td>
<td>61.74</td>
</tr>
<tr>
<td>Execution of summons</td>
<td>31,314</td>
<td>33,663</td>
<td>2.43</td>
</tr>
<tr>
<td>Execution of warrants</td>
<td>1,011</td>
<td>1,251</td>
<td>4.67</td>
</tr>
</tbody>
</table>

Note. MCT = mobile computing terminals.
reasonable to say that all communication has some intended effect on conduct. In our research, we take the technical and semantic issues as given and measure the extent to which MCTs help effective communication between officers and the public, other officers, and supervisors.

2.2.2 Time. The time dimension has been observed to be important in a number of studies on IS productivity and effectiveness. Several studies have pointed to the advantages of integrating technology into various organizational functions to speed up cycle time for product and service delivery [24, 25]. However, other business process reengineering literature has pointed out that improper introduction of technology may result in poor performance and increased cycle times [26, 27]. Further, decrease in cycle time has also been seen to have potential impacts on other areas of work performance.

One of the major impacts of the introduction of MCTs in the department has been a reduction in the amount of time taken by officers to perform regular tasks. As pointed out in the introduction to this article, this research was initiated by a request to assess the actual savings in time in the department because of the introduction of the MCTs. In the Appendix we show that these savings amount to an equivalent of 68 full-time officers in the department.

In this study, we focus on the savings in time achieved by officers who use the new information system. This is a measure of the direct impact of the MCTs in saving the time spent by officers on routine tasks and is the focus of the COPS MORE program.

With the introduction of the MCTs, officers save time because they make fewer trips to the station house to complete routine paperwork, which can now be done online. There are also other activities where MCTs save officers’ time. Moreover, officers save time in handling many low-priority calls by pulling up required information on their MCTs. MCTs therefore significantly reduce non-value-added time [28].

2.2.3 Information. Information has been defined as the measure of one’s freedom of choice in selecting a message [23]. There is more information if you choose freely from a set of 50 standard messages than if you choose from a set of 25 standard messages. Another way of viewing this formulation is that information is the measure of the extent to which a message helps the receiver select from among a number of available choices. The more the available choices, the greater the information.

Information in the police context is primarily generated and filtered by patrol officers, who determine the quality, amount, and content of most of the information that rises to higher levels of management in these organizations [29]. MCTs create an independent alternate channel by which officers can get information. They allow officers to pull up any information required to solve the problem at hand and help officers make better decisions at work. MCTs help exchange of information because transmissions are encrypted and cannot be intercepted by scanners. Information on pending calls is also an useful input to officers. A suitable measure of the information produced by the MCTs is therefore the amount of messages made available to officers.
2.3 Work Environment

Two key factors of the police work environment that are impacted by the new technology are job satisfaction [21, 30] and the deterrence exercised over law violators [12, 17]. MCTs reduce the risk faced by officers on the job, thereby increasing self-initiated activities and making the job easier [12]. At the same time, they help officers do their job better because they are an important tool for gathering the information necessary in the battle against crime. Most employees prefer to work in relatively modern facilities and with adequate tools and equipment [31] and MCTs help increase the professionalism of officers.

2.3.1 Job Satisfaction. Job satisfaction is an extensively researched subject. It is generally defined as an affective (i.e., emotional) reaction to a job that results from the incumbent’s comparison of actual outcomes with those that are desired (expected, deserved, etc.) [32]. Research on job satisfaction indicates that the important factors conducive to job satisfaction are challenging work, equitable rewards, supportive working conditions, and supportive colleagues [22].

We observed these factors during the study when we worked with police officers using the MCTs. The officers found that their work had become more interesting and challenging because they now had a tool that helped them in a wide range of activities. Before these devices were introduced in the department, officers had to ignore a number of suspicious activities because many routine checks were extremely time-consuming without MCTs. The time they spent on routine checks was now being used more efficiently allowing them to spend the time on more important activities. Checks that took 20 min earlier now only took 15 s. Officers also told us that they now felt safer in many neighborhoods because they could easily gather information on dangerous elements in the area over their MCTs. Earlier, they had to depend on personal knowledge about these details. In many cases, officers were not even aware that a person living in a certain locality was wanted in connection with an offence in another locality, but MCTs reveal this information in a very short time. Thus MCTs are likely to make a significant contribution to the job satisfaction of the officers.

2.3.2 Deterrence. The three basic measures of crime control discussed most frequently in the criminological literature are deterrence, incapacitation, and rehabilitation [16, 17]. In our context we are interested in deterrence, which essentially aims at modifying the price of crime for all individuals, potential and actual. The rational deterrence theory is based on the premise that sanctions are negative incentives and their imposition on detected offenders serves to discourage at least some others from engaging in similar pursuits [33]. It is concerned with what is called the fundamental deterrence problem—the use of threats to induce an opponent to behave in desired ways.

In the basic form of the theory, there are two actors—the initiator and the defender. The defender seeks to prevent some action by the initiator. The initiator moves first, deciding whether to attack or not. Then the defender chooses whether to retaliate or to capitulate. This sequence is common knowledge between the two players. However, what is not known to the initiator with certainty is the defender’s
ability and commitment to retaliate after the attack. If the defender’s ability to retaliate is credible, the initiator believes it likely that the option to retaliate actually exists before the defender and that the defender would find it economically wise to do so if the initiator attacks. Then, if the initiator is deterrable and the threatened punishment exceeds the gains from attacking, he will see that an attack will make him worse off than restraint and he will not attack. Conversely, if the deterrable initiator believes that it would very likely not be in the defender’s interest to retaliate or that the defender lacks the means or the will to do so, the initiator will attack.

Thus, under conventional assumptions of rational choice, when the attacker is deterrable, successful deterrence depends upon the defender’s credibility. The model therefore implies that some conceivable punishment would deter a deterrable initiator. But it is not necessary that a feasible punishment would deter all attackers. Not all the conceivable opponents are deterrable. It has been shown [17] that in a large class of cases, efficient crime control only requires deterring punishments without any attempt at individual control.

MCTs significantly raise the probability of detection of certain offences and improve the credibility of officers. For example, plate checks can now be performed in a fraction of the time and with minimal human intervention than was possible without MCTs. MCTs therefore influence the level of deterrence offered by the officers in the department. MCTs also help officers spend more effort on deterrent activities than on unproductive tasks.

3. RESEARCH MODEL

The research model depicted in Figure 2 is based on the foregoing ideas.

The following hypotheses are tested in this research:

More information is assumed to be better than less in police agencies, an assumption that justifies the investments made by these agencies in information technologies [29]. Because the introduction of MCTs provides an additional communication channel for officers to collect, exchange, and request information, they
increase the availability of information to the officers. Research in the marketing literature also suggests that communication is among the most favored mechanisms of providing information [9]. Therefore:

**H1a:** Better communication because of the MCTs improves the availability of information to the officers.

The channels of communication opened by the MCTs provide much of the information required by officers for daily work such as plate checks, addresses of suspects against whom warrants have been issued, and so on. MCTs thus eliminate many occasions for self-investigation [34] and save time. As a result, the use of information technologies helps increase the number of calls attended by officers [15]. Therefore:

**H1b:** Better communication because of the MCTs helps officers save time.

As discussed earlier, the deterrence exerted by officers over law violators is a function of the costs incurred by the officers to retaliate and take action when a crime takes place. The MCTs reduce this cost by enabling the officers to obtain direct access to information without requiring the assistance of dispatch (social costs). In many cases, for example, information on warrants of arrest, the MCTs provide information to an officer that is not available from any other source (infinite costs). Therefore:

**H2a:** Availability of information from MCTs improves the capability of officers to deter law violators.

One of the central issues in the management of patrol officers is whether the uncommitted time of patrol officers, when they are not involved in processing service requests, is well managed [13]. Though it may not be fully known how the use of patrol officer time impacts on the occurrence of crime, it may be assumed that more time devoted to patrol activities than to filling out forms or appearing in court would somehow be related to crime deterrence [14]. One of the measures suggested in criminological literature to measure the efficiency of utilization of patrol time derives from the mechanical definition of efficiency. Thus, the proportion of input person-hours that are utilized in activities whose performance could reduce crime rates is a measure of the efficiency of the officers on patrol. Since MCTs reduce the time spent by officers on non-value-added functions such as filling out forms [28], it is hypothesized that:

**H2b:** Availability of time on the beat because of the MCTs improves the capability of officers to deter law violators.

The core technology of policing even today is persuading people by various means of communication and interaction strategies to comply with requests and commands that follow from the law and to maintain the peace [29, 35]. Bittner [35], for example, reported how often officers avoid the use of force in daily work by effective communication. Thus:
H2c: Better communication by officers because of the MCTs improves the capability of officers to deter law violators.

Few professions have the level of uncertainty present on the patrol job [12]. If uncertainty is characterized as a situation produced by low information, then an increase in the availability of information through MCTs should improve job satisfaction. Thus, by providing useful information, MCTs provide a greater feeling of security to officers. Hence:

H3a: Availability of information from the MCTs improves the job satisfaction of the officers.

MCTs significantly reduce the time taken by officers to perform routine activities (see Appendix). This allows officers to spend the time to complete other activities at their discretion and also improves their personal comfort. This is expected to improve their job satisfaction. Hence:

H3b: Availability of time on the beat because of the MCTs improves the job satisfaction of the officers.

Unlike goods, which are “objects, devices or things,” police work may be considered a service. In contrast to goods, services are “deeds, performance and effort” [36]. The literature on services marketing has identified a number of factors that influence job satisfaction in service industries and the impact of communication on these factors.

Line staff such as patrol officers has the best opportunity to identify ways in which the expectations of customers may be satisfied. Upward communication enables them to transmit information about such opportunities to upper management, who can use these ideas to introduce necessary changes [37, 38]. Downward communication clarifies the expectations of managers and supervisors and provides information on the means by which patrol officers may satisfy such expectations. Such communication also provides information on how performance is evaluated and rewarded. This reduces role ambiguity and provides role clarity. Communication also helps reduce problems of role conflict, when competing customer demands cannot be simultaneously satisfied [37]. The negative impact of role conflicts and ambiguity on job satisfaction has been found using increased absenteeism and turnover as some of the effects of reduced job satisfaction [37, 39]. The communications capabilities of MCTs also enable the officers to explain matters to complainants. Similarly, better opportunities for communication with colleagues are also likely to lead to an increase in job satisfaction for the officers. Therefore:

H3c: Better communication because of MCTs improves the job satisfaction of the officers.

The availability of time on the beat as a result of the introduction of MCTs is expected to allow officers the opportunity to collect more information through
various means than before. Information leads that were previously ignored for want of time may be better followed up because of the availability of time at the discretion of the officers. Hence:

H4: Availability of time improves the availability of information to patrol officers.

4. RESEARCH METHODOLOGY

The constructs were measured using a survey instrument developed specifically to examine the effectiveness of the MCT system. The pilot instrument was administered to 30 officers to verify the readability of the items and to test the reliabilities of the scales. Based on the feedback obtained, some items were reworded to eliminate multiplicity of constructs and to ensure consistency in the unit of analysis.

The unit of analysis for all items was the patrol officer. There were two reasons for this choice. The officers act as the interface between the department and the public and are in the best position to evaluate the impact of the MCTs. They are also the immediate users of the MCTs.

The final questionnaires were given to all 160 officers of the department who were using patrol cars equipped with MCTs. All officers volunteered to complete the survey. Respondents were drawn from all the police districts in the department and we obtained 153 responses, resulting in a response rate of over 95%. The excellent response rate gives us confidence in the robustness of the results [40]. Respondents ranged from 23 to 60 years in age with a mean age of 34 years. Their average experience in using computers was 3.6 years.

4.1 Construct Measurement

The items used in the survey instrument are shown in Table 2. Based on overwhelming anecdotal evidence on parameters described in Table 1, the organization had already completed the installation of mobile computers in all patrol cars before the study was initiated and all officers were using these terminals. Therefore, no control group could be identified to compare the use of MCTs against nonuse. Therefore, to identify the role of MCTs, we asked respondents in the survey to respond to questions regarding the use of MCTs against the earlier environment where they were not using MCTs. Because the study was initiated soon after the introduction of MCTs, all respondents had worked in the department before MCTs were introduced and were very familiar with work conditions when MCTs were not available. The survey instrument is shown in Table 2.

These items were measured using a 5-point Likert scale instrument. Two sample items are shown in Table 3.

The deterrence scale was adapted from variables used in the criminological literature. The variables commonly measured in the literature include sanctions (arrests, etc.), police resources (often measured in terms of budgets), and socioeconomic
Table 2
Survey Instrumenta

<table>
<thead>
<tr>
<th>Job satisfaction</th>
<th>Difficulty of the job without MCTs</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha = .88 )</td>
<td>Increase in self-initiated activities</td>
</tr>
<tr>
<td></td>
<td>Increase in degree of professionalism of officers</td>
</tr>
<tr>
<td></td>
<td>Help in doing the job better</td>
</tr>
<tr>
<td>Deterrence</td>
<td>Less time spent on administrative tasks in the station house</td>
</tr>
<tr>
<td>( \alpha = .723 )</td>
<td>Increase in arrests since the department began using MCTs</td>
</tr>
<tr>
<td></td>
<td>More frequent plate checks</td>
</tr>
<tr>
<td></td>
<td>Less time spent dealing with high-priority calls</td>
</tr>
<tr>
<td></td>
<td>Easier to issue a summons</td>
</tr>
<tr>
<td>Information</td>
<td>Served one warrant that could not have been served without the MCT</td>
</tr>
<tr>
<td>( \alpha = .633 )</td>
<td>More information available than from dispatch alone</td>
</tr>
<tr>
<td></td>
<td>Information helpful in making better decisions at work</td>
</tr>
<tr>
<td></td>
<td>Confidentiality of information</td>
</tr>
<tr>
<td></td>
<td>Utility of seeing all pending calls</td>
</tr>
<tr>
<td>Communication</td>
<td>Help in communicating better with the public</td>
</tr>
<tr>
<td>( \alpha = .62 )</td>
<td>Help in communicating better with supervisors</td>
</tr>
<tr>
<td></td>
<td>Help in communicating with other police officers</td>
</tr>
<tr>
<td>Time</td>
<td>Fewer trips to the station house during a shift</td>
</tr>
<tr>
<td>( \alpha = .77 )</td>
<td>Reduction in some time pressures on the job</td>
</tr>
<tr>
<td></td>
<td>Reduction in time spent dealing with medium-priority calls</td>
</tr>
<tr>
<td></td>
<td>Reduction in time spent dealing with low-priority calls</td>
</tr>
</tbody>
</table>

Note. \( \alpha = \) Cronbach’s alpha; MCT = mobile computer terminal.

Table 3
Sample Items

| How Does This Statement Apply to You and Your Experience with the MCTs? |
|---|---|---|---|---|
| **Response** | 1 | 2 | 3 | 4 |
| I spend less time on administrative tasks in the station house now | Disagree | Somewhat Disagree | Have No Opinion | Somewhat Agree | Agree |
| I make fewer trips to the station house during a shift since I received the MCT | Completely |

Note. MCT = mobile computer terminal.

variables [17, 33]. The information scale is adapted from the scales used in user satisfaction research [41]. The reliability of each scale was measured using Cronbach’s alpha for internal consistency. The scores range from .622 to .88. Alpha scores of .63 and above have been used for reliability analysis [42]. All but one alpha score is above the acceptable value and the lone outlier approaches acceptability.
5. RESULTS AND DISCUSSION

We used structural equation modeling (SEM) [43–45] to evaluate the research model in Figure 2. The results based on the hypotheses proposed are presented in Figure 3.

5.1 Structural Equation Model

There are no unique standards for goodness-of-fit measures for SEM models [45]. Table 4 gives several recommended goodness-of-fit indicators used in SEM [43] and their comparisons with observed values in the research model.

The chi-square statistic tests the fit of the model with the original data, a model with a high chi-square value should be rejected because it is not plausible given the original dataset. The chi-square statistic obtained for the model was .538 with one degree of freedom and a probability value of .463. In this case, therefore, the null hypothesis is not rejected because of the low chi-square value ($p = .463$).

Overall, the parameters indicate a satisfactory fit of the model with the data. All paths are in the proposed directions.

5.2 Discussion

The squared multiple correlation coefficient, which is similar to the $R^2$ value in regression analysis, is quite high for the deterrence and satisfaction measures. Thus, the model explains a significant amount of the observed variance in deterrence and job satisfaction.

The strongest path coefficient in the model is observed between communication and time. Communication also has a high impact on the amount of information available to officers, which indicates that features of the MCTs that help communication, such as e-mail and display of pending calls, have a significant impact on the availability of information to officers. The relationship between communication

![Figure 3](image)

Figure 3. Path coefficients of the structural equation model. Asterisks indicate squared multiple correlation coefficients (standardized).
and time appears to be a reflection of the usage of the e-mail utility, which helps officers save time through effective communication without occupying the radio channel. These features also significantly save officers time. Savings in time have a small influence on the availability of information. The two factors (communication and time) explain a significant amount of the observed variance in the information construct. The strongest influence on job satisfaction is observed from information, which indicates the importance of the availability of information in police work. Time and communication also have a moderate impact on job satisfaction, giving support to Hypotheses 3b and 3c.

The high path coefficient from time to deterrence indicates that the savings in time obtained from computerized plate checks have a high impact on the effectiveness of officers. Communication and information have moderate influence on the deterrence construct. One possible explanation for the low path coefficient from information to deterrence is the fact that the MCT-based information system was not fully implemented at the time of the study. At that time, the system was only used for plate checks on automobiles and license checks on drivers. On full implementation, the system will have many features to aid investigation such as field reporting. Information on local warrants will also soon be made available on the system. These features, when implemented, would constitute a major information input to help officers in controlling crime.

6. CONCLUSIONS AND FURTHER STUDY

The results show that the three variables time, information, and communication explain a significant proportion of the observed variance in deterrence and satisfaction of the officers. The ability of the officers to communicate with each other using MCTs was found to save officers a significant amount of time on the job. Communication was also found to improve the availability of information to officers. As hypothesized, availability of information significantly improved the satisfaction of officers. Savings in time from plate checks were found to significantly impact the deterrence construct.

This research is an exploration of the factors that are likely to influence the success of the first major initiative of a major metropolitan police department to provide its officers with access to crime information over computers. The research

<table>
<thead>
<tr>
<th>Measure</th>
<th>Recommended</th>
<th>Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-square/degrees of freedom</td>
<td>≤3.0</td>
<td>0.54</td>
</tr>
<tr>
<td>Chi-square p value</td>
<td>≥0.05</td>
<td>0.46</td>
</tr>
<tr>
<td>Goodness-of-fit index</td>
<td>≥0.90</td>
<td>0.99</td>
</tr>
<tr>
<td>Adjusted goodness-of-fit index</td>
<td>≥0.9</td>
<td>0.92</td>
</tr>
<tr>
<td>Normed fit index</td>
<td>≥0.0</td>
<td>0.99</td>
</tr>
<tr>
<td>Comparative fit index</td>
<td>≥0.90</td>
<td>0.99</td>
</tr>
<tr>
<td>Root mean square error of approximation</td>
<td>&lt;0.10</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Table 4
Structural Equation Model Results
supports the hypothesis derived from discussions with department officers that the ability of an information system to save time, improve communication, and provide information significantly improves the ability of patrol officers to deter criminals. These factors also improve the job satisfaction of officers. The research also makes an assessment of the actual time saved by patrol officers from the introduction of MCTs.

Though the research was conducted in a nonprofit setting where the hardware and software of MCTs were custom-designed to meet specific real-time information needs of its users, it would be useful to speculate about how some of the conclusions of this research might apply to the use of mobile computing in other, more general business contexts. These conclusions may be particularly important because of the likely impact of mobile computing as described earlier in this article. The first observation is that communication capabilities can be very useful in saving time. This suggests that the development of basic communication infrastructures to enable staff to use e-mail and other communication technologies on the move can free up a significant amount of time for productive work. Because communication was also found to significantly influence the perceived availability of information, information-intensive companies, such as financial firms, would significantly benefit from such communication infrastructures. The role of communication observed in the research is perhaps related to the observations made by analysts who suggest that hand-held devices will increasingly be expected to be connected to the network [46]. The influence on job satisfaction suggests that organizational staff is also likely to welcome these measures. As seen in this study, the use of MCTs has made a considerable impact on deterrence.

There are some limitations that need to be addressed in future research. The percolation of MCTs in the department is still low, with the instruments being used only in patrol cars. As the percolation of computers and the use of computerized applications in the department increases, it is likely to trigger further changes in work practices in the department. This is likely to have many consequences, both foreseeable and unforeseen. Future research needs to address these issues. Also, the impact of the MCTs on the public, who are key stakeholders [47] in the exercise, may be considered in future research.

REFERENCES


