# LAW ENFORCEMENT IT UTILIZATION & PERFORMANCE

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## Abstract

This study aims to expose the impact of the law enforcement IT expenditures and utilization on achieving effectiveness in law enforcement organizations. It uses crime clearance rate (percentage of offences cleared by arrest) as an outcome measure for eigth law enforcement agencies of Virginia, USA. By using secondary data from LEMAS and UCR datasets of 2000, it performs statistical analysis. It deduces that there is no significant difference between law enforcement agencies using mobile digital devices and law enforcement agencies not using mobile digital devices; there is no significant relationship between the variables of the mobile digital devices and crime clearance rate; and there is no significant relationship between law enforcement budget and crime clearance rate among Virginian law enforcement agencies.

**Key Words:** Police, Law Enforcement, IT, Performance

## Polisin Teknoloji Kullanımı Ve Performansı

## Özet

Bu çalışma kanun uygulayıcının (polisin) bilgi teknolojilerini kullanımı ve harcamaları ile etkililiği arasında nasıl bir ilişki olduğunu nitel olarak ortaya koymaya çalışmaktadır. Çalışma polisin suçu aydınlatma oranını (suç işlendikten sonra müsebbibinin ortaya konularak tutuklanması oranını) başarı ölçüsü olarak almakta ve ABD'nin Virginia eyaletinde bulunan sekiz farklı polis biriminde bunu test etmektedir. 2000 yılına ait LEMAS (Kanun Uygulayıcının Yönetim Alanındaki İstatistikleri) ve UCR (Birleştirilmiş Suç İstatistikleri) verilerinin kullanıldığı çalışma ikincil verilerin istatistikî analizine dayanmaktadır. Çalışmanın ortaya koyduğu sonuçlar dijital mobil cihazları (dizüstü bilgisayar ve mobil veri terminalleri) kullanan ve kullanmayan birimler arasında anlamlı bir farkın olmadığı, mobil dijital cihaz kullanımı ile suçun aydınlatılması arasında bir ilişkinin bulunmadığı ve Virginia polis teşkilatları arasında kanun uygulayıcının bütçesi ile suçun aydınlatılması arasında ilişkinin bulunamadığı şeklinde sıralanabilir.

**Anahtar Kelimeler:** Polis, Kanun Uygulayıcı, Teknoloji, Performans

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## INTRODUCTION

Investments on information technologies (IT) are generating a responsibility on the part of managers to provide economic justification and documentation of proper utilization of IT for productivity improvement, organizational performance. According to Maguire (2000), law enforcement agencies have utilized various new technologies to attain effective outcomes as they provide service to their communities. Crime clearance rates are one of the ways to look at law enforcement effectiveness (Nicholson & O'toole, 2004). This study is going to examine the relationship between the crime clearance rates by arrest and spending on law enforcement information technologies, in Virginia counties and cities in 2000.

Using Information Technologies in law enforcement agencies impacts on their functions (Dewan & Min 1997; Bharadwaj, Bharadwaj, & Konsynski, 1999; Sohal, Moss & Ng, 2001; Nunn, 2001; Devaraj & Kohli, 2003). For example, highly computerized cities reported larger shares of employees in technical positions, spent more per capita, and reported fewer officers per capita than cities with lower computerization levels (Nunn, 2001).

Generally, vendors as well as public managers often characterize acquisition of IT packages as a direct means of improving administrative functions, service delivery, information processing, and intelligence gathering (Rao 1997; Wilkinson, 1998). However, in order to look at the real effect of the IT utilization in law enforcement organizations, IT utilizations need to be evaluated (Devaraj & Kohli 2003). Therefore, the main objective of this study is to demonstrate the impact of using IT on law enforcement organizations, realizing the anticipated benefits of enhanced IT. To what extend the use of laptops and digital mobile data devices affects the total arrests in Virginia cities and counties is going to be the contribution of this study to the literature.

## I. PURPOSE OF THE STUDY AND RESEARCH QUESTION

For the last decade, there has been a great increase in the number of using IT in law enforcement organizations. The Department of Commerce estimates that about 46% of all equipment spending in the US is for IT components (U.S. Department of Commerce, 1998). Law enforcement organizations make investments in IT to improve productivity, profitability, and the quality of operations. The purpose of this quantitative study is to show and clarify the impacts of these IT utilizations on law enforcement agencies. The main question to be answered in this context is going to be as fallows: is there a relationship between IT expenditures on law enforcement and effectiveness of law enforcement organizations in Virginia?

## A. THEORETICAL BACKGROUND AND LITERATURE REVIEW

*Technology acceptance model* is one of the behavioral models to explain user acceptance of a new IT, and the behavioral constraints of accepting it (Succi & Walter, 1999). It explores the computer acceptance, computer usage behavior and measures technological acceptance. The related research literature has mostly looked at IT usage and its effect on organizational performance rather than evaluating the IT usage within the context of technology acceptance (Davis 1989). However, positive performance measures in an organization utilizing IT may be a good indicator to show the relationship between IT acceptance and performance.

*Diffusion of innovation theory (DIT)* addresses the patterns of adoption of IT (Rogers, 1995). DIT seems pretty compatible to analyze the utilization of IT. According to it, outdated technology is renewed by more advanced and efficient one, which is beneficial to the organization (Rogers, 1995). DIT explains how a new progress, related to the IT, could be successfully included into the body of existing working elements; therefore, it could be helpful to identify the effectiveness of utilizing IT in law enforcement organizations.

The significance of the link between IT and organizational performance has long been discussed in research literature. Especially in recent years, the relationship between investment in IT and its effect on organizational performance continues to be fertile ground for research. There are some studies exploring and examining the relationship between IT usage and organizational performance (Dewan & Min, 1997; Bharadwaj, et al., 1999; Sohal Moss & Ng, 2001; Nunn, 2001; Devaraj & Kohli, 2003). Although they are different in terms of the level of the analysis, the methodologies, the variables, and the contents, most of them look at the issue from an economical angle, the association between information technology investment and organizational performance. They generally observed a negative relationship between IT related variables and performance.

However, some industry-level focused studies generate mixed results for the association between IT investment and organizational performance. Among those studies, Siegel and Griliches (1992) and Kelley (1994) conclude that IT investments have positive impact on organizational performance; whereas, Morrison and Berndt (1991) and Koski (1999) find out IT investments have not any significant advantages on organizational performance.

When the analysis is explicitly focused on the firm, the relationship between information technology investment and organizational performance is positive (Barua, Kriebel, & Mukhopadhyay, 1995; Dewan & Min 1997). Moreover, other studies have found evidence that technology capital and labor has a positive effect on outcome measures (Menon, Lee, & Eldenburg, 2000).

Primarily, IT is added to an agency to develop things (Landauer, 1996; Sichel, 1997). For law enforcement agencies this means better administration, more

effective service deliverance, the faster solution of crimes, and improved overall public safety (Nunn, 2001). The ultimate value of IT lies in service effectiveness. According to Nunn (2001), greater effectiveness is related to outcomes, including crime reduction, clearances, and property recovery.

According to the literature, quicker access to computerized criminal histories and crime data grants better and more comprehensive information about the identity and location of perpetrators; thus it enables more arrests, higher clearance rates, and more stolen-property recovery (Danziger &Kraemer 1985; Dawes 1996). In law enforcement, the notion of effectiveness means a higher proportion of crimes solved or cleared and more stolen property recovered; and it can be achieved ideal types of outcomes such as more arrests (Danziger & Kraemer 1985).

According to the literature, crime clearance rate provides more outcome measures than other possible measures of performance in law enforcement organizations and it can be used to measure performance of a law enforcement organization (Nicholson and O'toole (2004). Nicholson and O'Toole (2004) argue that the performance of law enforcement depends on the level of adapting new information technologies which improve the effectiveness of practices. Utilizing IT practices is especially required for information driven policing, such as problem oriented policing which is not depending on just incidents, and the success is depending on how much technological investment is accomplished in their term (Harries 1999; Nunn 2001).

## B. CONCEPTUAL FRAMEWORK AND HYPOTHESES

This study conceptualizes two interrelated issues: law enforcement IT usage/expenditures and crime clearance rate as an outcome measure for law enforcement agencies. Crime clearance rate show law enforcement agencies performance; therefore, law enforcement agencies aim to achieve high performance by clearing crime to reduce the crime rates in their jurisdictions. Reducing crime and creating safer environment are what they serve to the community.

Here, the organizational context is the law enforcement agencies in Virginia, based on a 2000 cross-sectional sample of 50 cities and counties (US Department of Justice, 2003). In order to show the expenditures on law enforcement IT, both using laptop and digital mobile data terminals and number of laptops and digital mobile data terminals are going to be used.

**$H_0$1**: There is no difference in crime clearance rate between law enforcement agencies using mobile digital devices (laptops and digital mobile data terminals) and law enforcement agencies not using mobile digital devices.

**H1**: There is a difference in crime clearance rate between law enforcement agencies using mobile digital devices and law enforcement agencies not using mobile digital devices.

According to the literature, there should be a performance difference in law enforcement agencies using IT technologies. As it was seen in literature crime clearance rate is a good indicator for law enforcement agencies to show their performance.

**$H_0$2**: There is no relationship between the number mobile digital devices used in law enforcement agencies and the number of arrest.

**H2**: There is a relationship between the number of mobile digital devices used in law enforcement agencies and crime clearance rate.

Here, the number of mobile digital devices, used in law enforcement agencies, is used as a proxy for law enforcement expenditures on IT. Crime clearance rate is used as a proxy for law enforcement effectiveness (performance). As it was showed in literature, organizational effectiveness is affected by the diffusion of IT. The number of such mobile and portable devices shows us how IT diffused among a law enforcement organization. Also, the number of such devices shows us the law enforcement expenditures on IT.

**$H_0$3**: There is no relationship between law enforcement budget and crime clearances.

**H3**: There is a relationship between law enforcement budget and crime clearances.

Spending more on law enforcement does not solve the crime problem itself, but helps law enforcement agencies to invest on personnel, training, and technology, which provides the agencies with more intelligent and analytical way of policing. Assuming that law enforcement budgets are limited, decisions to computerize activities require hardware and software purchases that require new expenditures and reduce funds available for personnel (Nunn, 2001).

## II. METHODOLOGY

This study is a typical cross-sectional design. It conducts a secondary data analysis. It is framed by counties and cities of the Commonwealth. The unit of analysis in this study is the number of offences cleared by arrest in jurisdiction of a law enforcement agency (clearance rate).

For the crime clearance rate, the FBI's Uniform Crime Reports (UCR) data is going to be used. UCR is a periodic nationwide assessment of reported crimes and clearances by Arrest (N=3146) (U.S. Department of Justice, 2002). In order to get crime clearance rate, a new variable, showing the arrest and offence rate, is computed.

For the number of mobile and portable digital data devices, the Law Enforcement Management and Administrative Statistics (LEMAS) data is going to be used. LEMAS is a periodical survey of law enforcement agencies nationwide (U.S. Department of Justice, 2003). It uses two different sampling. One is a sampling formed from all law enforcement agencies with 100 more sworn employees (N=866). And the other is a stratified sampling of all remaining agencies (N=2119). One major advantage of the LEMAS database is its comprehensiveness: the response rat is 97.4% (2,985 / 3,065).

UCR have data for both total number of violent and property crimes, and individual number of violent and property crimes, such as murder, rape, and theft. It also has total number of all arrests, which is going to be used as dependent variable. Our second data set, the LEMAS, asks police agencies about their use of computers, computerized functions, and computerized files, as well as other detailed questions about budgetary expenditures and the allocation of certified and non-certified personnel to administration. In the context of assessing the effects of IT, the UCR and LEMAS databases offers a valuable opportunity for quantifying and assessing the relationships between number of used computer hardware, law enforcement budget, the number of officers, the maximum salary of officer and the arrest association.

Due to the frame of the study, only the cases related with Virginia were captured from the LEMAS (N=75) and the UCR (N=443). Same as in UCR data, the city code (cty_code) variable was created in LEMAS by checking the location and type of the agency. In order to merge these two data sets, first, the common variable (cty_code) was sorted. Then, the two data sets were merged by using the common variable. After the merging process, some cases were out of the data for not having a counterpart from the other data set. Finally, we have 50 cases for the statistical test that we are going to process.

***Dependent Variable*:** in order to find out the relationship between effectiveness of law enforcement agencies and their expenditures on mobile IT devices, "*crime clearance rate*" is going to be used as dependent variable (DV). Measurement level of this variable is going to be ratio, which improves our inference by allowing multiple regression and transformation. Data for the DV are going to be created by using offences and arrests in UCR data set of 2000.

***Independent Variables***: agency use of "*mobile"* devices, "*the number of laptop*," "*the number of Mobile Digital Computer (MDC)*," "*the number of Mobile Digital Terminal (MDT)*" "*the number of portable in use*," and "*law enforcement budget*" will be used as independent variables (IVs). Except for the "mobile", shows if the agency uses mobile devices or not (1, 0), measurement level of all IVs is ratio too. Data for the IVs are going to be gathered from the LEMAS data set of the year 2000.

***Control Variables*:** "*total number of the sworn officers*" and "*population of the county"* are going to be used as control variables. According to Nachmias, et al., (2000), using a control variable reduces the risk of wrongly attributing explanatory power to the independent variables. They are used to ensure that there is a causal link between the variables stated in the hypothesis and to determine whether any other relations can be explained by variables other than those stated in the hypotheses (Nachmias, 2000). Measurement level of all control variables is going to be ratio. Data for these variables are going to be gathered from the LEMAS of 2000 too.

## A. RELIABILITY AND VALIDITY

The precision of our measurements may be affected by reliability and validity (Nachmias & Nachmias, 2000). Reliability means repeatedly measuring the same values when no change has occurred, which means another research, measures the same subject with same variables, should obtain the same results. Since the study is a secondary data analysis, reliability may not be a problem.

For the validity concerns, we need to be careful with the validity of data, primarily with the dependent variable. We choose our variables carefully by checking the related literature because we believe that validity in quantitative research depends on careful instruments. They have to measure what they are supposed to measure (Patton, 2002). Again, using a government dataset and a high response rate governmental survey enhances the validity of the study.

Since we do not use any control group, the study is a cross-sectional. Therefore, its internal validity is lower than an experimental design, but it may have a better external validity. External validity can be generalized to individuals and situations beyond those involved in the study (Gall, Borg, & Gall, 1996). Because the sample in this research study is chosen from a state, the generalization of it can not be problem.

Reliability can depend on who performs the measurement and when, where, and how data are collected. For reliability, large samples are always preferable. Here, we frame the study with Virginia, which limits the number of cases (N=50) and (N=8). Especially for the multiple regression part N=8 is not a good case number to generalize the performed analysis. For a more reliable result, studying the issue nationwide can be a good solution.

A measure with high validity is an aim for this study. Therefore, we gave importance to the concepts that we are going to use in the study. Having clear conceptual definitions of our variables is very important for the construct validity, which is about the correspondence between our concepts and the actual measurements that we use. Since we define all the concepts, including the variables, we do not have problems with concepts.

### B. LIMITATIONS

Accessing to secondary data is not easy (Nachmias, et al, 2000). The datasets were not available to all users. In order to download those datasets, user should have a password and login from University libraries, which have an access to ICPRS. Secondly, there are a few versions of UCR dataset for the same year. Researcher needs to be careful to choose the right dataset. Since the second dataset of the study is agency level, agency level UCR dataset has been chosen. Finally, while merging the two data sets, we may have problems and accidentally reduce the number of cases, which causes wrong analysis. Therefore, we need to double check the merged data and control it manually.

### C. STATISTICAL TECHNIQUE

An independent t-test is going to be used to test if there is a difference between agencies using mobile digital devices and agencies not using mobile digital devices. Then, in order to find out the degree of relationship among variables, "multiple linear regression," is going to be used. Multiple regression assesses the degree to which one continues variable (the DV) is related to a set of other variables (the IVs) (Tabachnick & Fidell, 2001). It is used to predict the score on the DV from scores on several IVs. The result of regression is an equation that represent the best prediction of a DV from several continues (or dichotomous) IVs.

Results cannot show the causality, but represent the best prediction with the fallowing equation: $Y' = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + ... + b_k x_k$. If the second hypothesis is accepted, coefficients of the variables together with ($R^2$) would be reported. In this case, B (unstandardized coefficient) shows the contribution, change by one unit, and the direction of the relationships (-/+). If an IV increases one (1) unit, DV is going to increase as its B value.

Doing the multiple regression analysis, we need to be careful about normality, linearity, and homoscedasticity of residuals, outliers, and multicollinearity. In order to test the hypothesis for significant relation, values from ANOVA, which partitions the variance due to regression (explained) and residual (unexplained), can be used to test the lack of fit assumption, and then if assumptions met, test for a significant regression, and examine practical significance. Multicolinearity is also needs to be checked before performing the multiple regression.

Actually, we may measure the impact of implementing those IT devices on law enforcement agencies with binary logistic regression, if we are able to model our DV in two dummy variables, such as "low crime clearance rate" and "high crime clearance rate". Then, we can use it as DV and do the logistic regression. Finally, we can predict the outcome variable. However, comparing to the logistic

regression, multiple linear regression gives better results, so we are going to conduct the multiple regression.

## III. FINDINGS

First, frequencies of the variables have been checked if there is any missing data. It was seen that there is no missing data problem. Then, an independent sample t-test was performed to see if there is a significant difference in crime clearance rate between the agencies using mobile digital devices (N=8) and agencies not using mobile digital devices (N=42). The result is not statistically significant at .05 (p=.109). This means that there is no statistical significant difference between the agencies using mobile digital devices and agencies not using mobile digital devices in Virginia. Based on this result, *when all other variable values are held constant*, we do not reject the first null hypothesis ($H_0$1).

Secondly the relationship with the crime clearance rate and the number of "mobile digital devices" was checked. In order to find out degree of relationship among variables related with using digital devices and crime clearance rate, first, agencies using mobile digital devices were chosen and "multiple regression" was used. Control variables are also added to the equation. SPSS software was performed for regression analysis. Before the analysis, the data was checked if it meets the assumptions of multiple regression.

First assumption is the DV is going to be at least in interval scale. Measurement level of our DV (crime clearance rate) is ratio, so the first assumption is met. Second assumption is "ratio of cases to IVs," which means I have to have more cases than IVs. Since I have 8 cases using mobile devices and total 7 IVs and control variables, this assumption is met. Third assumption is absence of univariate and multivariate outliers among variables. Outliers may lead Type I and Type II errors (Tabachnick & Fidell, 2001).

Univariate outliers are cases with extreme value on one variable; whereas, multivariate outliers are cases with an unusual combination of scores on two or more variables (Tabachnick & Fidell, 2001). Cases with standardized scores in excess of +/- 3.29 ($p<.001$) are potential outliers. In order to expose if the data has any univariate outlier, SPSS DESCRIPTIVES was run and standardized values were saved as variables (appendix D). It was seen that the data does not have any univariate outliers.

After checking the univariate outliers, the search for multivariate outliers begins. Multivariate outliers are combine results and chi-square value determines the biggest value (Tabachnick & Fidell, 2001). For the analysis, the degree of freedom (df) is 7, which is the number of our IVs and control variables, so df 7 at 0.05 level from the "critical value of chi-square (x2)" table was checked. The value is 14.0671. Mahalanobis distance of our cases cannot exceed this "critical value of

chi-square." After running a multiple regression, it was seen that there is a multicolliniarity problem, which occurs when two or more of the explanatory variables in a sample overlap and drives coefficient standard errors upward (Tabachnick & Fidell, 2001).

In order to avoid multicollinearity problem, a researcher have to screen perfect or very high Squared Multiple Correlations (SMC) among IVs or very low tolerances (1-SMC), or multicollinearity diagnostics (Tabachnick & Fidell, 2001). After running the regression with collinierity statistics, it was seen that tolerances of variables are very close to the zero (0), which means that there is a collinierity problem (appendix E).

This collinierity problem can also be seen in our SPSS output (correlation) table (Appendix F). Collinearity happens when a correlation coefficient between two variables is greater than .90 (Tabachnick & Fidell, 2001). There is a high correlation between population and number in use MDT (.907); between population and total operating budget (.953); and between full time equivalent and total operating budget (.952). Therefore, after checking the IVs' relationship with the DV, and comparing the IVs' correlation coefficients with the DV, "population" and "full time equivalent" variables were dropped. Now, the df is 5. Therefore, mahalanobis distance of the cases cannot exceed 11.0705, at .05. After saving and checking the mahalonobis distances, it was seen that the data has no multivariate outliers (Appendix G).

Another assumption is normality of variables, which has two components: skewness and kurtosis. For sample size of 8, critical value of skewness is – 1.6974 and + 1.6974, and critical value of kurtosis is – 3.3948 and + 3.3948.

$$S_s = \sqrt{\frac{6}{N}} = \sqrt{\frac{6}{8}} = 0.8660 \qquad S_k = \sqrt{\frac{24}{N}} = \sqrt{\frac{24}{8}} = 1.7320$$

$$z = \frac{S-0}{S_s} = 1.96 = \frac{S-0}{0.8660} \qquad z = \frac{K-0}{1.7320} = 1.96 = \frac{K-0}{1.7320}$$

$$S = 1.96 * 0.8660 = 1.6974 \qquad K = 1.96 * 1.7320 = 3.3948$$

After checking the skewness and kurtosis, it was seen that only Fairfax Police Department has positive skewness in number of used MDT. To check the heteroscdasticity and normality of residuals, a linear regression was performed, with Y:*ZPRED and X:*ZRESID in plots, saved the residuals, and check the histogram, normal probability plot, and partial plot. Here, normality of residuals, skewness and kurtosis was observed. Therefore, no transformation of variables was carried out.

After checking the data for the assumptions of multiple regression, a standard multiple regression was performed. Number in use-mdt portable, total operating budget, number in use-laptops, number in use-mdc, and number in use-mdt are IVs. Analysis was performed using SPSS REGRESSION for evaluation of assumptions about relationship between DV and IVs.

According to model summary table (Appendix I), the explanatory power (R2) is (.525). The adjusted R2, which shows the penalty factor, is not very close to the R2 because we have very limited cases (N=8). Overall strength of the model is not significant (p=.8) (Appendix J). Therefore, there is no need to look at the coefficients. This means that there is no statistically significant relationship between the number of utilized mobile digital devices and the number of arrest at .05. Based on this result, *when all other variable values are held constant*, we do not reject the second null hypothesis ($H_0$2).

For the third hypothesis, which is about relationship between law enforcement budget and crime clearance rate, correlations between the variables need to be checked. According to correlations table (Appendix F), correlation between law enforcement budget and crime clearance rate is not significant (p=.338). This means that there is no statistically significant relationship between law enforcement budget and crime clearance rate. Based on this result, *when all other variable values are held constant*, we do not reject the second null hypothesis ($H_0$3).

## DISCUSSION

It was expected to see a statistically significant difference between law enforcement agencies using mobile digital devices and law enforcement agencies not using mobile digital devices. Also, it was expected to see a statistically significant relationship between the variables of the mobile digital devices and the DV (crime clearance rate), at least .05. Moreover, we were expecting to see a statistically significant between law enforcement budget and crime clearance rate. However, we could not get any statistically significant result.

Limited number of cases, especially for the second and the third hypothesis (N=8), can be a reason that may impact analysis. Future studies can try to find out an answer to the research question and the hypotheses by using a nationwide dataset with more cases. Budget of an agency depends on the population. For the budget crime clearance rate, future studies may use budget population rate rather than total budget of the agency.

Moreover, they may also examine the relationship between the computerization of crime-solution functions (criminal investigations and crime analysis) and the use of criminal-history files in particular. They may look at the manpower allocation as well. For example, they may examine if the agencies with

heavy computer use have more or fewer administrative staff or if they have more or fever sworn officers, comparing to the county population. They may search if there is a shift of resources from "street-level" patrolling to IT-staffing activities. Also, they may do research on if per capita law enforcement officer expenditures are high or low in computerized departments.

**REFERENCES**

BARUA, Anitesh; Charles KRIEBEL & Tridas MUKHOPADHYAY (1995), "Information technologies and business value: An analytical and empirical", Information Systems Research, Vol. 6; 3-24.

BHARADWAJ, Anandhi; Sundar BHARADWAJ & Benn KONSYNSKI (1999), "Information Technology Effects On Firm Performance As Tobin's Q.", Management Science, Vol. 45; 1008-1024.

DANZIGER, James & Kenneth KRAEMER (1985), "Computerized Data-Based Systems and Productivity among Professional Workers: The Case of Detectives", Public Administration Review, Vol. 4; 196-209.

DAVIS, Fred (1989), "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology", MIS Quarterly, Vol. 13; 319-340.

DAWES, Sharon (1996), "Interagency Information Sharing: Expected Benefits, Manageable Risks", Journal of Policy Analysis and Management, Vol. 15; 377-94.

DEVARAJ, Sarv & Rajiv KOHLI (2003), "Performance Impacts Of Information Technology: Is Actual Usage The Missing Link", Management Science, Vol. 49; 273-290.

DEWAN, Sanjeev. & Chung-ki MIN (1997), "The Substitution Of Information Technology For Other Factors Of Production: A Firm Analysis", Management Science, Vol. 43; 1660-1675.

GALL, M.D.; Joyce GALL & Walter BORG (1996), Applying Educational Research, London: Longman Group.

HARRIES, Keith (1999), Mapping Crime: Principle and Practice, İnternet Adresi: http://www.ncjrs.org/html/nij/mapping/pdf.html, Erişim Tarihi: 29.04.2005.

KELLEY, Maryellen, (1994), "Productivity And Information Technology: The Elusive Connection", Management Science, Vol. 40; 1406-1425.

KOSKI, Heli (1999), "The Implications Of Network Use, Production Network Externalities And Public Networking Programs For Firm's Productivity", Health Research Policy and Systems, Vol. 28; 423-439.

LANDAUER, Thomas (1996), The Trouble with Computers: Usefulness, Usability, and Productivity, Cambridge, MA: MIT Press.

MAGUIRE, Mike (2000), "Policing by risks and targets: some dimensions and implications of intelligence-led-crime control", Policing and Society, Vol. 9; 315-336.

MENON, Nirup; Byungtae LEE & Leslie ELDENBURG (2000), "Productivity of information systems in the healthcare industry", Information Systems Research, Vol. 11; 83-92.

MORRISON, Catherine & Ernst BERNDT (1991), "Assessing the Productivity of Information Technology Equipment in U.S. Manufacturing Industries", National Bureau of Economic Research (working paper no. 3582), Washington, D.C.

NACHMIAS, Chava & David NACHMIAS (2000), Research Methods in the Social Sciences, New York: Worth Publishers.

NICHOLSON- CROTTY, Sean & Laurence O'TOOLE (2004, January), "Public Management and Organizational Performance: The Case of Law Enforcement Agencies", Journal of Public Administration Research and Theory, 14; 1-18.

NUNN, Samuel (2001, March/April), "Police Information Technology: Assessing the Effects of Computerization on Urban Police Functions", Public Administration Review. 61; 221-234.

PATTON, Michael (2002), Qualitative Research &Evaluation Methods, Thousand Oaks, CA: Sage Publications, Inc.

RAO, Srikumar (1997), "Robocop", Forbes, 7; 190-196.

ROGERS, Everett (1995), Diffusion of Innovations, The Free Press, NY, 1995.

SICHEL, Daniel (1997), The Computer Revolution: An Economic Perspective, Washington, DC: Brookings Institution.

SIEGEL, Donald & Zvi GRILICHES (1992), "Purchased Services, Outsourcing, Computers, And Productivity In Manufacturing", Z. Griliches (ed.), Output Measures in the Services Sectors, Chicago, IL: University of Chicago Press; 429-458.

SOHAL, Amrik; Simon MOSS & Lionel NG (2000), "Using Information Technology Productively: Practices And Factors That Enhance The Success Of IT", International Journal of Technology Management, 20; 340-353.

SUCCI, Melissa & Zhiping D. WALTER (1999), "Theory of User Acceptance of Information Technologies: An Examination of Health Care Professionals", Proceedings of the 32nd Hawaii International Conference on System Sciences.

TABACHNICK, Barbara & Linda FIDELL (2001), Using Multivariate Statistics, Needham Heights, MA: Allyn & Bacon.

U.S. DEPARTMENT OF COMMERCE, (1998), The emerging digital economy, Report ESA-OPD 98-4, İnternet Adresi: http://www.ecommerce.gov, Erişim Tarihi: 29.04.2005.

U.S. DEPARTMENT OF JUSTICE, (2002), Uniform Crime Reporting Program Data [United States]: County Level Detailed Arrest and Offense Data, 2000, Ann Arbor, MI: Inter-University Consortium for Political and Social Research.

U.S. DEPARTMENT OF JUSTICE, (2003), Law Enforcement Management and Administrative Statistics (LEMAS): 2000 Sample Survey of Law Enforcement Agencies, Ann Arbor, MI: Inter-University Consortium for Political and Social Research.

WILKINSON, Scott (1998, February), "PC Apps Help Take the Byte Out of Crime", PC Week, Vol. 23; 83-5.