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COMPUTERS AND THE POLICE REVISITED: A SECOND LOOK AT THE EXPERIENCE OF POLICE DEPARTMENTS IN IMPLEMENTING NEW INFORMATION TECHNOLOGY

by

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FOREWORD

The research project, "Innovative Resource Planning in Urban Public Safety Systems," is a multidisciplinary activity, supported by the National Science Foundation (RANN, Division of Advanced Productivity, Research, and Technology); and involving faculty and students from the M.I.T. Schools of Engineering, Architecture and Urban Planning and Management. The administrative home for the project is the M.I.T. Operations Research Center. The research focuses on three areas: 1) evaluation criteria, 2) analytical tools, and 3) impacts upon traditional methods, standards, roles, and operating procedures. The work reported in this document is associated primarily with category 3, which entails an evaluation of the impact of new technologies, methodologies, performance criteria, and organizational forms upon system operating policies, employees and their organizations, crime hazard rating schemes, regulations and standards, and personnel performance criteria.

In this report Dr. Colton reports on the results of an extensive survey--utilizing questionnaires, telephone interviews, and personnel interviews--of police departments throughout the United States, with the aim of assessing the impact of computers and computer-related techniques (for instance, resource allocation and semi-automated dispatch) upon police operations. This report serves as a follow-up to an earlier paper by Colton, "Use of Computers by Police: Patterns of Success and Failure" (Urban Data Service, Vol. 4, No. 4, April, 1972).

- Richard C. Larson
Principal Investigator

ACKNOWLEDGEMENTS

Although this article is being produced as an IRP "Preprint" and will appear in several publications for the International City Management Association, further refinement is anticipated. As a consequence, the author is still very interested in receiving any comments or ideas.

The author wishes to acknowledge the contribution of Scott Hebert and Carl Strauss towards the preparation of this report. Scott worked as the research assistant on the project and was particularly helpful throughout. Carl was responsible for the computer work.

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COMPUTERS AND THE POLICE REVISITED: A SECOND LOOK AT THE EXPERIENCE OF POLICE DEPARTMENTS IN IMPLEMENTING NEW INFORMATION TECHNOLOGY[1]

In Oakland, California, a patrol officer reaches down to the remote computer terminal in his car and types in the license number of the speeding automobile which just raced past. Within a matter of seconds, information is displayed that the vehicle is stolen. In St. Louis, Missouri, an experiment is underway in the largest police district in the city to monitor each of the patrol cars by using new locational and computer technology. Precise vehicle movement will be displayed on a television-like screen in the dispatch center, and decisions will be made regarding which car should respond to a call based on a knowledge of which vehicle is the closest.

Does this sound like "James Bond" or "Dick Tracy," or is it reality? Indeed, these are just two examples of the wide variety of technological tools which have been implemented, proposed, or tried on an experimental basis in the police field in recent years. What is the extent of such computer-related innovations, are they really working, and what do they mean for police work?

In July, 1965, in the face of dramatic rises of reported crime and delinquency rates, the President's Commission on Law Enforcement and the

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[1]The research for this article was supported jointly by the National Science Foundation (NSF) and the International City Management Association (ICMA). One of the primary sources of information for this report was a mailed survey which was sent out and sponsored by the I.C.M.A. The staff time in analyzing the data and writing this report, and other research activities such as the telephone interviews, were supported by the NSF, Grant GI38004, Research Applied to National Needs, Division of Social Systems and Human Resources.

The NSF-RANN project is being carried out at the Massachusetts Institute of Technology and is entitled, "Innovative Resource Planning in Urban Public Safety Systems." It aims at developing policy-related procedures and guidelines for improving the planning and decision-making in urban public safety systems, particularly police and emergency medical systems.

Administration of Justice was created. One area selected for special attention in the Commission's final report was the potential contribution of science and technology in the generally labor-intensive field of law enforcement. Because criminal justice agencies need to process enormous quantities of data, the use of electronic computers seemed a particularly promising tool.

In accordance with the Commission's recommendations, the Law Enforcement Assistance Administration (LEAA) was established in 1968; and in its first four years, LEAA distributed over $1.5 billion to states and local governments and to private agencies. A significant portion of these funds--estimated at more than a hundred million dollars--was given out for the creation of automated information applications such as computerized criminal history files. There is disagreement as to the utility of this expenditure. The emphasis of the federal aid program on computer hardware and software development, as well as other types of high crime equipment, has drawn criticism from a number of groups who feel that the money could be better utilized on less technical approaches to the crime problem.[2] Others argue that portions of this money have been wasted, and that, more threateningly, the proliferation of such systems represents a potential infringement on civil liberties.

In response to the growing interest in computers for law enforcement purposes, research was undertaken in 1971 by the author under the aegis of the

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[2]See for example Law and Disorder III, State and Federal Performance Under Title I of the Omnibus Crime Control and Safe Streets Act of 1968, Lawyers Committee for Civil Rights Under Law, particularly pp. 41-57.

International City Management Association (ICMA) to measure the extent of police computer use and to begin to consider the degree of success or failure of such systems to date.[3] That study revealed that 39% of the 498 departments responding to the survey were using computers;[4] and when only cities over 100,000 population were considered this figure rose to 69.8%. Projections regarding future use anticipated that by 1974 nearly two-thirds of all the departments surveyed would be utilizing a computer. However, this research represented only one point in time; and since it seemed worthwhile both to confirm these results and to see if the trends predicted for the future were achieved a second study was designed and carried out during the spring of 1974. The article presents the results of that follow-up research.

Two primary tools were utilized for the 1974 study--a mailed survey and telephone interviews. First, ICMA sent a questionnaire to 410 police departments around the country. This questionnaire was designed specifically to permit comparison with the 1971 survey, as well as to collect information on issues which grew out of the analysis of the earlier survey. The sample included all police departments in cities over 50,000. (In 1971, the first questionnaire had additionally been mailed to 25% of the police departments in cities between 25,000 and 50,000.) A total of 326 departments responded to the second survey, representing 80% of the sample. (Table 1.)

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[3]See Kent W. Colton, Urban Data Service, "Use of Computers by Police: Patterns of Success and Failure (Washington, D.C.: International City Management Association, Vol.4, No. 4, April 1972); and Kent W. Colton, "Police and Computers: Use, Acceptance and Impact of Automation," 1972 Municipal Year Book, International City Management Association.

[4]All cities with a population over 50,000 were surveyed along with a sample of those between 25,000-50,000.

In order to test the validity of the impressions received from the survey responses and to explore in greater detail the impact of the computer on various aspects of police operations, telephone interviews were conducted with the police chief (or, on occasion, the member of the chief's staff most familiar with data processing) in 28 of the responding cities.[5] Because of the small sample size, no definitive conclusions can be reached based on the telephone interviews. However, they have proven to be invaluable in understanding and interpreting the mailed survey.

As expected, many of the findings are similar to those of the 1971 study. In fact, if this were not the case we would have been concerned about the consistency between the two data sources. However, with the combined weight of the two surveys it is now possible to speak about the results with greater confidence. In addition, certain shifts have occurred in the nature of police electronic data processing (EDP) use, and in general implementation of computer use has proceeded at a slower pace than first expected, especially in particular application areas. Further, there seems to be a "second generation" of problems or implications that are beginning to emerge; and although the study has not attempted directly to assess the effectiveness, or the full range of costs and benefits of police computer systems, the report will offer some of the author's impressions on the impact of these systems on police departments and their services.[6]

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[5]Eighty-two responding jurisdictions met the criteria of having a population of 100,000 or more and of indicating that they were currently using EDP equipment for police functions. These cities were stratified according to geographic location, and 28, or approximately one-third, were selected randomly for the telephone interviews.

[6]Since this report will only begin to scratch the surface regarding impact, more detailed research along these lines is currently underway as a part of the Innovative Resource Planning project at M.I.T. funded by NSF-RANN. In that work an effort is being made to document a variety of cases where new information technologies have been tried and to follow their implementation, problems, and impact. Cases will be drawn from two police application areas: resource allocation and computer-aided dispatch.

The report is divided into three major sections:

1. Computer Use By the Police: A review of how computers are used by the police, how this has changed over time, and what plans exist for the future.
2. Computer Implementation: An examination of the problems encountered in computer use and how implementation has proceeded to data.
3. Computer Impact: A discussion of some of the issues and preliminary findings concerning the implications and impacts of computer use.

COMPUTER USE BY THE POLICE

The first real-time police computer system was installed in the United States only ten years ago in the St. Louis police department. Since then, tremendous growth has clearly occurred in the use of information technology by the police. However, when comparing the extent of computer use which was anticipated in 1971 to what has actually taken place in the last three years, implementation has transpired at a slower rate than expected. Of the 325 cities responding to the mailed survey in 1974, 183, or 56%, indicated that they were using a computer (Table 2). In 1971, for cities of comparable size, 44% of the departments had indicated EDP use. By 1974, an increase of 12% had occurred in the number of law enforcement agencies using computer equipment. But the 1971 predictions for computer use by 1974 had been much higher. At that time 24% of the departments of comparable size who were not using a computer had stated that they would be within three years. Thus, although a number of departments have acquired an EDP capability since 1971, the growth of computer use was fully 50% less than what was predicted. (Figure 1.)

The discrepancy may be due, in part, to the slightly different response rate between the two studies and possible changes through interpretation that might occur if a different person filled out the questionnaire in 1974. Further, people generally tend to be overly optimistic in making estimates for the future. However, the author feels that the diminished growth also indicates that some police departments are taking a more careful and sophisticated approach to computer use. A healthy pragmatism exists in many departments, and in some there is even skepticism. Still, given past experience, estimates for the future remain tempered, but quite high. According to present predictions, 74% of

United States police departments will be using a computer by 1977 (Table 3).[7]

In the first survey, the single most important factor found for predicting whether a police department used a computer was the size of its city. As anticipated, the data from the 1974 survey indicates that this same pattern holds, with 100% of the responding departments in cities of 500,000 using a computer, 69.7% of departments in cities between 100-500,000, and 39.3% of departments in cities less than 100,000 in population. (Figure 2.)

As a further step of analysis in reviewing the 1974 data, an "index of computer sophistication" was developed. Each department was rated on whether or not they had a real-time computer, the size of their computer core storage, and on their in-house and outside EDP programming capability. Using this new index, city size once again was found to be an important indicator. As city size increased, so did the overall rating of "computer sophistication." (Table 4.)

In addition, central cities tended to use computers to a greater extent than suburban cities. (60% of the former type of department were users, as compared to 49% for the latter two categories--Table 2.) Central cities also demonstrated a higher degree of computer sophistication. (Table 5.)

Regarding type of government, council-manager cities showed a much higher percentage of use (61%) than did cities with mayor-council forms of government (47%). This was true even given the fact that mayor-council cities tend to have a larger population and thus might be expected to have a higher rate of computer use.

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[7] As indicated previously, 326 police departments responded to the 1974 survey. However, a few of these departments--about 40-- answered somewhat belatedly in a third mailing. Because of the time constraints of publication, the initial analysis of data was carried out based on a response from 285 cities. As a result, Tables 4,5,7,8,9,10,12, and 13, and Figures 5-12 are based on the 285 city sample. Tables 1,2,3,6,11 and Figures 1-4 are based on results from all 326 cities.

Geographically, the Western states had the largest number of EDP users with 61 of the 84 responding departments, or 73%, indicating that they had access to a computer (Table 1). The South, which was actually the leader in use in 1971, remained a close second with 67% of the responding departments reporting use, followed by the North Central states with 48%. In 1971, the Northeast was by far the lowest user of computers, and in 1974 that phenomenon clearly was true again, with only 34% of the police departments in the Northeast using a computer. Among the individual states, California and Virginia had by far the largest number of cities with police-related computer use.

It is particularly interesting to look at regional comparisons between predictions of computer use which were made in 1971 and what has actually occurred (Table 6). Significantly, the West was the only region of the country to meet their expectations. 73% of the police departments in the West anticipated use by 1974, and 73% actually achieved such use. The South fell short of their predictions, but not by as much as the Northcentral or the Northeast. In fact, failure to meet expectations in the Northcentral and Northeast areas was responsible for a large majority of the unmet predictions between 1971 and 1974.

How Do Police Use Computers?

In filling out the mailed survey, the departments were asked to indicate each of 24 different applications where they presently were using computers and to specify whether such applications involved real-time access or not.[8]

[8] The 24 application choices for the second survey were nearly identical to the list presented to the departments in the 1971 questionnaire. The only differences were: (a) the "communications switching" application was dropped from the list in the 1974 questionnaire, and (b) the application "traffic allocation and distribution" was added. This application was included to enable the authors to distinguish between the use of computers for traffic force and patrol force resource allocation.

Departments were also asked to designate if they were planning to implement a particular computer application within three years to specify whether or not this application would be real-time.

The 24 applications were grouped into 8 application areas, depending on their basic thrust: (Figure 3)

1. Police Patrol and Inquiry - This area refers to those applications which allow a police officer to make rapid "real time" inquiries about identification of people or property (wanted, missing, stolen, and the like). Applications included here were files of outstanding warrants, stolen property files, and listings and cross references between registered vehicles and their owners. The actual technology in this application area varies widely. Some police departments retrieve information on "teletype" computer terminals, while others have installed a "CRT" terminal (cathode-ray-tube) for each police dispatcher. The most recent technological innovation in this application area is to place CRT digital display terminals in patrol cars so that policemen can make inquiries without going through an intermediary operator.

2. Traffic - Applications in this area provide automated records of traffic accidents, traffic citations, and parking violations. Besides providing statistical data, these applications often serve to bring additional revenues to the city by increasing efficiency in collecting fines for traffic and parking violations.

3. Police Administration - Computer use in this area corresponds closely to that in other governmental areas and in business organizations. Personnel records, payrolls, budget analysis and forecasting systems, inventory control files, and fleet maintenance records can all be automated to

aid in the administrative operation of the police departments.

4. Crime Statistical Files - This area includes basic files on the type and number of criminal offences and arrests and on juvenile criminal activity. These records are used widely in filling out reports such as the FBI uniform crime report and in supplying historical records. These data also are vital to computer use in other application areas such as resource allocation, program formulation and planning, and criminal investigation.

5. Miscellaneous Operations - Applications in this area include files related to jail arrests (to keep track of people who have been arrested, released, released on bail, etc.) and files related to intelligence records.

6. Resource Allocation - This area of computer use begins to get into non-routine processing activities. Programs are used to analyze police service and to provide for the allocation and distribution of patrol units. In some cities, computers help predict workloads and alter police patrol force deployment to meet changing crime patterns on an hourly and seasonal basis. (In the 1974 survey an application was added specifically to gather information on resource allocation in the traffic area. The results of this application will be included in the totals for the resource allocation area.)

7. Criminal Investigation - These applications provide an officer or detective with supporting information for investigating and solving crimes. This may include information on crime patterns, modus operandi (an individual or group pattern or a method of operation), automated access to field interview reports, nickname files, and fingerprint matching.

8. Computer Aided Dispatching - This area concerns computer utilization to provide for the automated or partially automated "command and control" of field units in order to speed up and to handle more effectively the dispatch of patrolmen in answering calls. Ultimately, computerized visual

displays are anticipated with these applications to show for the dispatcher the location and status of patrol cars, service times, nearest car to an incident, etc. However, the development of a geographic base file for the city must precede such a system.

Structured and Unstructured Computer Applications

In evaluating the use and impact of computers in U.S. police departments to date, a further distinction and grouping among application areas is useful. Two basic types have been identified: those which can be termed as "structured" and those which are "unstructured."[9]

Structured applications are generally those uses which involve the relatively "routine" automation of information processing activities. They involve the straightforward, repetitive manipulation and inquiry of prescribed data, and often include a definite procedure for handling these situations. In many cases, the same manipulation which is occurring by machine was already being done by hand before the advent of the computer. The computer just made the process far quicker and less cumbersome. For example, although applications for police patrol and inquiry may bring great benefit and utilize third-generation computers, from a technical point of view, inquiry systems to handle wanted warrants, stolen property and motor vehicles are relatively straightforward and can be considered structured. Other structured application areas include traffic, crime statistical files, police administration and miscellaneous operations. (Figure 4.)

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[9] The distinction between "structured" and "unstructured" problems related to computer applications first came to the author's attention in G. Anthony Gorry and Michael S. S. Morton, "Management Decision Systems: A Framework for Management Information Systems," Working Paper Number 458-70, Alfred P. Sloan School of Management, M.I.T., April, 1970. (The terms "programmed" and "unprogrammed" have also been used by Herbert A. Simon in The Science of Management Decision (New York: Harper and Row, 1960), p. 6, to draw a similar distinction.)

On the other hand, unstructured applications are more elusive and complex. It is in this "unstructured" area that the machine begins to become a tool for decision making, strategic planning, and man-machine interaction. In handling problems in unstructured applications, there are no absolute cut-and-dried methods, either because the area is elusive or complex, or because it is so important it deserves custom-tailored treatment. The human decision maker plays a vital role in judgment, evaluation, and insight. In law enforcement, unstructured application areas include resource allocation, investigation of crime, and command and control and dispatch.

Naturally, it would be a mistake to consider "structured" and "unstructured" categories as sharply-defined classifications. It is more reasonable to regard them as opposite ends of a spectrum. For example, moving toward the unstructured end, systems design becomes more difficult, and behavioral, personality, and organizational considerations become increasingly significant. For more unstructured applications to be successful, an effective interaction between man and machine is necessary. Further, several applications seem to fit somewhere in between the two extremes with tendencies towards both. The best example is crime statistical files. Generally routine in collection and processing, these files provide the basic data which is essential for a number of unstructured activities such as criminal investigation or resource deployment.

Nevertheless, realizing that there are imperfections in any classification system, the distinction between structured and unstructured computer applications in law enforcement is very useful in beginning to analyze the implementation and effectiveness of computer use to date.

The Evolution of Computer Use Reexamined

In the 1971 study, it appeared that one could view the evolution of

computer use by the police as having essentially three distinct phases: (1) 1960 to about 1966 or 1967, when traffic, crime reporting, and police administration were most prominent; (2) 1967 to 1971, highlighted by the rapid expansion of systems for police patrol and inquiry; and (3) 1971 to a more hazy future, which was felt would bring an increasing focus on the more unstructured, difficult, and perhaps potentially more beneficial applications related to resource allocation, criminal investigation, and command and control.

The 1974 survey essentially confirmed these patterns for use prior to 1971. However, concerning the predicted future, and in particular in regard to what has occurred between 1971 and 1974, some important shifts have taken place.

1960-1966. During this initial era of police computer use, first applications were in traffic applications, police administration, and criminal statistical files, the latter group undoubtedly being used for the preparation of state and local reports and the FBI's Uniform Crime Reports. By the end of 1966, traffic and police administration applications were clearly the leaders, representing better than half (54%) the total computer use (in terms of number of applications) at that time. (Figure 5.) The most common single application was payroll preparation, with 20 of the 32 departments who were using a computer in 1966 indicating such use.

Criminal statistical files proved to be the third most prevalent category of computer use at the end of 1966.

1967-1971. By the middle of the decade of the sixties the capability for real-time computer applications had been developed, and the President's Crime Commission seized on this development and suggested a variety of ways in which the rapid access to information might be beneficial to a department's operation.

Subsequently, in the period of 1967 to 1971, some shifts in emphasis occurred in the police's use of computers. For one thing, although the total number of traffic and police administration applications increased considerably, the criminal statistics category experienced the greatest reported growth. Indeed, 47 departments added automated criminal offenses files to their computer operations--the largest absolute increase for any individual application during this period. Even more striking, however, was the tremendous growth realized in the police patrol and inquiry area. From relative obscurity in 1966, the police moved quickly to implement such applications. Between 1967 and 1971 the number of inquiry applications increased seven times. By 1971, almost one-fifth of all reported police computer use was devoted to the rapid retrieval of information on outstanding warrants, stolen property, or vehicle registration; and police patrol and inquiry applications had moved from fourth to second in terms of total computer use. (Figure 6, Table 7.)

The primary explanations for this widespread adoption of patrol inquiry applications are the convenience and the safety for the patrolman in the street. If a patrolman stops a speeding car, it is extremely helpful for him to know if the car is stolen so he can be prepared for any potential reaction when he approaches the driver. Although such situations may be relatively rare, it is understandable that any computer application which could help reduce the risk in officer inquiry would be given a high priority in a department's planning. Also, the patrolman receives a response with maximum convenience and minimum delay because an overwhelming percentage of police patrol and inquiry applications are real time--allowing a response in seconds rather than minutes.[10]

[10] For greater information concerning police patrol and inquiry applications see the earlier I.C.M.A. article by Colton on computer use.

During the late sixties increased attention also focused on another area of computer application--using information technology to aid in patrol resource allocation decision-making and in the evaluation of police service. In absolute numbers, the resource allocation area still represented only a small fraction of total police computer operations at the end of 1971; but the greater than six-fold increase between 1966 and 1971 strongly suggested that this category was in the process of becoming a major EDP application area.

Development in police administration applications, on the other hand, seemed to be losing some steam in this second period. In spite of the fact that this area accounted for about one-fifth of police data processing activity, its rate of growth (expecially the rate of increase of individual applications) seemed to be lagging behind the other major areas.[11]

1971-1974, Predicted Vs. Actual. In the 1971 article an attempt was made to estimate what police computer use would look like in the near future. Predictions were based on the relative rates of growth in the various application areas up to that point, the responses regarding future use, and departmental response on the importance of various applications areas.

With this information, it appeared that the police would continue to acquire crime related files at a high rate, and therefore this area would exhibit the highest average use in 1974. Furthermore, the article predicted that while real-time systems would remain important, the emphasis would shift towards resource allocation. Due to a larger projected increase, the resource

[11] It should be noted that in interpreting the various figures and tables concerning computer use the police administration area has a special advantage. Five applications are included in that area whereas in most others there are only three--see Figure 3. As a result, the "tables" for police administration are unfairly weighted on the high side.

allocation applications were expected to overtake the police patrol and inquiry area by 1974, and become the second highest use category. Nevertheless, police patrol and inquiry applications were anticipated to represent a strong third, with traffic related applications dropping to fourth.

The anticipated growth in the resource allocation area was consistent with the 1971 survey findings that police regarded patrol deployment and resource allocation as their most significant computer application.

Another significant finding from the first survey was that although computer aided dispatch and criminal investigation received relatively little use in police departments by 1971, these two application areas still were ranked fairly high above traffic, police administration, and miscellaneous operations. Moreover, the survey showed that the number of departments with a computer-aided dispatch program was expected to increase to almost six times its 1971 level by 1974. Criminal investigation applications were expected to experience an almost equally high rate of growth. Although in terms of average use, these two categories would remain relatively minor, such increases were felt to be important because they represented a shift towards greater use of unstructured computer applications by the police.

The results of the 1974 survey indicate, however, that the actual pattern of computer expansion has differed in several ways from what was predicted originally, particularly in the unstructured areas. In structured uses, the general pattern was much as expected, although the total number of applications added was fewer than anticipated.

It was predicted that crime statistical files would display the highest average use, and indeed, in 1974 they did. (Table 7.) They were closely followed, though, by applications for resource allocation and police

administration, with both having the same total (255 applications each). The third and fourth highest areas were traffic and patrol and inquiry.

Of special note is how "evened out" use nad become in all five of these application areas by 1974. (Figure 7) In 1971, there were major differences in use, and continued major differences were anticipated for 1974 (Table 7). But by 1974, the first five application areas were only separated by a difference of 25 applications between the high (crime statistical files at 268) and the low (police patrol and inquiry at 243). The primary reasons for this were first, the major increase in the resource allocation area; and second, the failure of the other four application areas to expand at the rate anticipated.

Earlier in the article it was noted that the speed at which new departments are acquiring computer systems for the first time was well below the rate predicted in 1971. The experience in individual application areas, on the other hand, has been mixed. (Figure 8.) Resource allocatior was the only category whose growth since 1971 exceeded the predicted rate (realizing an increase of 144 rather than the anticipated 131). This further corresponds with the 1971 rating of importance in this area. (However, there is a major difference between having a computer application and actually using that application. With this in mind, there is still some question as to just how far along implementation really is in the resource allocation area, and this will be discussed in greater detail later.) Traffic increases were 57% of those anticipated; criminal statistical files and police patrol and inquiry files were at 45% of the predicted level; and police administration applications were only

one third of the expected level.

In two of the categories, however--the other two unstructured application areas--one gets the strong impression that the 1971 projections were exceedingly over-optimistic. The earlier survey had predicted a considerable increase in the installation of systems to aid criminal investigation and dispatch. However, of the 158 criminal investigation applications planned for use by 1974, only 29 have actually been implemented. Similarly, of the 61 departments in cities of 50,000 or more who indicated that they would implement a computer-aided dispatch system by 1974, only three had managed to meet the goal. The general failure of the departments to acquire such systems in the specified time frame is a strong indication of the difficulty involved in implementing such applications. It also may demonstrate a lack of prior understanding in the various police departments as to what is actually entailed in developing these applications. (Such as the prerequisite of a geographic base file before implementing a sophisticated computer-aided dispatch system.)

Although the expansion of police computer usage has deviated quite a bit from the patterns suggested in 1971, our survey shows that remarkably there have been no significant changes in the departments' perceptions of the relative importance of the different applications. According to the survey, the departments believe strongly that overall resource allocation activities are their most important computer applications. (Figure 9.) Following this category in perceived importance was the criminal statistics area, which just edged-out the patrol and inquiry applications in the departments' evaluations. Computer-aided dispatch remained the fourth most valued application area, which is particularly interesting given the poor record of successful implementation to date. Only a handful of departments have actually installed applications in

this area, but it is still regarded high in importance.

Police administration and traffic applications once again ranked very low in the departments' estimation. (In the telephone interviews, traffic applications were most often named as the departments' least important application.)

As a check on the reliability of the questionnaire responses, interviewers asked a number of the same questions over the telephone which were posed in the mailed survey. Once again, departments considered resource allocation extremely important. Indeed, a number of the chiefs felt that the financial squeeze in which many cities are finding themselves was going to get worse before it gets better, and therefore they considered it essential that the department have a capacity to use whatever resources it has in the most efficient way possible.

A further finding was that the chiefs and their command staff were strongly committed to implementing those applications which they believed were most helpful to the man in the street. In particular, this commitment was manifested in the acquisition of a real-time police patrol and inquiry system. In fact, the number of interviewed departments whose representative said that their want/warrants file was their most essential computer operation was much higher than indicated in the mailed survey. However, upon closer examination of the data a number of other indicators were found which emphasized the police patrol and inquiry area. As an example, over 39% of the departments which had a warrent file felt it was their most important application. For those possessing criminal offense files or an automated patrol force resource allocation (the other two applications most cited), the comparable figures were significantly lower, 18.9% and 29.8% respectively.

In summary, important variations exist between anticipated computer use

by the police and actual implementation over the past three years. In structured application areas use did increase and indeed four of the five top application areas are structured. However, in each case use was significantly less than was initially predicted.

In unstructured application areas, resource allocation was the only area --structured or unstructured--where the expected use level was actually met and surpassed. However, in the other two unstructured application areas, use has fallen far short of initial expectations in 1971. Although still ranking fairly high in importance to police departments, the indications to date are that estimates of future use in these areas should be viewed with skepticism.

The Future. In predicting police computer use for the near future, we have a number of advantages over the 1971 article. For instance, we know now that the departments' own projections must be taken with a grain of salt--in the past they have tended to be overly optimistic. (However, there may be hope that the departments themselves have also learned from the past four years' experience and that their objectives and milestones may be more realistic.)

According to the 1974 responses, the greatest predicted growth will center primarily around unstructured application areas. The criminal investigation area is top (155 new applications), followed by police administration (150), and resource allocation (148). Computer aided dispatch is also high. If one considers geographic base files a part of such an application area 148 applications will be added by 1977. (Table 7.)

If this pattern of expansion actually occurs, the resulting use by 1977 is shown in Figure 10. Perhaps the most striking phenomenon is the continued rise in popularity of the resource allocation application area. From fifth place in 1971, it seems that resource allocation (along with police administration) will

become the major computer use area by 1977. Since resource allocation was the only application area to achieve and surpass its predicted use from 1971-1974, it seems more likely that future predicted growth will actually occur in the resource allocation area than in some of the other application areas. For example, with police administration applications only one third of those expected by 1974 were actually implemented. If this were to happen again, resource allocation would clearly be the number one area by 1977. Applications for criminal statistical files, traffic, and police patrol and inquiry will be third, fourth and fifth respectively. Once again, with the exception of resource allocation, the top computer uses will be in the structured area.

From the findings above, growth in the two unstructured areas of computer-aided dispatch and criminal investigation categories are the most questionable projections. Computer-aided dispatch systems, if they include such things as car locator systems, can represent one of the most sophisticated computer applications available to the police. Even designing and developing simpler versions of such systems is a complicated endeavor requiring a good deal of effort and time. If only three out of 61 departments stated that they were able to implement a system within the three-year span of 1971 -1974, it is unreasonable to expect that the rate of success will be very much greater by 1977. This is especially true if one considers that at present only 35 of the sampled departments have working geographic base files, most of which are not real-time. Moreover, because of the particular "command and control" orientation of computer-aided dispatch systems, such applications have a greater probability of encountering rank and file

resistance.[12]

The design and implementation of criminal investigation applications should be less difficult from a technical viewpoint than the developmental work required for a computer-aided dispatch system. However, to this point, the departments' record in implementing such applications has been almost as bad. Past history would suggest, therefore, that growth in this area is likely to fall short of projections.

[12]There has been little actual experience with computer aided dispatch and automatic vehicle monitoring systems to date. The most advanced such experiment in a large city police department is currently being used in the St. Louis Third District to constantly track and display the location of 25 cars on a map of the city found on a "television-like" terminal at the dispatch center. If the experiment works technically, it will ultimately be spread to the entire city starting in the first part of 1975.

COMPUTER IMPLEMENTATION

As previously indicated, the rate of computer implementation has proceeded at a slower pace than was anticipated in 1971. However, one must realize that the third generation of computers has been commercially available only since the late 1960's. In this light, the transition to computer use is proceeding amazingly fast. In fact, some slowing and settling down is probably quite positive--with it may come a greater caution, possible skepticism, and increased understanding.

As part of this understanding and to do a better job in the future, it is important to gain greater insights into the problems that have hindered implementation to date. A number of other important aspects of implementation should also be raised. In this section of the report, then, five general topics will be discussed:

1. Problems Hindering Computer Operations
2. Integrating Computer Use With the Operations of the Police Department
3. Staffing a Police Data Processing Facility
4. Transfering Computer Technology
5. The Differences in Implementing Structured and Unstructured Police Computer Uses

Problems Hindering Computer Operations

The primary problems faced by the police in using the computer are not technical, but are behavioral and people-oriented. It was true in 1971, and in 1974 the conclusion is strikingly similar. The single greatest problem, both in 1971 and in 1974, was scheduling and priorities--determining what

applications to implement and what the priorities and scheduling will be. This concern far outshadowed any other issue. Sixty-six departments indicated problems in this area, and 36 of them stated this was their most important difficulty. (Figure 11.) Training of police personnel, other than technical EDP staff, in computer operations was found to be the second most mentioned problem. And developing software was the third most common difficulty.[13] Other typically named problems in order of frequency included facilities for the EDP equipment, patrolmen's acceptance, management acceptance, and integrating the EDP operations with the rest of the department. In contrast, strictly hardware or equipment problems consistently rated low on the problem scale, once again similar to the 1971 findings.

The telephone interviews attempted to probe the kinds of scheduling and priority difficulties that were occurring. Two aspects were most commonly mentioned: turn-around time and problems surrounding the ownership and control of the computer between the police department and the city. When asked to explain the nature of the turn-around time problem in more detail, most of the chiefs interviewed felt the fault rested with the city--in one case the city was cited because it didn't provide around the clock services; in another the city had arbitrarily (according to the police spokesman) decided to go off-line, a decision which seemed ironic since the computer was originally justified for

[13] On closer examination it became apparent that "developing software" in many cases referred to the departments' inability to get adequate programmer time from the city for the development of the software programs which the police most wanted. In other words, this response was closely related to scheduling and priorities, and in many cases was another manifestation of conflict between the police and the city EDP staff over priorities.

police use; and in a third city the police department was given a priority which was too low and the information simply could not get back to them when they needed it. At least several chiefs seemed to feel that the difficulty arose from the "fiscal" orientation of the city-run computer. Priority was placed on applications which produced revenue for the city and showed the greatest "cost-benefit" ratio. This goal was different than getting "real time information to the policeman on the street," and as a consequence, difficulties arose.

To many policemen, the resolution of this issue is simple and straightforward. As one chief stated, we must "fight very hard for a computer system dedicated solely to the police." Unfortunately, the answer is not that clear, particularly to a smaller city. Costs of a system dedicated solely to the police are often prohibitive, particularly in a city of 250,000 population or smaller. In addition, the author's experience in visiting police departments around the country shows that dedication is not an ultimate panacea. Even when a department owned and controlled its own system, the problems of down-time were still evident. Further, some of the more successful systems examined existed in a non-dedicated environment; whereas some departments were found to have made almost no progress since 1967, even though they had full control over the EDP equipment and staff.[14]

[14] See Kent W. Colton, "The Dedicated Police Computer--Does It Really Make a Difference?", The Bureaucrat, Vol. I, Number 4, Winter 1972, pp. 357-365.

Integrating Computer Use With the Operations of the Police Department

Although the questions of scheduling and priorities remain somewhat unresolved, some progress has been made since 1971 in several other behavioral aspects of computer use by the police. In 1971, the second most important problem was integrating the computer operation with the rest of the department, but in 1974 that issue seems to have a comparatively low significance. (Figure 11.) Indeed, in many places the computer has become an integral part of department operations. When asked if he felt the computer was essential to his operation, one chief replied, "You bet--I would hate to tackle the job [of running the police department] without it." To another police spokesman, the computer was the "greatest thing since fingerprint classification."

Since the police are somewhat notorious for their antipathy to change, we had expected the mailed survey to reveal fairly widespread resistance to the introduction of computer applications in their daily operations. The telephone interviews were useful in demonstrating why this expectation proved to be false, particularly with the implementation of structured computer applications.

As it turned out, most patrolmen came in contact with the operation or output of very few EDP applications; consequently, to such officers the introduction of the computer in most application areas generally isn't considered a very big deal (nor is it particularly threatening). When the patrolman does become involved with the computer operation it is predominantly in connection with a want/warrant or motor vehicle inquiry, or the provision of incident reports. In both such activities, the current procedures are much the same as before the installation of the computer. For example, before the department had its EDP capacity, the officer submitted incident reports. The only change brought about by the computer is that now more detailed information may be requested

which might cause some grumbling. In many instances however, the forms are pre-coded so that while the patrolman provides more data than before, filling out the report actually takes less time.

In instances of suspiciousness or lack of utilization of computer applications by patrolmen, it was felt that such problems could be resolved by in-service training. Most of the interviewed chiefs felt that if one explained to officers what the computer was going to do and why and allowed them to voice their concerns, then the men would accept the new system without too much fuss. In fact, in a number of departments, the utilization of the inquiry system has been so much larger than expected th . the departments were forced to install additional terminals and terminal operators. For example, when the police patrol and inquiry system was first established in Washington, D.C. they were receiving 22-23,000 inquiries per month. As the system became more reliable, usage skyrocketed to the point where now 50-60,000 on-line inquiries are made each week.

However, even though officer acceptance of computer use seems to be progressing favorably, its importance should never be underestimated. Better than five years ago the Los Angeles Police Department designed and implemented an Automated Field Interview Reporting System. The program aided investigation by providing rapid computer access to information on stops and interviews made by policemen in the field. The system was an immediate success. However, after a few years the interview form was redesigned, and in doing so it became less convenient to place in the pocket. As a result, the men quit carrying them, and it was only when the old form was reissued that the system began to function again. Because of form design the system was almost lost. Acceptance and use by the policeman is absolutely essential to success, and assuring such

use is often not a technical matter alone, but involves such practical behavioral factors as convenience and comfort.

Interestingly, according to the telephone interviews, management's acceptance of the computer appears to be a more stubborn problem, since in this realm the computer operation is more likely to disrupt the status quo. Most personnel at the middle management and command staff level have been socialized to accept the traditional methods of doing things. New methods bring an element of uncertainty to their work and may be resisted. As a result, decision making which relies on quantitative data will be counterproductive if the officers are not educated and familiarized with the new technique. As one chief put it, the biggest problem "is trying to get first-level supervisors to understand what the system offers them and to take advantage of it. The men in the field aren't a problem, it's the supervisors."

Staffing a Police Data Processing Facility

A number of chiefs gave considerable attention to the issue of hiring an adequate EDP staff. Several of those interviewed said that if they had one piece of advice to give to a department which was just starting out in developing an automated information system it would be to concentrate on bringing together a competent EDP staff. Others mentioned the difficulty in competing with private industry for good systems analysts and computer personnel and urged departments to pressure police and city budget bureaus to provide adequate salaries for these people.

Further, an interesting shift seems to have occurred regarding who the police feel should be trained as programmers for a police system. In 1971, sentiment was strongly in favor of training patrolmen as programmers. (As one officer put it, "You can train a policeman to be a computer programmer,

but you can never train a programmer to be a policeman.") However, in 1974, the majority of interviewed chiefs indicated that they would not prefer to have police officers trained as programmers. Instead, they would like to see a mix of sworn and non-sworn personnel within the EDP staff, with civilian computer experts reporting to a supervising police officer. Many believed that patrolmen were too valuable, and too well-trained in other matters, to be assigned to programming duties. The police also felt that civilian employees would probably bring more computer-related skills and expertise into the department than could be imparted to a patrolman in a "quickie" computer course. As one chief put it, in general, "analysts should be civilians, and police officers should be police officers and not computer programmers. Civilians can ride along with patrolmen to get a feel for the officer's problems if necessary."

Transfering Computer Technology

One of the most common pieces of advice which the chiefs and their data processing directors offered during the telephone interviews was to "avoid reinventing the wheel." Departments in the planning phase of their computer operation effort were instructed to visit other cities to see what has been done already and to benefit from these experiences. Most of the interviewed departments had sent some of their personnel to visit at least one of the considered leaders in the police computer field--such as Kansas City, Dallas, Los Angeles, Cincinnati, or St. Louis. In their advice, however, chiefs stressed that departments should seek out computer users in the cities which were most like themselves. The bigger departments might have the fanciest equipment, but the most valuable and practical advice would be available from the less advanced, though similarly oriented police forces.

Most of the departments indicated a willingness to share whatever programs or expertise they had with other departments. Several departments said that they would send any law enforcement agency the full set of their system documentation as long as the requesting department provided mailing and copying costs.

Even with this attitude of cooperation, though, the process of technology transfer still seems to be proceeding at a very slow rate. Although a large number of visits among different police departments have been made, only a comparatively small amount of work has actually been transferred. One reason may be the lack of formal mechanism for transfer. The primary people who visit police departments to discuss technology are vendors who have a strong vested interest in making implementation look easy. Perhaps the LEAA might hire a series of technology consultants who could come into a department and provide free, neutral advice as well as technical assistance. If such a plan is to work, though, it must keep in mind that technology transfer is first an organizational and behavioral concern, only second a technical one. As in the general discussion of implementation problems, people are the key! Directories of computer applications have been tried, but they mean very little. Only when the human side can be expressed, can the transfer of technological innovation occur.

The Differences in Implementing Structured and Unstructured Police Computer Uses

In considering computer implementation, some important differences appear in the experience to date between implementing structured police computer applications and unstructured ones.

Many aspects of daily police operations are particularly suited to computer processing. This is especially true of applications related to routine or structured tasks where the storage and rapid access to large amounts of

information is desired. Such structured application areas include police patrol and inquiry, traffic, crinimal statistics and police administration. These are four of the five top application areas in number of applications currently in use (Figure 7), and the expectation is that they will remain high in the future. Certainly the level of success in implementation varies somewhat from department to department, but these variances can generally be attributed to internal departmental factors. On the whole the general success level is positive and the use of the computer is well integrated into the operations of the department.

In contrast to this, implementation of unstructured computer applications is far more mixed. One reason is that unstructured areas often involve initiating a new process or way of behavior in the department. Computer assisted resource allocation may mean a new means of decision making in deployment and a significant change in the current beat structure; computer aided dispatch may alter the criteria by which a dispatcher decides which car will be sent to respond to a call, or it may provide central headquarters with new information for "big brother" about a policeman's behavior and activity while on duty. Criminal investigation applications may bring alteration to the detective's job and to the approach towards law enforcement investigation.

In addition, the process of implementing computer use in unstructured areas is not purely a quantitative one. A number of qualitative considerations arise. In a recent article in Technology Review, Larson has outlined some of these.[15]

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[15]See Richard C. Larson, "Resource Planning for Urban Public Safety Systems." Technology Review, June, 1974, Vol. 76, Number 7, pp. 20-29.

First, objectives, performance criteria, and constraints for these systems are very difficult to isolate and design. One may state as an objective for public safety systems the "efficient, effective, and equitable distribution of quality emergency service, within reasonable budget constraints." But it is hard to transform such sweeping statements into performance criteria that...are easily measured...Moreover, objectives for an urban public service may vary between administrators, operatives, and consumers...One soon begins to realize that a popular word in operations research, optimization, often bears little relevance to the operational realities of governmental service systems, primarily because of the difficulties in defining objectives and constraints.

Second, as system objectives are poorly defined so too are measures of system productivity...Because productivity measures are lacking, those forces that would tend to favor the status quo within an urban public safety system often prevail. The alternative of "no change" while it assures that visible failure will not occur, makes visible progress more difficult to achieve.

Third, with their civil service orientation, these systems have tended to be insular, fraternal, and staffed with career employees whose average formal education often stops with high school...Implementation in governmental service, in contrast with their industrial counterparts, must be viewed as a multi-year process.

(And finally), the operational behavior of urban public safety systems is complex and, at this time, poorly understood.

Because unstructured computer use is far more complex, progress is often slow, and to date, the long-run use and implementation of such applications by police departments is still uncertain. This is particularly true in the area of computer-aided-dispatch and criminal investigation, and the data presented earlier emphasized that in these areas reality has lagged far behind initial expectations. Even in the area of resource allocation where growth seems to be leading all other application areas, it is still questionable as to just how well integrated such uses have become in the operations of U.S. police departments. Whereas police patrol and inquiry applications have become an ingrained part of day-to-day police operations, unstructured applications are far less established, and it is still uncertain whether they will gain acceptance and use over the long run. (And in fact, what their

impact will be if they do.) The actual feasibility and utility of such unstructured applications is still untested.

In the mailed survey, 63 departments (42% of all computer uses) "checked a box" that they were using a computer for police patrol allocation and distribution--that is automatically predicting crime levels, establishing beat boundaries and distributing department resources. Another 97 departments (64%) indicated that they had an application for "police service analysis" (information on type of call, location, time, arrest, etc.). However, there is a difference between having an application and actually using it. A closer look is therefore required, and although this report can only begin to raise questions and point out issues, in order to start such a process it will examine the state of implementation in the largest unstructured application area: resource allocation.

Resource Allocation It has already been pointed out that computer use for resource allocation experienced a significant growth between 1971 and 1974, and in fact, was the only application area where the number of applications actually implemented between 1971 and 1974 exceeded the number predicted in 1971. Just what does this mean, though? Because further information was necessary on how police departments around the country made decisions for manpower deployment, several additional questions were included in the mailed survey. Departments were requested to characterize their resource allocation process, and 147 departments responded. The largest portion of these--70 departments or 48%--indicated that they used no mathematical technique in making decisions on how best to deploy their patrol force. Another 50 departments, 34%, indicated that they did rely on some version of a hazard

or quantitative formula for distributing resources.[16] Only 27 of the responding departments, or 18%, claimed to be using what was termed "an advanced mathematical method," such as a computer simulation or other computer aided resource allocation approach.[17] (Figure 12.)

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[16]A hazard formula identifies a series of factors which are felt to be significant in determining the demand for police patrol service. Generally, an attempt is then made to deploy patrol units, so that each sector has about the same "hazard" values. Most departments simply determine the anticipated workload but a number of departments have more sophisticated approaches which entail the computation of total service times, or consider a number of additional factors. Some of the most commonly used factors in calculating the "hazard" value of an area include the number of crimes against persons, total of all crimes, calls for service, population, juvenile delinquency, accidents and aided cases, school crossings and licensed premises, etc.

[17]Length does not permit a complete discussion in this report of the various resource allocation approaches and methods which have been developed and in some cases tried over the last several years. Some of these are highlighted in the April, 1972 Urban Data Service article by Colton. Some of the most promising experimentation is being done under the sponsorship of the NSF-RANN, Innovative Resource Planning Project at M.I.T. mentioned earlier. Under the direction of Professor Richard C. Larson an allocation and simulation model has been designed to address the basic questions of police deployment. The method requires police administrators to specify a number of policy objectives for each command area or beat. These are stated in terms of constraints. Objectives can involve average response time to a call, preventive patrol, equality of work load, or a variety of other factors that might be deemed important.

The procedure determines the minimum number of units required for each beat, so that all objectives are fulfilled. If the total number of units to be allocated is insufficient to satisfy objectives, then the method computes the deficiency and requires a more modest set of objectives. If there are additional units to allocate beyond those needed solely to satisfy constraints, they are deployed by using a mathematical optimization technique known as "dynamic programming" in order to fulfill certain city-wide objectives (for instance, minimization of average overall waiting time for dispatch.). For a more complete explanation of this work and a further bibliography, the reader is advised to see Richard C. Larson, "Resource Planning for Urban Public Safety Systems", Technology Review, June, 1974, pp. 20-29.

At first review, such information might lead one to feel that comparatively little use is being made of quantitative information and statistics by the police. Although one third of the departments utilize hazard formulas such formulas are often outmoded and have remained unchanged for years. In addition, a surprisingly large number of departments--almost half--indicated they presently were not using a mathematical method. The question, though, is how these numbers relate to earlier data on the growth of resource allocation computers applications. When a comparison was made, it was found that even in those cities which said they were using no mathematical method, far more than half--60 percent-were using the computer to collect and store information for police service analysis. (Table 9.) In other words, although in some of the cities resources are still undoubtedly distributed on the basis of political considerations or intuitive judgment, there is strong evidence to suggest that many of them actually are using quantitative information for decision making, but in a more informal context. Indeed, this same phenomenon seemed to be confirmed in the telephone interviews. A number of departments stressed the importance of using computer provided data to analyze workload and deploy forces. However, very few were actually using a rigorous mathematical formula or technique.

On the other hand, those claiming to use advanced mathematical methods may also require further interpretation. Such methods often look good on paper and may work for short periods, but in reality they are extremely difficult to maintain and utilize in the long run and usually are abandoned, at least in part. One of the best illustrations of this is the St. Louis Police Department, one of the early pioneer departments in the area of resource allocation.[18]

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[18]For a more complete description of the St. Louis resource allocation experiment see Colton, April 1972, Urban Data Service, pp. 12-13.

Resource allocation efforts in St. Louis began as early as 1966, and in 1970 the police department began to use its deployment program city-wide. However, four years later many of the formal aspects of the project have been dropped. Revised beat structures for a police district are still run on occasion, but since it was found that the need for a beat change occurs far less often than expected, runs are made only on request by a district commander. Such requests seldom come, though.

However, to say that resource allocation in St. Louis has failed would be far from the truth. Clearly the overall philosophy of resource allocation has caught on in the St. Louis department. As one person put it, "Resource allocation is not a mathematical model, it's a tactic, a way of doing business." To him, the specific formula or algorithm is far less important than the basic philosophy or approach. The St. Louis police department has returned to a simpler, less formal procedure, and they have generally abondoned the widespread use of a specific technique; however, they have not abandoned "resource allocation."

What then does all this mean as far as implementing computerized resource allocation applications? Four conclusions come to mind. First, there is no simple set of criteria which can be used to allocate police resources. As a result, there can be no one ideal mathematical model; instead, a number of criteria must be utilized and stressed depending on the department, the philosophy of police work being stressed, etc. Second, there is an increased use of quantitative information and data to allocate resources, but only very limited use of specific algorithms or formulas, particularly over the long-run. Based on field experience, the author expects this trend to continue. Third, although in the long run many of the efforts to implement specific techniques or formulas for patrol deployment may falter, and there is still

not enough evidence to fully weigh the costs and benefits, in some cases there are definite advantages in undertaking such endeavors. In St. Louis, for example, significant alterations have occurred in patrol force utilization since the efforts to revamp their resource allocation approach began in the mid-1960's. Such changes would not have occurred without technological innovation. And fourth, in implementing such unstructured applications the organizational and behavioral factors become especially important. In the Urban Data Service article by Colton in 1972, five factors were listed which stood out as being particularly important in determining the differences between those departments that were unmistakably successful in their use of computers and those in which the computer fell short of expectations. They were:

1. Involvement and quality of leadership at the top
2. Involvement of other police personnel (and ability to bridge the gap between EDP and police)
3. Basic approach and establishment of priorities
4. Caliber of computer systems and technical staff
5. Emphasis placed on human-computer interaction.

These same factors still seem to be critical in determining successful computer use, particularly when it comes to unstructured applications. In addition a sixth important ingredient has been identified--continuity in personnel and purpose over the years.[19]

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[19] It was mentioned earlier that case studies are being carried out as a part of the NSF-RANN Innovative Resource Planning Project. One of the purposes will be to try to test the importance, significance and relationship of these six factors.

COMPUTER IMPACT

Before discussing implications and impacts, the question is raised as to why computers are being implemented by police departments around the country. Naturally, there is no single answer.

When asked why police use computers, the most common answers reflect a desire to take advantage of the computers ability to process huge amounts of data with speed and precision, and in turn to increase police efficiency and effectiveness. In the 1971 ICMA survey, departments were asked to indicate their major reasons for using a computer. The three top responses were: to improve service to the public; to improve the patrolman's ability to rapidly identify and apprehend criminals; and to make internal operations more efficient.

Such responses seem straightforward and sincere. However, to really get to the heart of why police departments use computers, two other primary reasons must be considered: (1) vendor influence, and (2) Law Enforcement Assistance Administration funding.

It is only natural that the producer of a product wants to sell and market that product as effectively and as extensively as possible. That means if potential users do not understand why a particular item may be useful to them, the key is to raise the demand by going out and "beating the bushes," developing "saleable" applications, and promising or demonstrating utility. The situation regarding the computer and other technological innovations with the police is no different. Although it is difficult to confirm with hard data, one of the primary stimulants to computer use is the salesmanship of various hardware and software vendors. For example, one of the reasons computer-

aided dispatch and command and control systems have received a fair bit of emphasis lately is because of the fairly large number of vendors who are interested in perfecting and marketing their product.

The telephone interviews and field work efforts of the authors have confirmed these influences. One department spokesman explained that their original impetus for computer use was a combination of the city's desire to have a computer and one vendor's desire to build a law enforcement computer package which could be sold elsewhere. As a result, the development of the system did not always follow the desires and best interests of the police department. In another department, software and hardware vendors were felt to be responsible for overselling the system, thus causing many unmet expectations later on. When asked at the end of the telephone interview what advice they had for other departments, several chiefs commented on the importance of being cautious with salesmen. One put it this way: "My advice would be to take it slow and easy. Resist salesmen trying to sell you the maximum system the first day." To another the key was to first have a good problem-solving session within the department and to develop priorites for desired use. Then, the vendors could be brought in to discuss these already established needs and to see what they could do to meet them.

Computers are also being installed because large amounts of money are presently being spent by the federal government to support police and criminal justice. In fact, one of the reasons vendors are so anxious to get into the law enforcement field is because the money is available. In the 1974 ICMA survey, questions were raised as to the number of departments who had received LEAA funding, and what impact it has had on their computer use. The police departments using computers were almost exactly split between those who had received LEAA funding (71 of 144 or 49.3%) and those who had not (73 of 144 or

50.7%). Regarding impact on use, only three out of ten felt that LEAA funding had had little or no effect on their computer operation, whereas six out of ten felt that without LEAA aid either they would have had no EDP facilities or their computer efforts would have been smaller. (Table 10.) Of those who were not using a computer but plan to do so in the future, 64% are hoping to receive aid from the LEAA, with only 13% hoping for no such assistance, and another 20% being uncertain.

Recent visits by the author to police departments also confirmed this influence. In one case, the police spokesman explained about a recent grant of around one million dollars to be used in the area of command and control systems. Had they solicited the grant? No, they had received a call from the state LEAA planning office telling them a million dollars was available and if the department wanted the money they would have to let them know within the next several days what they wanted to do with it. Since the chief was interested in response time, the decision was made to go ahead with command and control.

It is not the contention of this report that in and of themselves vendor pressures and the existence of LEAA money are always negative influences on police computer use. They have been in some cases in the past, though, and it does mean that in the future there will continue to be a strong potential for oversell, unnecessary computer use, and even abuse. Such potential must be watched more carefully. And above all, a more thorough evaluation of the benefits, implications, and impacts of computer use seems increasingly important. The remainder of this report will begin to discuss some of these implications and impacts. Unfortunately, it will only begin to raise the issues involved and will not discuss them completely. Still it is a first step; and, hopefully, a later report will be able to examine these issues in greater detail.

A "Second Generation" of Problems

In the implementation section of the report a number of problems were discussed which dealt simply with the implementation of automation. Some of the results of innovation are not always expected, though, and in addition to such implementation problems, there may be a "second generation" of problems which are just beginning to appear. These problems were demonstrated in the telephone interview with Chief Joseph McNamara, the comparatively new Chief of Police from Kansas City.

Kansas City is unquestionably one of the foremost police departments in the country in the area of computer use. It was one of the first cities to establish a truly effective real time computer system, and is noted not only for the excellence of the system from an operational perspective, but for the acceptance the computer has received in their police department as well. In 1973 alone, over 575 visitors came to the Kansas City computer facility from all over the world to gain a better understanding of the system. When Chief McNamara was queried as to the computer problems he felt were the most significant for Kansas City, his answers were remarkably different from those received from other cities; but, as such, they may reveal problems to be faced by others in the future.

First, he felt that there was an enormous problem of security and privacy. There are better than 190 terminals and almost 50 agencies involved with the Kansas City Alert II System, and this leads to difficulties in controlling access, instructing operators, and maintaining all of the security precautions required. Even with the best of intentions which they have regarding the privacy of information within the system, problems have arisen.

Second, he felt that the computer indirectly had hurt the manpower of the police department. Because of the rapid retrieval the system provides for data

on stolen cars, outstanding parking tickets, unregistered vehicles, etc., officers were now making more field stops and arrests for such offenses as unpaid parking tickets. To a point this was "OK," but it was now beginning to drain manpower from what the chief felt were more important areas of law enforcement activity such as crime prevention and service and order maintenance activities. Thus they were trying to develop a new set of decision rules as to when and how to invest officer time.

Chief McNamara's concerns raise two important issues which will now be discussed. The first--the question of privacy--is a major issue in and of itself and deserves to be singled out. His second concern is equally important and really opens up a whole broad area for consideration--the impact, whether it be subtle or direct, of the computer on the nature of police work.

The Issue of Privacy.[20] A number of valid law enforcement purposes can be served by the creation of criminal justice information systems. Many of these have already been discussed. However, computerization of law enforcement records also has a great potential for harm. In the absence of adequate rules on what information can be gathered and stored and how it may be distributed, the computer's tremendous capacity to store and quickly manipulate data may result in the invasion of individual privacy.

[20]As a part of the NSF-RANN project, Ms. Katherine Gardner prepared a background memo on "Police, Computers, and Privacy Issues." Although space does not permit a full printing of that memo, she is credited for many of the ideas and thoughts printed here.

In the face of criticism of their system, law enforcement officials often argue that such databanks are necessary if the police are to attain the level of crime control desired by the public. Further, some claim that if an individual has done nothing illegal, he or she has nothing to fear. However, the reputation of innocent individuals, along with such factors as their credit rating or job may be threatened or destroyed by the improper sharing of police records with government agencies and private institutions. Past surveys have indicated that employment agencies refuse to recommend individuals with arrest records, regardless of whether the arrests are followed by convictions.[21] This suggests that an important principal of criminal justice--the right to a presumption of innocence--may be subject to erosion unless we are careful. As one critic of the growing number of domestic intelligence databanks has said:

> The trouble is that people with records don't simply disappear from the face of the earth, they continue to live in our cities, many of then in our black ghettos. Having used their records to keep them out of our places of employment, we still have to live with them.[22]

Of course, many of the undesirable practices and problems associated with record-keeping uses of the computer were already known in the era of paper records and manual transmission of information. But the inherent inefficiencies

[21]Congressman Don Edwards of California reported that a recent survey has shown that 75% of all employment agencies in New York City refuse to recommend an individual with an arrest record regardless of whether is was followed by a conviction. Another survey of 75 employers indicated that 66 of them would not consider employing a man who had been arrested for assault and acquitted. Security and Privacy of Criminal Arrest Records, Hearing Before Subcommittee No. 4 of the Committee on the Judiciary, House of Representatives 92nd Congress, Second session on H.R. 13315, p. 1.

[22]Aryeh Neier, "Have You Ever Been Arrested?" New York Times Magazine, April 15, 1973.

of manual police files provided some built-in protection from the misuse of sensitive personal information. For example, in cases where offenses were not too serious, a person could move to a new location, and like the bankrupt businessman, begin again with a clean slate. The electronic revolution, though, has removed many of the protective inefficiencies and thus eliminated some of the traditional boundaries between different types of record-keeping systems.

There are many technical and mechanical security devices which can be used to safeguard the rights of the individual in law enforcement's computer age. However, to begin with such technological options is to focus our attention away from the central issue. Rather than viewing the issue as a narrow question of record-keeping technique and system design, it should be addressed as an important area of social policy. The critical question to focus on is "what is it that law enforcement and other agencies necessarily need to know?" All too often we have let lesser questions of "what can be collected?" or "once we have the information how do we protect it from unwanted use?" serve as the initial guidelines. Both society and the law enforcement community must consider carefully the extent to which additional information will actually assist in controlling the nation's crime problems.

Moreover, the following basic issues should be explicitly addressed by every community or agency where such information systems are planned or already operating: Why should such types of information be stored in an automatic system? Where should it be stored? Who should control or monitor the dissemination process? For what purposes should the data be used?

Only when these basic policy questions have been adequately answered it is appropriate to consider the technical, operational problems relevant to privacy and the security of records. In turn, a set of basic standards can be set. Time and space does not permit a full elaboration of such standards,[23] but a few recommendations can be outlined as illustrative of the type of control which must be considered:

1. An individual should be guaranteed the right of access and review of any information which is stored in a file concerning him.
2. It should be a punishable crime to improperly access or use any information on an automated law enforcement record system. A verbal chastisement is not enough; real legal penalties must be involved.
3. If data concerning arrests are in the system, information concerning the disposition of that arrest should also be included. If a conviction is not involved, then perhaps the arrest record should be fully purged from the system.
4. All files should be regularly updated and "old" information must be purged systematically.

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[23] One of the most complete and most recent works on this topic is Records, Computers and the Rights of Citizens, Report of the Secretary's Advisory Committee on Automated Personal Data Systems, U.S. Department of Health, Education and Welfare (Washington, D.C.: U.S. Government Printing Office, July, 1973). Also, see: Security and Privacy Considerations in Criminal History Information Systems, Project SEARCH, Committee on Security and Privacy, Dr. Robert Gallati, Chairman, Technical Report No. 2, July 1970.

Important strides have been made towards achieving public participation in the value discussion which must accompany increased computer use by police and other institutions. Numerous Congressional Committees have met, and exhaustive hearings have been held.[24] In addition, a National Presidential Commission on privacy has been established and extensive deliberations are now underway. Recently, the Department of Health, Education and Welfare released an advisory committee report calling for restraints on the operation of computer databanks containing information about individual Americans.[25] However, to date few definitive steps have been taken to assure the implementation of necessary safeguards. Meanwhile, computer development continues to expand.

Unlike most other difficulties encountered by police in their computer operations, the issue of privacy generally won't appear to be a real problem to the department until an outside group defines it as such. In all of the follow-up telephone and mailed surveys, only one police department raised the issue as a problem. Once enough public criticism has been brought to bear, however, it might be perceived by the department as one of its principal computer-related concerns (as was the case in Kansas

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[24] See Report of the Task Force on the Storage of and Access to Government Statistics, October 1966, U.S. Government Printing Office, Washington, D.C. and Federal Data Banks, Computers and the Bill of Rights, Hearings before the Subcommittee on Constitutional Rights of the Committee on the Judiciary, United States Senate, 92nd Congress (Washington, D.C.: U.S. Government Printing Office, 1971).

[25] See Records, Computers and the Rights of Citizens, Report of the Secretary's Advisory Committee on Automated Personal Data Systems, U.S. Department of Health, Education and Welfare (Washington, D.C.: U.S. Government Printing Office, July 1973).

City). In the majority of communities, though, the local police computer system is unlikely to come under a great deal of adverse publicity. Nevertheless, the lack of vocalized public concern should not be looked upon as an excuse by departments to avoid dealing with the issue. Achieving total efficiency at catching criminals is a Pyrrhic victory at best if it is done by infringing on or threatening the constitutional rights of the population at large.

Computer Impact on the Nature of Police Work. One hypothesis in the follow-up study was that the introduction of automated information systems would make decision-making more centralized in the upper echelons of the command staff. It seemed logical that as more and better information regarding a patrol unit's daily activities and its relative performance became available to the chief and his immediate staff, they would be in a much better position to make judgments regarding how such units should function in the future. Indeed, in the mailed survey, some indicators pointed in this direction.

When asked if the decisions reached in their department were becoming increasingly based on quantitative or numerical information as a result of the availability of the computer facilities, the large majority--87%--said partially or yes, with the largest number--51%--saying partially and 36% indicating yes. Only 13% said no. (Table 11.) The question was asked also if shifts in control or influence had occurred in the department as a result of putting the computer to use. In most cases, results in the 1974 survey were remarkably similar to those in the 1971 survey. (Tables 12 and 13.) For both years, the three principal "gainers" were the Research and Planning Division, the Data Processing Division and the Chief. Interestingly, according

to the survey, essentially no one lost power or influence because of the computer, although some did gain significantly more than others.

However, when asked in the telephone interviews whether decision making was getting to be more centralized or less centralized, a sizable number of cities in our sample (10 out of 15) felt that decision making was getting to be more decentralized. Several of the departments believed that the move toward decentralization really was unrelated to the introduction of computers to their organization. Instead this development was tied in with the adoption of "team policing." In other cities, however, we got quite a different rationale for the decision to decentralize. According to these cities, although the computer provides the command staff with necessary information, it is generally not detailed sufficiently to enable them to supervise and command successfully the operations of the individual units on a day-to-day basis, and especially not on a minute-to-minute basis. (As one chief put it, "Sometimes I ask myself whether I'm decentralizing decision making simply because I don't have enough information about what is going on.") Consequently, the emphasis in these departments is often to summarize the statistics and crime patterns, and then to get such information down to the patrol supervisor and district commander to help them in their deliberations. However, as indicated earlier, such data is not always welcomed with much enthusiasm. In many departments, the patrol supervisors don't understand the relationship between the various statistics on crime and service times, and what is actually happening in the streets. In their own mind they've been supervising the district's units successfully for years without the benefit of such data.

What does all this mean for the impact of computer use? Some evidence exists for centralizing influences, and other indicators point toward decentralization. The reality is probably a little of both--that is, if a chief is interested in increasing his control and is capable of understanding and utilizing quantitative data, the information from the computer will serve his purposes. On the other hand, if the predominant focus of the department is to decentralize, then the computer can also be used to move in this direction as well. The computer is far less important in such situations than the prevailing spirit, attitude, and capability of those in the upper levels of the department. Computers then, in and of themselves, do not "cause" centralization or decentralization. Instead, they are a powerful tool which can be used by people to move in either direction. Centralization may still be the most common result, but it doesn't have to be--as demonstrated by the phone interviews.

In ascertaining the impact of the computer on police work, it is necessary to do more than simply ask about centralization or quantification of decision making. Real potential influences are deeper and more subtle than these. In particular, there are two such impacts that are worth noting.

First the use of the computer sometimes tends to place a greater emphasis on certain aspects or focuses of police work. Such emphases may often be unconscious, but the result can be to lock a department into a certain direction or trend. Once established, such trends can become self-reinforcing. If this is done unconsciously or if the resulting focus is undesirable, the sum total of the influence may be negative.

Case illustrations are probably the best way to demonstrate this point. One of the best is the example already given by Chief McNamara of Kansas City. As the real-time computer which provides information to the officer on the street in just a few seconds becomes more fully accepted and utilized, not only will the number of car stops and "hits" rise, but it may become so great that the existence of the computer indirectly will hurt the department's manpower for other police activities such as preventing crime or responding to order-maintenance or service calls. A dramatic rise in the number of inquiries resulting from the installation of a real-time file is by no means an experience unique to the Kansas City Police Department. It has already been mentioned how other departments found this inquiry volume so heavy that they had to add additional terminals, and that in at least one case, an additional radio channel. In fact, in the mailed survey, 56% of the departments indicated that since the implementation of their ECP equipment there had been a change in the patrolman's function or in the manner that patrolmen carried out their tasks. (Table 14.) In pursuing this question in the phone interviews, it became clear that most departments were referring to the impact of their police patrol and inquiry applications and the resulting increase in the number of car stops and outstanding warrant checks now made by their men. While such activities have been shown to result in the apprehension of additional criminals, they also offer the potential of subtly refocusing police activity and of increasing the hostility between the police and community as the number of stops rises, particularly in a minority section of town where such interrogations generally are felt to be harassments.

Another illustration of the more subtle impact of computer use is demonstrated by the efforts in Los Angeles to implement a computer aided resource allocation system. In the early 1970's the Los Angeles Police Department (LAPD) began to experiment with LEMRAS (Law Enforcement Manpower Resource Allocation System), a resource allocation package patterned after the one first developed in St. Louis and discussed previously. The goal of the system was to allocate police resources so that 95% of the calls for service received by the department could be responded to without any dispatch delay. (In other words, when a call came in, the dispatcher would have a car immediately available to send to the scene 95% of the time.) The system was first tried in the Van Nuys District, and then the experiment was extended to the entire San Fernando Valley area in Los Angeles. (In the meantime some modifications were made in the program and the name was changed to ADAM--Automated Deployment of Available Manpower.)

After an eight month trial (from May, 1973-March, 1974), the effort was essentially dropped. (ADAM is now used as a management information system and plays an important role in the department. However, it is not used as a tool for deployment.) The basic reason--the conflict between the ADAM system and team policing.

At the same time ADAM was being tried, the LAPD was heavily involved in an experiment to administratively decentralize their police operation. The first step was the Basic Car Plan. In the Basic Car Plan one Basic Car is assigned to a geographic area. Enough men are allocated to the car to staff the vehicle 24 hours a day, and one officer is responsible. This car is expected to spend 50% of its time working with the people in the area. The idea is to improve police-citizen relations and to build a trust and pride in law enforcement service.

The Basic Car Plan has been implemented city-wide, but the LAPD did not stop there. The next step was team policing, a full scale effort to assign a "team" of policemen to a particular portion of the city and to make that group of men and women responsible for all of the law enforcement activity in that area. A sergeant is placed in charge of each team, and he is responsible for that area, not just when he is at work, but 24 hours a day. When a call for service is received in a "team area," the goal is that a "team car" would respond unless no "team cars" were available and the call was a real emergency. In December, 1973, team policing was implemented throughout the San Fernando Valley, and in the spring of 1974 a decision was reached to make team policing city-wide.

In the valley area of L. A., the ADAM experiment and team policing overlapped for about three months. In talking to one of the lieutenants in LAPD's Advanced Planning Division, it became clear why ADAM was essentially given up as an operational device. According to him "ADAM and team policing represent two separate philosophies of police work which meet head on." The philosophy of ADAM is to place priority on responding to calls for service. The philosophy of team policing, on the other hand, focuses on an area of the city and on the repression of crime in that area. With team policing, responding to calls for service without delay is not the main criterion. The key instead is to allow men to patrol in a particular area in an effort to prevent crime and to take them out of this area as little as possible. The result will undoubtedly be a slower response time, but the LAPD understands and seems willing to accept that fact.

What all this means then, is that any resource allocation system is obviously based on some basic set of criteria or decision rules which are used to deploy police forces. If a police department is not careful, they may select a set of rules which are not conducive to their basic objectives and the result may be just the opposite from what they are seeking. Or even worse, a police department may buy a resource allocation package from a vendor which relies on what to the department is an essentially unknown set of decision rules. The result will be to place a special emphasis on the criteria for that purchase, such as responding to calls for service--a choice which the department really may not want to make.

All this is not to say that scientific resource allocation is bad. What is at fault is the improper use of such techniques. In deploying manpower there is not one single criterion which will bring magic results. Goals and objectives vary depending upon the focus or emphasis of police work which is desired. Resource allocation approaches must often be flexible with multiple-objectives.[26] Unexpected or negative consequences do not necessarily mean that police departments should steer away from automation altogether. More sensible is to realize that technology may lead to subtle impacts. As particular innovations are implemented, they should be carefully considered so that instead of undesired or unexpected results, such changes can be used to focus the department in directions which are anticipated.

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[26] One of the positive aspects of the NSF-RANN sponsored Innovative Resource Planning Project is that the various computer programs and models have been developed with multiple-objectives. That is, the police planner is allowed to specify those criteria which he or she deems most significant--whether it be workload, response time, etc. The philosophy of the model is to serve as an interactive tool which can demonstrate the consequences of possible choices. See, for example, Richard C. Larson, "Illustrative Police Sector Redesign in District 4 in Boston," Urban Analysis, 1974, Vol. 2, pp. 51-91.

Even more important than unintentially shifting the focus of a police department, there is a second subtle impact of computer use, one which is potentially more dangerous. The use of the computer is a hardware approach to improving police activity. However, there are many who would contend that the basic problems of the police are not questions of hardware, instead they are "softer" or people oriented problems. A number of basic issues are currently faced by the police such as: What is the basic purpose of police work, to fight crime or provide social or order maintenance service? Who should serve as a policeman? Who should control the operations of the police? To ignore such issues is to ignore a crucial part of the law enforcement question. However, over the past few years, particularly with LEAA funds serving as a primary motivation, there has been a tendency to look to hardware as a means of solution. The answer does not lie in hardware, it lies in basic value judgments and in people. To the extent that hardware approaches divert our attention from the real issues, such applications may have a negative influence.

In talking about a computer application in Oakland--terminals in the car--one sergeant remarked:

> The computer terminal in the car is an effort by the police department to professionalize from a hardware approach. This may be OK, but the more we concentrate on hardware, the more often we move away from the basic people and judgment issues. The real police problems don't have technical solutions. Instead it's the people who are screwed up; and we need more people-to-people type efforts in police departments such as improvements in communication, increased motivation, productivity modifications, better interpersonal relations, etc. In short, instead of hardware resolutions we need policy resolutions of the basic issues of the police force. The result of the computer may be to take our mind off what are the real issues.

Some Concluding Thoughts

In evaluating the success or failure of computer use by the police, one can examine at least four levels:

--First and most simply, does the computer application "work"--that is, does it stay in operation over time.

--Second, does the application do what those who were responsible for implementing it said it would (e.g. does it get information back to the men in the field in seven seconds, or does it allow response to 95% of the calls without delay).

--Third, in a narrowly defined way, has the application proven to be effective--that is, has the police output or performance, even it narrowly defined, increased as a result of the computer application (for example, have the number of arrests or number of recovered stolen cars increased, has the application increased revenues to the city by establishing an automated process of billing and collecting for parking tickets, has the response time for calls for service decreased).

--And fourth, has the computer application, in a much broader sense than number three above, improved police service (e.g. brought a reduction in the crime rate, reduced the number of traffic accidents, improved the overall satisfaction of citizens with police service, etc.). (In many ways this is the most important area, but also the most difficult since trying to establish causal relationships between the use of the computer and, say, a reduction in the crime rate is difficult if not impossible.)

Unfortunately, we do not have the data to evaluate all of the various computer applications against each of these criteria. Such evaluation should be the intent of more detailed work at a later date. However, after carrying out two mailed surveys, the phone interviews, and field work, the author has begun to formulate some impressions or hypotheses about the impact of computer use. It seems worthwhile to report these, first as they relate to structured computer applications, and second to more unstructured uses.

Regarding structured applications, although success still varies greatly from department to department: (1) They generally have proven to work (numerous police patrol and inquiry applications and crime statistical files are in operation around the country today); (2) They generally have shown to do what their sponsors said they would (sever second retrieval to the man in the street in Kansas City or Los Angeles has been a reality for several years); (3) In a narrow sense, they have proven to be cost effective. Although full scale analyses of costs and benefits were not carried out, in the 1971 ICMA article numerous illustrations were given of the narrow effectiveness of such applications--e.g. in Tulsa, Oklahoma it was estimated that an additional $180,000 of revenue was brought in as a result of the first year's operation of a new automated traffic citation system. In Long Beach, California, membership in an automated want-warrant system in the Los Angeles area brought an increase in the number of warrant arrests in 1970 of 31.5% over those in 1969. In Kansas City, Missouri, the number of inquiries concerning stolen cars or wanted persons per policeman rose from 36 in January, 1970, to 90 by May, 1971.

And in Oakland, California, with the installation of digital computer terminals in half the cars in the city in 1971 and 1972, the units with the terminals in their car were found to make more than seven times as many information requests as did the units without terminals, to receive more than three times as many "possible hits," and to be almost three times as effective in the area of warrant arrests and vehicle recoveries. (4) However, when it comes to the broader impacts of even structured computer applications, the results are far less straightforward. Clearly a number of positive impacts have resulted, but some unexpected implications have also arisen, such as the potential manpower drain from over-accentuating car stops. Further, questions of privacy loom dominant as a large area of potential impact which still remains unresolved. Yet overall, the success to date of structured applications is relatively straightforward, and with the exception of unresolved privacy issues, the results are generally positive.

In 1971 the results of unstructured computer applications were far less clear; and in 1974 the situation is much the same. Several of the prominent unstructured application areas--computer aided dispatch and criminal investigation--were anticipated to increase sharply between 1971-1974. Such rises did not occur. Among the unstructured application areas, resource allocation is the only one which has experienced a really serious use, either in an absolute sense or based on the increase between 1971 and 1974. Even with resource allocation applications, though, often they are working in a far different sense than originally intended. In St. Louis, for example, the philosophy of resource allocation has caught on, but the actual computer model is seldom used. In Los Angeles, the ADAM System was basically abandoned as a deployment strategy, both because it was less successful than originally

anticipated and primarily because it was at odds with team policing. Surely a number of police departments are using data provided to them by the computer to make deployment decisions, but it appears that only a few are utilizing advanced mathematical or operations research techniques to do so. Finally, when implementing such unstructured applications it is important that a police department not lose sight of some of the unintended potential consequences. In particular one should always keep in mind that the real solutions to the basic issues which face the police will not come through hardware efforts alone. At some point these questions must be faced and resolved at the more basic policy, people-to-people level.

In conclusion, an analogy between the computer and human nature seems appropriate. With people it is often the case that a person's greatest strengths are closely related to their greatest weaknesses. An aggressive, forceful person may achieve success as a result of his dynamic personality; but he may also alienate many because of his strong and single-sighted approach. His greatest strength--being forceful and dynamic--is closely related to his greatest weakness--being overpowering, threatening and alienating.

Such is the case with computer use by the police. There is a great strength and potential in using computers to aid in the more effective enforcement of the law through rapid communication and a more rational, structured approach to decision making. On the other hand, these very benefits, if not properly controlled or planned may result in misuse, unintended consequences, wasted resources, and unmet expectations. We are now to a crucial point when it comes to expanded computer use by the police--a point which requires careful consideration so that the strengths can be judiciously marshalled and the weaknesses and potential risks prudently forestalled.

TABLE 1: POLICE SURVEY RESPONSE

	No. of Departments Surveyed (A)	Number of Departments Responding	
		Number (B)	% of (A)
Total, all cities	410	326	80%
Population group			
Over 500,000	26	20	77%
250,000-500,000	30	26	87%
100,000-250,000	98	80	82%
50,000-100,000	256	200	78%
Geographic Region			
Northeast	102	71	70%
North Central	109	82	75%
South	103	89	86%
West	96	84	88%
City Type			
Central	260	213	82%
Suburban	150	113	75%
Form of Government			
Mayor-Council	165	115	70%
Council-Manager	215	187	87%
Other	30	24	80%

TABLE 2: POLICE COMPUTER USE

	No. of Departments Responding (A)	No. using a Computer (B)	% of Police Departments using a Computer % of (A)	No. of Departments not using a Computer (C)	% of Police Departments not using a Computer % of (A)
Total, all cities	325	183	56%	142	44%
Population Group					
Over 500,000	20	20	100%	—	—
250,000-500,000	26	22	85%	4	15%
100,000-250,000	80	53	66%	27	34%
50,000-100,000	199	88	44%	111	56%
Geographic Region					
Northeast	71	24	34%	47	66%
North Central	82	39	48%	43	52%
South	88	59	67%	29	33%
West	84	61	73%	23	27%
City Type					
Central	212	128	60%	84	40%
Suburban	113	55	49%	58	51%
Form of Government					
Mayor-Council	115	54	47%	61	53%
Council-Manager	186	114	61%	72	39%
Other	24	15	62%	9	38%

TABLE 3: FUTURE COMPUTER USE

	No. reporting not using a Computer (A)	Number Planning on Future Use: Yes	Percent Yes	No	Percent No	Uncertain	Percent Uncertain
Total	142	59	42%	17	12%	57	40%
Population Group							
Over 500,000	0	—	—	—	—	—	—
250,000-500,000	4	4	100%	—	—	—	—
100,000-250,000	27	15	56%	0	0	12	44%
50,000-100,000	111	40	36%	17	15%	45	41%
Geographic Region							
Northeast	47	16	34%	3	6%	21	45%
North Central	43	21	49%	5	12%	17	40%
South	29	11	38%	3	10%	14	48%
West	23	11	40%	6	26%	5	22%
City Type							
Central	84	34	40%	9	11%	30	45%
Suburban	58	25	43%	8	14%	19	33%
Form of Government							
Mayor-Council	61	23	38%	5	89%	27	44%
Council-Manager	72	33	46%	12	17%	25	35%
Other	9	3	33%	0	0	5	56%

TABLE 4: LEVEL OF TECHNICAL SOPHISTICATION OF COMPUTER FACILITIES AS IT RELATES TO CITY SIZE

Population Group (Number in parentheses indicate row percentage)	CATEGORY OF SOPHISTICATION[1] 0	1	2	3	4	5	6	7		MEAN SOPHISTICATION CATEGORY[2]
Over 1,000,000	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (66.7)	1 (33.3)	0 (0.0)	3 2.0%	5.333
500,000-1,000,000	0 (0.0)	0 (0.0)	0 (0.0)	1 (7.7)	0 (0.0)	6 (46.2)	4 (30.8)	2 (15.4)	13 8.6%	5.462
250,000-500,000	0 (0.0)	1 (5.3)	1 (5.3)	1 (5.3)	3 (15.8)	7 (36.8)	5 (26.3)	1 (5.3)	19 12.6%	4.737
100,000-250,000	0 (0.0)	4 (8.3)	7 (14.6)	13 (27.1)	7 (14.6)	8 (16.7)	8 (16.7)	1 (2.1)	48 31.8%	3.750
50,000-100,000	5 (7.4)	19 (27.9)	15 (22.1)	9 (13.2)	10 (14.7)	7 (10.3)	1 (1.5)	2 (2.9)	68 45.0%	2.515
	5 3.3%	24 15.9%	23 15.2%	24 15.9%	20 13.2%	30 19.9%	19 12.6%	6 4.0%		

N = 151 3.4967

MEAN FOR ENTIRE POPULATION

1. Category of sophistication is shown as a rating from 1-7 and is based on 3 factors:
   (1) Real time computer use
   (2) Size of core storage
   (3) In-house and outside EDP programming capability as measured by whether or not the police department had the capability to use and support certain computer languages.

2. Indicates the mean level of sophistication with mean based on category of sophistication from 1-7.

TABLE 5: LEVEL OF TECHNICAL SOPHISTICATION AS IT RELATES TO CITY TYPE

CLASSIFICATION: LEVEL OF TECHNICAL SOPHISTICATION OF COMPUTER OPERATION (Numbers in parentheses indicate column percentage)	CITY TYPE: CENTRAL	SUBURBAN	
0	3 (2.8)	2 (4.7)	5 3.3%
1	13 (12.0)	11 (25.6)	24 15.9%
2	15 (13.9)	8 (18.6)	23 15.2%
3	12 (11.1)	12 (27.9)	24 15.9%
4	16 (14.8)	4 (9.3)	20 13.2%
5	26 (24.1)	4 (9.3)	30 19.9%
6	18 (16.7)	1 (2.3)	19 12.6%
7	5 (4.6)	1 (2.3)	6 4.0%
	108 71.5%	43 28.5%	N = 151
MEAN LEVEL OF SOPHISTICATION	3.852	2.605	3.4967 (FOR ENTIRE POPULATION)

TABLE 6: REGIONAL COMPARISONS OF COMPUTER USE IN 1971 AND 1974

Geographic Region	1971 USE						1974 USE		
	No. of departments responding in 1971	No. using computers in 1971	% of respondents, 1971	No. of additional departments planning computer use by 1974	Total no. of users by 1974 (according to 1971 predictions)	% of departments planning on use by 1974	No. of departments responding, 1974	No. of depts. using computers, 1974	% of respondents, 1974
	(A)	(B)	% of (A)	(C)	(D) = B + C	(D/A)	(E)	(F)	% of E
Northeast	92	13	14.1	24	37	40%	71	24	34%
Northcentral	100	41	41.0	23	64	64%	82	39	48%
South	91	46	50.5	20	66	76%	88	59	67%
West	92	45	48.9	22	67	73%	84	61	73%
TOTAL, All Regions	375	145	38.6	89	234	62.4	325	183	56.3

TABLE 7: COMPARISONS OF 1971-1974 PREDICTED USE AND 1971-1974 ACTUAL USE

APPLICATION AREA	Actual No. of Applications in 1971 No. (A)	% of Total	1971-1974 Predicted Increase (B)	1971-1974 Actual Increase (C)	% Actual vs. Predicted (C/B)	1974 Predicted Total (D=A+B)	% of Total	1974 Actual Total (E=A+C)	% of Total	Difference Between Predicted and actual (D - E)	1974-1977 Predicted Increase (F)	1977 Predicted Total (G=L[C]+F)	% of Total
Police Patrol and Inquiry	180	19.9	138	63	45.7	318	15.7	243	17.1	-75	83	326	14.2
Traffic	162	17.9	151	86	57.0	313	15.5	248	17.4	-65	81	329	14.3
Crime Statistical Files	177	19.5	203	91	44.8	380	18.8	268	18.9	-112	104	372	16.2
Police Administration	192	21.2	191	63	33.0	383	18.9	255	17.9	-128	150	405	17.6
Miscellaneous Operations	40	4.4	83	37	44.6	123	6.1,	77	5.4	-46	77	154	6.7
Resource Allocation	111	12.2	131	144	109.9	242	12.0	255	17.9	+13	148	403	17.5
Criminal Investigation	34	3.8	158	29	18.4	192	9.5	63	4.5	-129	155	218	9.5
Computer Aided Dispatch	10	1.1	61	3	4.9	71	3.5	13	.9	-58	78	91	4.0
Total	906	100.0	1116	516	46.2	2022	100.0	1422	100.0	-600	876	2298	100.0

TABLE 8: RESOURCE ALLOCATION METHOD AS IT COMPARES TO USE OF "POLICE SERVICE ANALYSIS" AND "POLICE PATROL AND DISTRIBUTION" COMPUTER APPLICATIONS

	Total Number of Departments (A)	No. of (A) which have have "Police Service Analysis Application"	% of (A) which have have "Police Service Analysis Application"	No. of (A) which have "Police Patrol allocation and Distribution" Applications	% of (A) which have "Police Patrol allocation and Distribution" Applications
NUMBER OF DEPARTMENTS USING "NO MATHEMATICAL METHOD"	70	41	58.5	20	28.5
NUMBER OF DEPARTMENTS USING "HAZARD FORMULA"	50	37	74.0	27	54.0
NUMBER OF DEPARTMENTS USING AN ADVANCED MATHEMATICAL METHOD	27	22	81.4	18	66.7

TABLES 9a.,9b.: IMPACT OF LAW ENFORCEMENT ASSISTANCE ADMINISTRATION

9a.	No. of Departments	% of Total
RECEIVED LEAA ASSISTANCE	71	49.3%
DID NOT RECEIVE LEAA ASSISTANCE	73	50.7%
TOTAL	144	100.0

9b.	No. of Departments	% of Total
NO COMPUTER WOULD HAVE BEEN POSSIBLE WITHOUT LEAA FUNDING	16	18.0%
COMPUTER OPERATIONS WOULD HAVE BEEN SMALLER WITHOUT LEAA FUNDING	36	40.4%
UNCERTAIN OF EFFECT	11	12.4%
LEAA FUNDING MAKES NO DIFFERENCE	26	29.2%
TOTAL	89	100.0

TABLE 10

Decisions becoming more quantitatively-based as a result of Computer Operations?	Number of Departments	% of Total
YES	51	36.2%
NO	18	12.8%
PARTIALLY	72	51.0%
TOTAL	141	100.0

TABLE 11: CHANGE IN CONTROL OR INFLUENCE AS A RESULT OF COMPUTER IN 1971

Level or Division	No. Responding (A)	More Influence No.	% of (A)	No Change In Influence No.	% of (A)	Less Influence No.	% of (A)
CHIEF OF POLICE	109	51	43.6	66	56.4	0	0
ASSISTANT CHIEF OR CHIEF'S DIRECT STAFF	105	46	43.8	58	55.2	1	1
PRECINCT DISTRICT OR DIVISION COMMANDERS	109	46	42.2	60	55.0	3	2.8
RESEARCH AND PLANNING	110	64	58.2	45	40.9	1	.9
DATA PROCESSING	100	62	62.0	36	36.0	2	2.0
PATROLMEN IN THE FIELD	111	41	36.9	68	61.3	2	1.8
OTHER PERSONNEL	17	6	35.3	11	64.7	0	0

TABLE 12: CHANGE IN CONTROL OR INFLUENCE AS A RESULT OF COMPUTER IN 1974

	No. Responding (A)	More Influence No.	% of (A)	No Change In Influence No.	% of (A)	Less Influence No.	% of (A)
CHIEF	120	50	41.7	70	58.3	0	—
ASSISTANT CHIEF OR CHIEF'S DIRECT STAFF	110	40	36.4	70	63.6	0	—
DIVISION COMMANDER	112	43	38.4	66	58.9	3	2.7
RESEARCH AND PLANNING	119	66	55.5	51	42.8	2	1.7
DATA PROCESSING	107	50	46.7	56	52.4	1	.9
PATROLMAN	111	31	27.9	77	69.4	3	2.7

TABLE 13

Change in Function of Patrolman as a result of Computer Operations?	Number of Departments	% of Total
YES	78	56.1%
NO	61	43.9%
TOTAL	139	100.0

FIGURE 1: POLICE COMPUTER USE IN 1971, 1974, and 1977

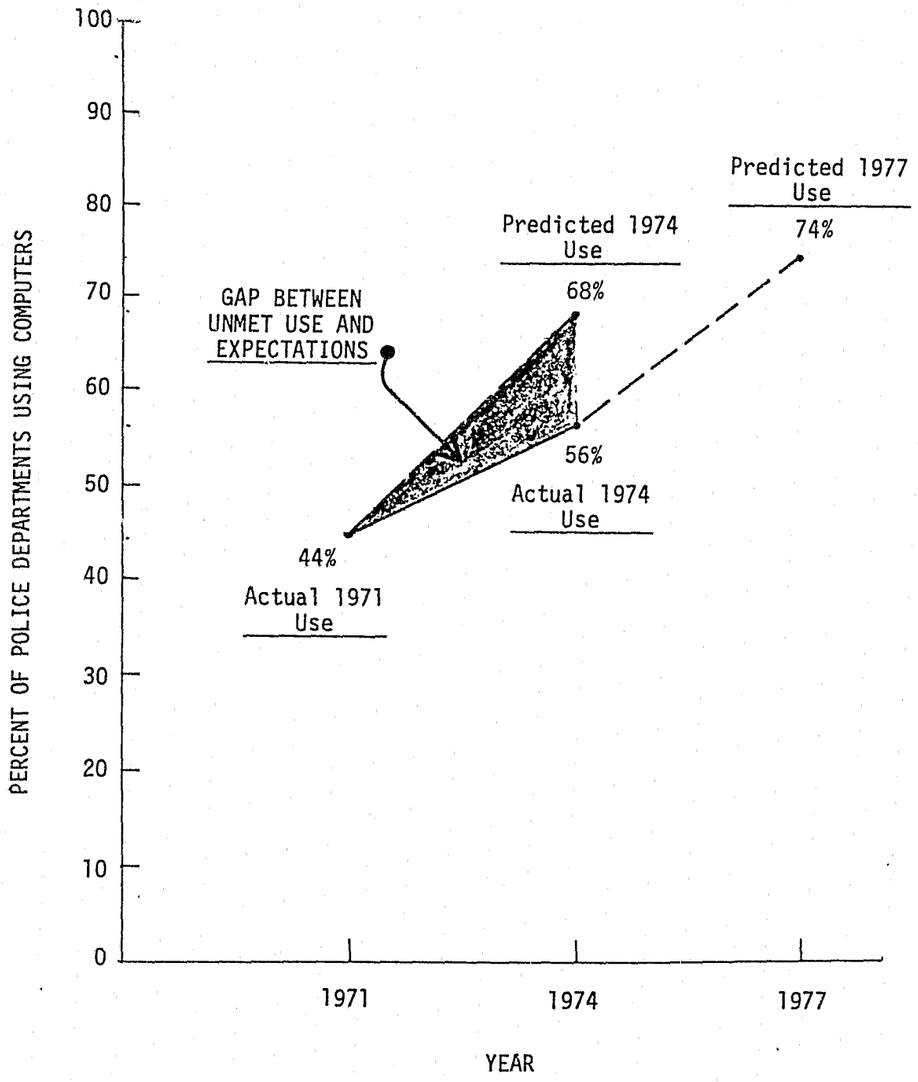


FIGURE 2: INFLUENCE OF CITY SIZE ON CURRENT AND PAST USE OF COMPUTERS BY POLICE DEPARTMENTS

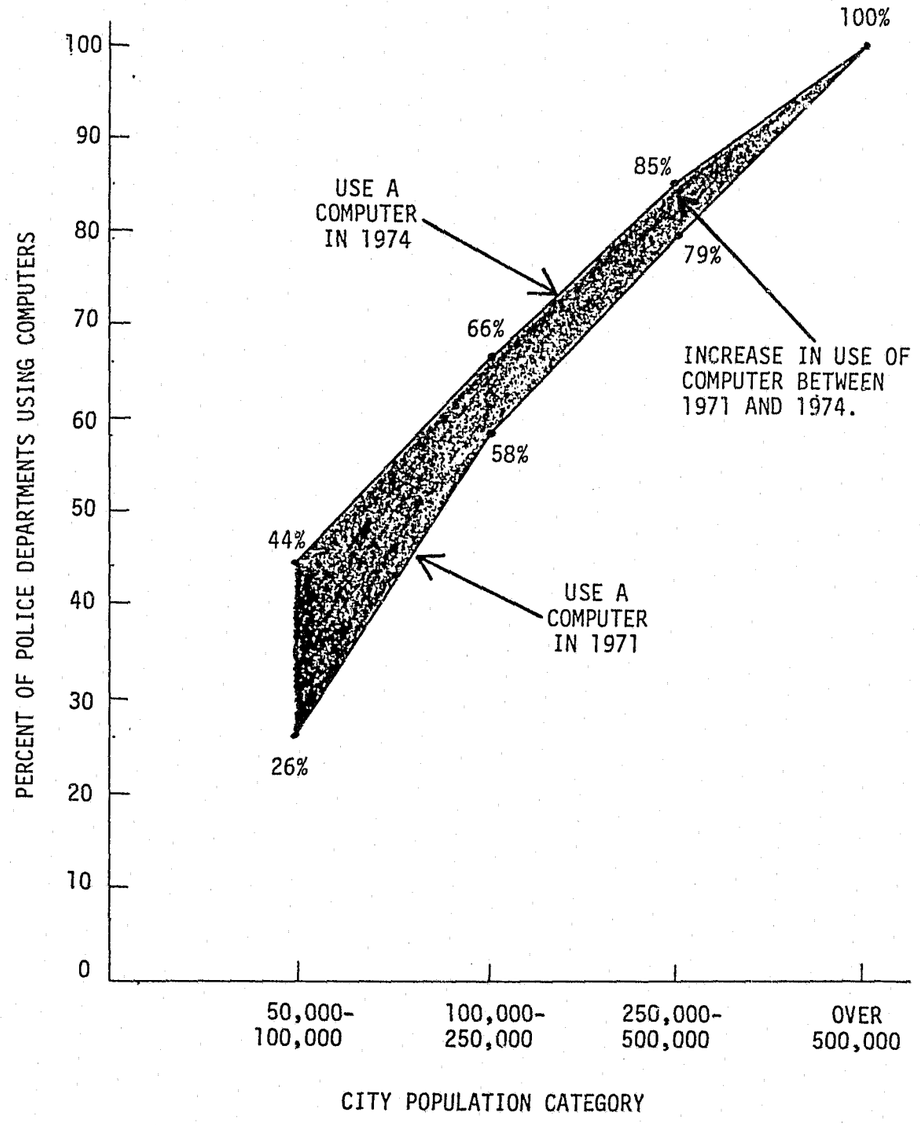


FIGURE 3

COMPUTER USE BY THE POLICE

Twenty-Four Computer Applications	Application Areas
- Warrant File - Stolen Property File - Vehicle Registration File	POLICE PATROL AND INQUIRY
- Traffic Accident File - Traffic Citation File - Parking Violation File	TRAFFIC
- Personnel Records - Budget Analysis and Forecasting - Inventory Control File - Vehicle Fleet Maintenance - Payroll Preparation	POLICE ADMINISTRATION
- Criminal Offense File - Criminal Arrest File - Juvenile Criminal Activity File	CRIME STATISTICAL FILES
- Intelligence Compilations File - Jail Arrests	MISCELLANEOUS OPERATIONS
- Police Patrol Allocation and Distribution - Police Service Analysis - Traffic Patrol Allocation and Distribution	RESOURCE ALLOCATION
- Automated Field Interrogation Reports - Modus Operandi File - Automated Fingerprint File	CRIMINAL INVESTIGATION
- Computer Aided Dispatching - Geographic Location File	COMPUTER AIDED DISPATCH

FIGURE 4

STRUCTURED AND UNSTRUCTURED POLICE COMPUTER APPLICATIONS

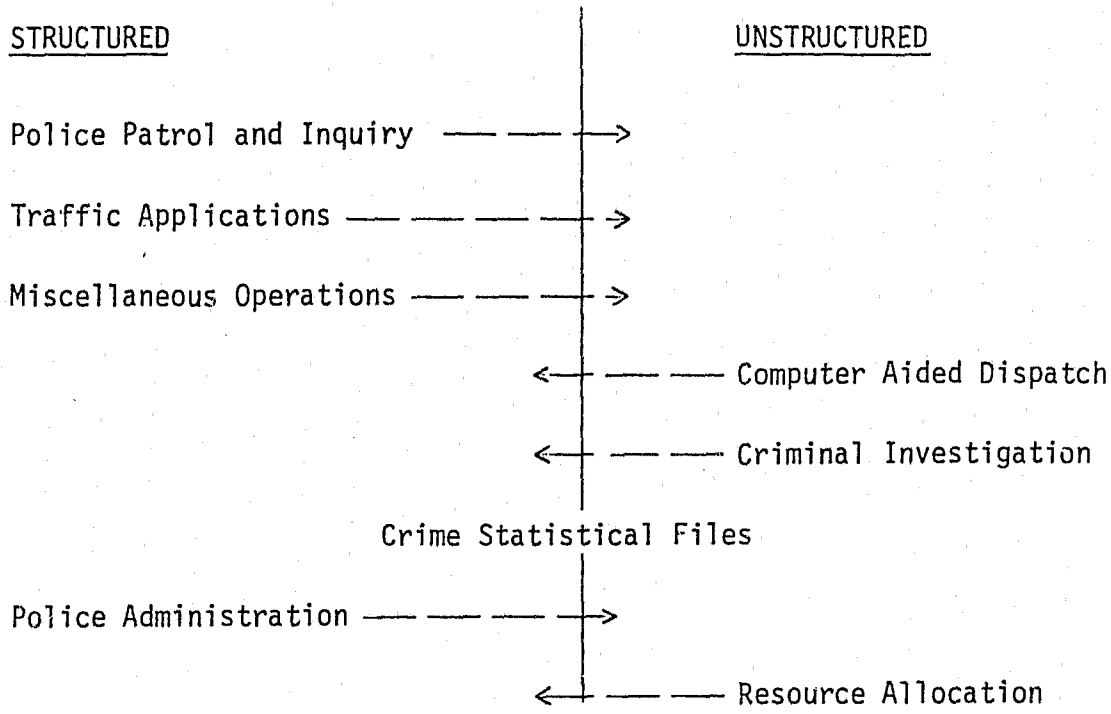


FIGURE 5: STATUS OF COMPUTER USE IN 1966

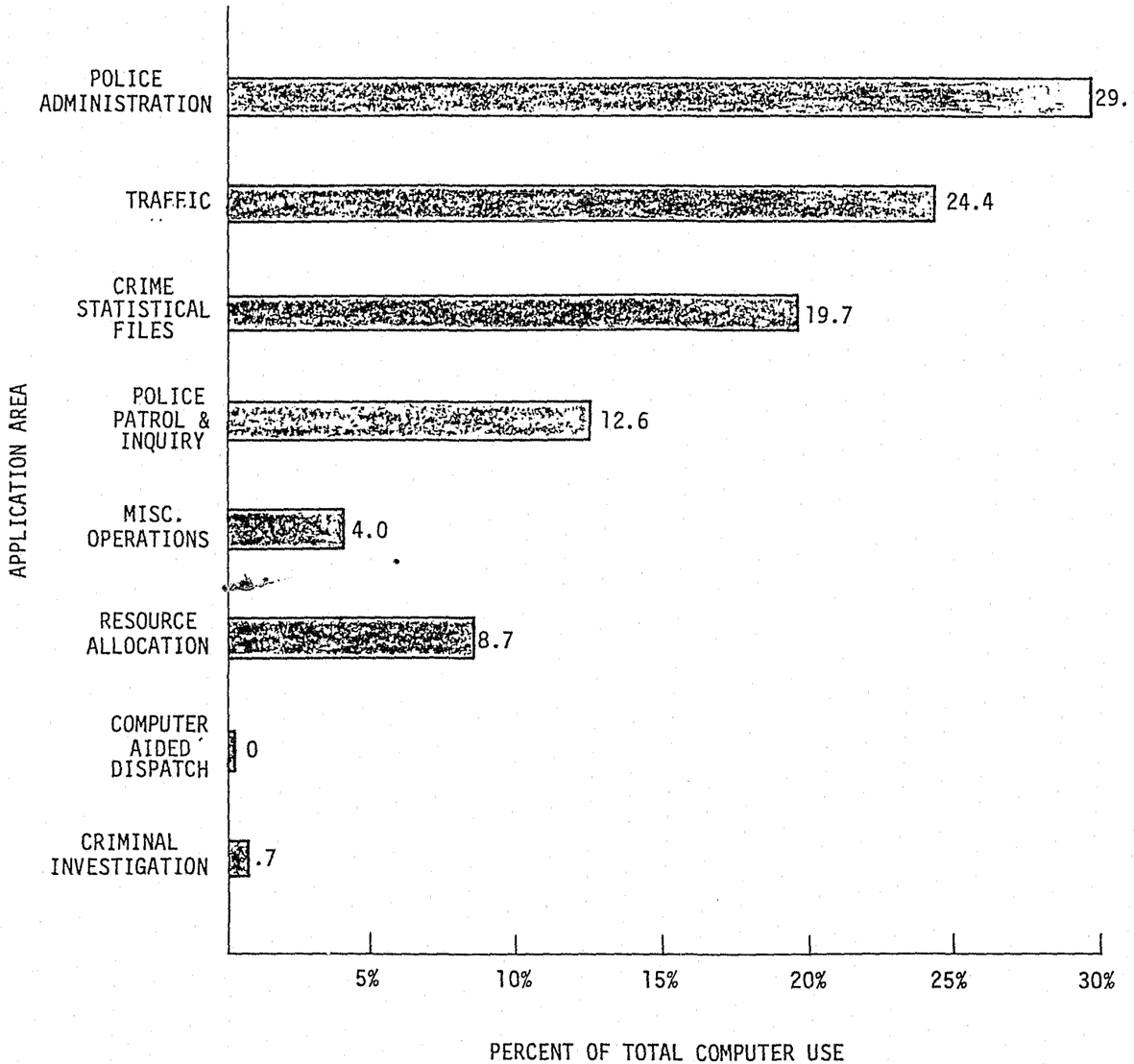


FIGURE 6: STATUS OF COMPUTER USE IN 1971

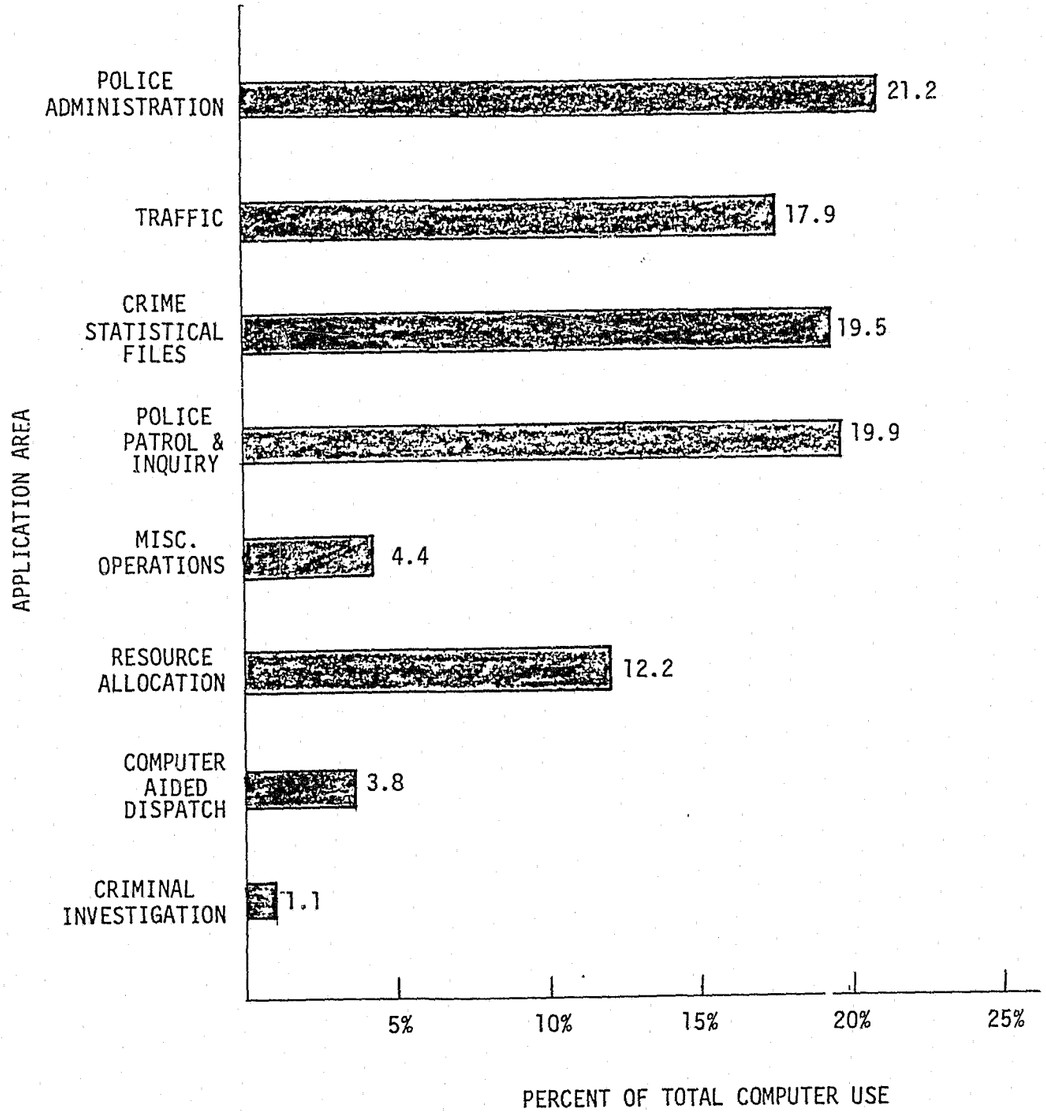


FIGURE 7: ACTUAL STATUS OF COMPUTER USE IN 1974

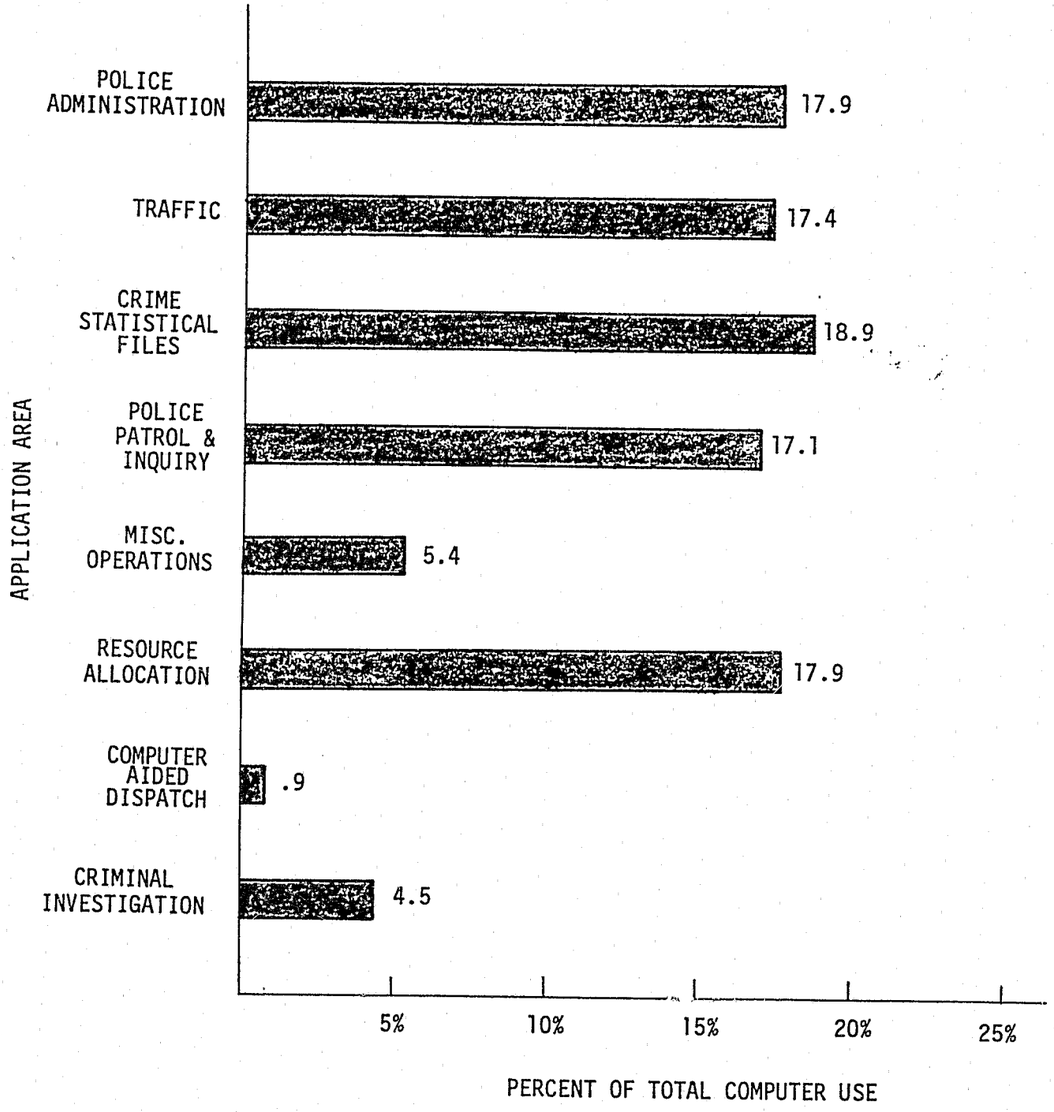


FIGURE 8: PREDICTED 1971-1974 GROWTH AS COMPARED TO ACTUAL 1971-1974 GROWTH

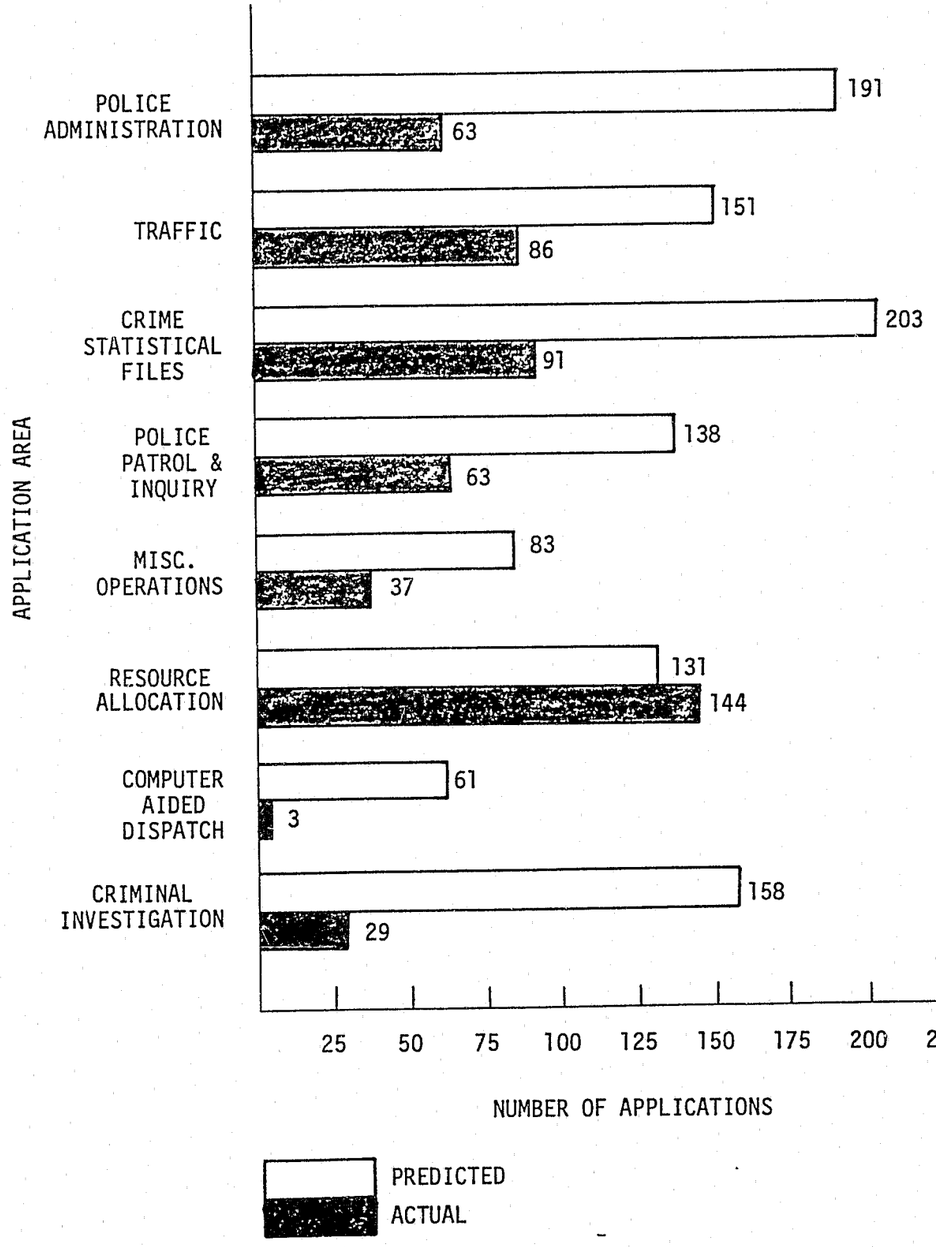
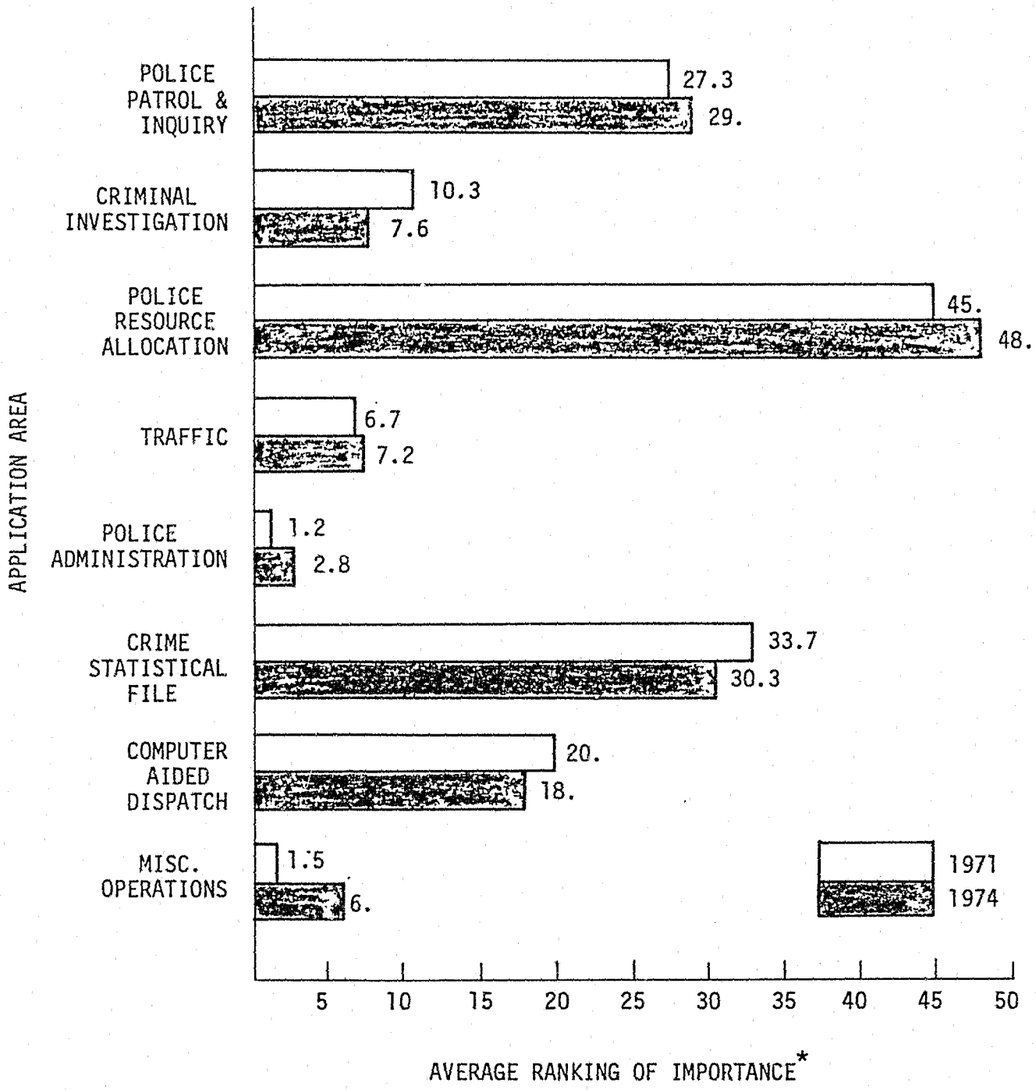


FIGURE 9: IMPORTANCE OF COMPUTER APPLICATIONS IN 1971 AND 1974, AS RANKED BY POLICE DEPARTMENTS*



*Ranking is based on the average number of times applications were selected by police department as 1 of their 3 most important applications.

FIGURE 10: STATUS OF PREDICTED COMPUTER USE IN 1977

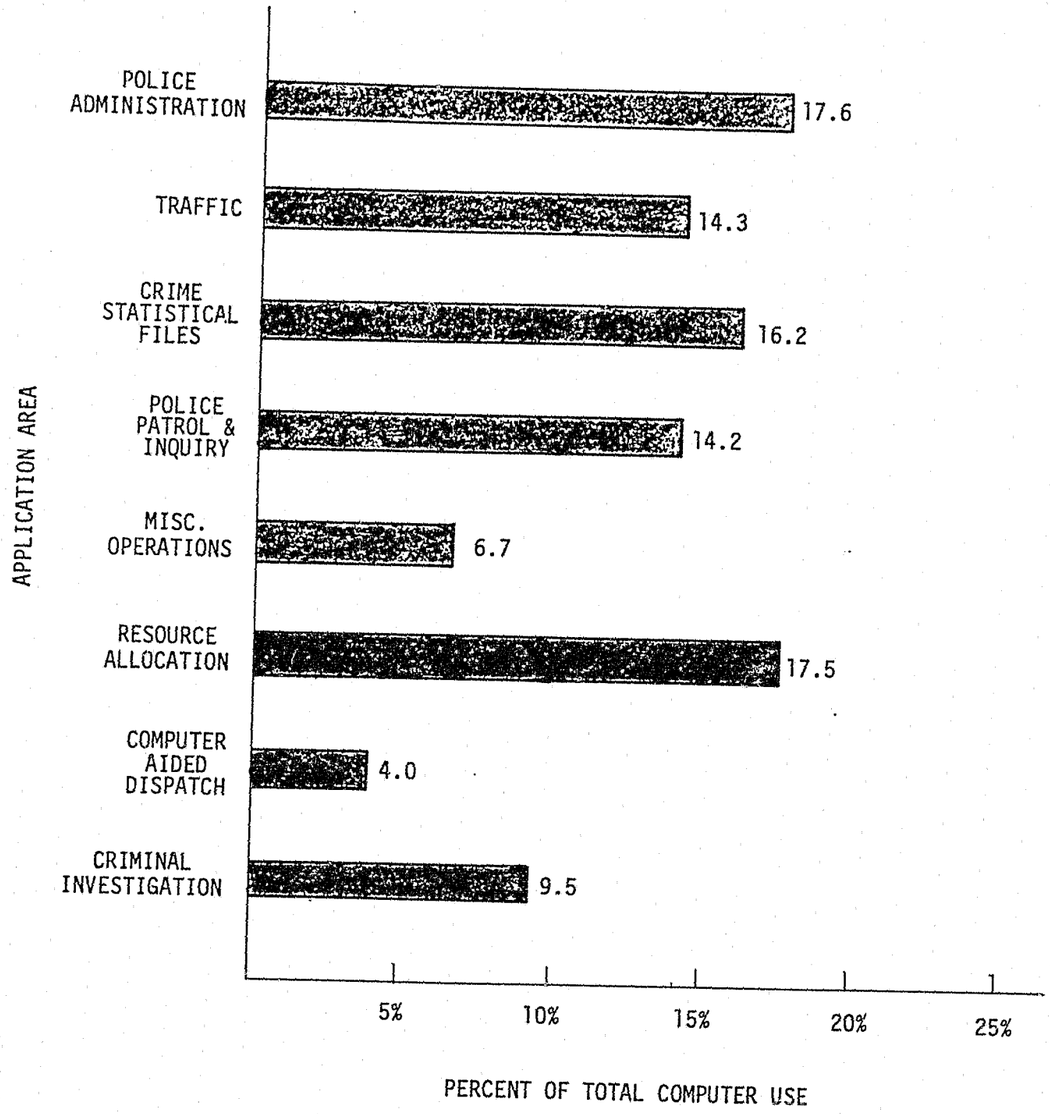


FIGURE 11: PROBLEMS HINDERING COMPUTER OPERATION

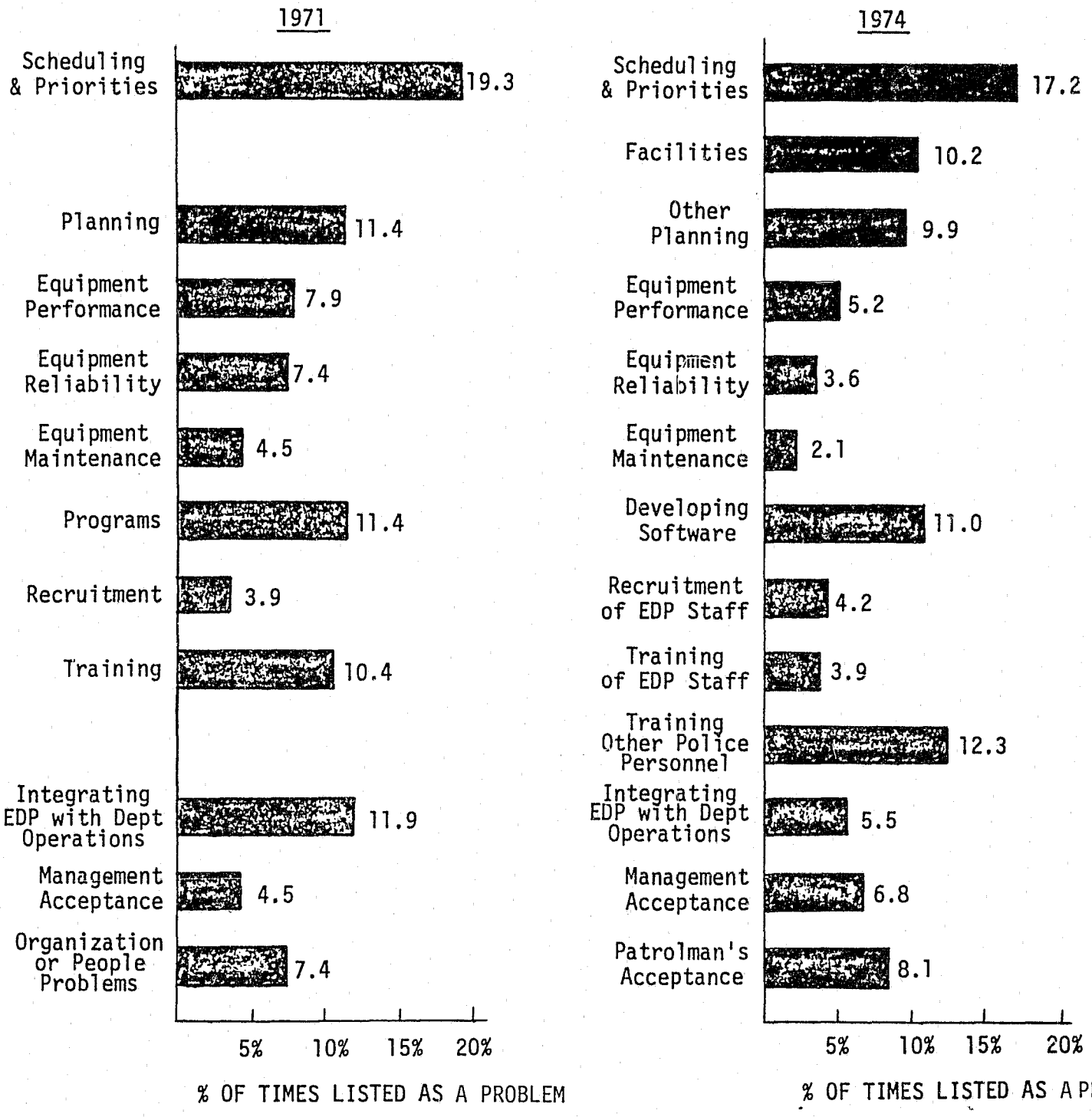
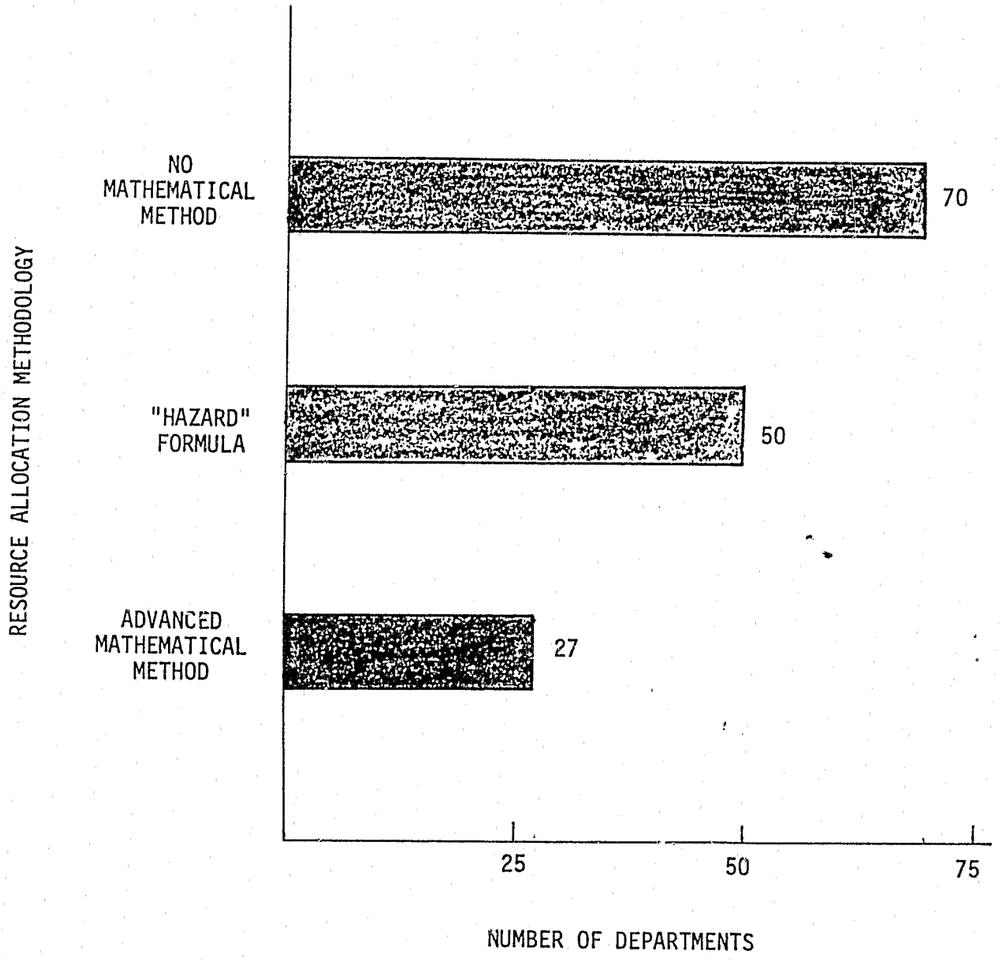


FIGURE 12: RESOURCE ALLOCATION METHOD



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