Optimizing the Use of Technology in Policing: Results and Implications from a Multi-Site Study of the Social, Organizational, and Behavioural Aspects of Implementing Police Technologies

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Abstract Although technology holds great promise for improving policing, research on police technology is not well developed and raises questions about technology’s impacts. This article presents selected results from a multi-agency study to improve understanding of both technology’s effects on policing and the contextual aspects of policing that shape the uses and effectiveness of police technology. Focusing on selected technologies, the authors investigated these issues through interviews, focus groups, surveys, and other methods. Findings suggest that the effects of technology are complex and that technological advancements do not always produce obvious or easy improvements in productivity, communication, cooperation, management, or job satisfaction. Further, police often fail to make strategically optimal uses of technology for reducing crime and serving citizens. The article offers suggestions for organizational strategies, training, and research that may help police to improve their acquisition and use of technology.

Introduction

Technological advancements have shaped policing in many important ways over the years. One need only consider that the primary police strategy for much of the 20th century—motorized preventive patrol and rapid response to calls for service—was developed in response to the invention of the automobile, two-way radio communications, and computer-aided dispatch systems. In recent decades, there have been many important developments with respect to information technologies (IT), analytic systems, video surveillance systems, license plate readers, DNA testing, and other technologies that have had far reaching effects on police agencies. Technology acquisition and deployment decisions are high priority topics for police
(e.g. Koper et al., 2009), as law enforcement agencies at all levels of governments are spending vast sums on technology in the hopes of improving their efficiency and effectiveness.

However, research on police technology is not well developed, and the available evidence suggests that technology’s impacts on police effectiveness may be limited considerably by numerous factors. To extend the research on this issue and inform police decisions about the acquisition and deployment of technology, this article presents selected results from a multi-agency, multi-method study of the social, organizational, and behavioral implications of police technologies. Broadly, the goal of the study was to improve understanding of: 1. the intended and unintended ways that technology affects police agencies (e.g. in terms of their operations, structure, culture, effectiveness, and legitimacy); and 2. the various contextual aspects of police agencies and their environments that shape the uses and effectiveness of policing technology.

**Police technology and its impacts**

The current emphasis on police technology reflects a strong belief (among both police and citizens) in its potential to enhance policing. Technology is thought to strengthen police crime control efforts by improving the ability of police to identify and monitor offenders; facilitating the identification of places and conditions that contribute disproportionately to crime; speeding the detection of and response to crimes; enhancing evidence collection; improving police deployment and strategies; creating organizational efficiencies; enhancing communication between police and citizens; and strengthening the ability of law enforcement to deal with technologically sophisticated forms of crime (e.g. identity theft, cybercrime, and terrorism). Technological advancements in automobiles, protective gear, weapons, and surveillance capabilities are seen as potentially reducing injuries and deaths to officers, suspects, and bystanders.

Technology may also be viewed as enhancing the legitimacy of the police, to the extent that it strengthens communication between police and citizens, reduces negative outcomes from police actions, or increases police accountability.

Yet, although technological change is a persistent force in policing that is perceived to hold great promise, there has been relatively little research on the impacts of technology in policing beyond technical, efficiency, or process evaluations (Lum, 2010a; Lum et al., 2010). Further, while recent technological advances have undoubtedly enhanced policing in a number of respects (e.g. Danziger and Kraemer, 1985; Roth et al., 2000; Ioimo and Aronson, 2004; Roman et al., 2008), it is unclear that they have made police more effective (Manning, 1992a; Chan, 2001; Harris, 2007; Koper et al., 2009; Garicano and Heaton, 2010; Lum 2010a; Byrne and Marx, 2011). As an illustration, the spread of advanced technology in policing in recent years, including greater forensics capabilities and more extensive data and surveillance systems, does not seem to have improved clearance rates for criminal investigations (Braga et al., 2011).

This absence of a clear link between technological progress and effectiveness in policing may have several causes. Technical, legal, and financial issues of various sorts can of course limit the impact of policing technology. At a more fundamental level, however, there is a need to better understand the relationship between technology and various organizational and behavioral aspects of policing (e.g. Mastrofski and Willis, 2010). Technologies can produce significant changes in police agencies that have unanticipated and collateral consequences to organizational structures, functions, goals, and mandates (Manning, 1992b). These changes may even distort crime control or legitimacy building efforts (Lum, 2010b). For example, today’s standard 9-1-1 emergency phone and response systems (or 9-9-9 in the UK) were a technological innovation intended to improve police response to reported crimes. However, these systems have not improved offender
apprehension as hoped (Sherman and Eck, 2002, p. 304–306), and the burden of answering 9-1-1 calls, roughly half or more of which are not urgent (Mazerolle et al., 2002, p. 98), lessens time for proactive or community-oriented policing (e.g. Sparrow et al., 1990). These systems have also arguably shaped and reinforced a reactive incident-based style of policing (Lum, 2010a) that appears ineffective in crime prevention (e.g. Skogan and Frydl, 2004).

Technology may also create new demands and complexities in police work that undermine its potential to produce gains in efficiency and effectiveness. New IT systems, for instance, give officers much greater access to information in the field, but the adoption of these systems often leads to more extensive reporting requirements that may negate expected time savings, lessen time for interacting with citizens or engaging in proactive work, and create frustration for officers (e.g. Chan et al., 2001; Colvin, 2001).

Finally, larger organizational and cultural factors mediate the potential of technology to improve police effectiveness and legitimacy. For example, technologies that facilitate hot spots policing (notably, IT and crime analysis), will have less impact if police managers fail to focus adequate resources on crime hot spots, or if the results of crime analysis are not adequately disseminated and utilized throughout the agency, particularly among patrol officers and first-line supervisors (Lum, 2013). Some technologies, including those coupled to larger management practices like Compstat, might serve to stifle creativity and strengthen the traditional police focus on reactive law enforcement tactics (Willis et al., 2007). In order to achieve the many improvements to existing police operations that might be sought with new technology, changes may thus be needed in an agency’s organizational culture, practices, and infrastructures (e.g. Chan et al., 2001; Chan, 2003; Zaworski, 2004; Harris, 2007).

**Studying the impacts of technology in four agencies**

In this project, we investigated technology’s impacts in policing through case studies in four large urban and suburban police agencies in the USA. These studies focused on the uses and impacts of a number of information, analytic, surveillance, and forensics technologies that are central to everyday police functions. Specifically, we used interviews, focus groups, surveys, field observations, and other methods to investigate nine behavioural, social, and organizational aspects of policing that are important to understanding the effects of technological change: experiences with technology implementation; police culture and receptivity to technological change; organizational units, hierarchy, and structure; internal accountability and management systems; individual officer/supervisor discretion and decision making; efficiency of police processes and daily work productivity; effectiveness in reducing crime; police–citizen communication and police legitimacy; and job satisfaction. In this article, we highlight some key themes that cut across these areas.1

The qualitative findings presented here are based primarily on two sites where the authors conducted all fieldwork. The first, ‘Agency 1’, is a suburban agency of over 1,000 officers that serves a large but relatively low crime county. Agency 1 recently implemented a new records management system (RMS) that has given officers the ability to file reports remotely from the field for the first time in the agency’s history while also providing officers with in-field access to a wider variety of data on crime reports, citizen contacts, and other information. This afforded an opportunity to study how the

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1 Given the scope of the study, we can only summarize some key findings here. Further details about the study methods and results are available in Koper et al. (2014).
agency has been affected by and adapted to a recent and significant technological change, which proved to be difficult for the agency in several respects. We also examined Agency 1’s experience with license plate readers (LPRs), as the agency had also just recently expanded its LPR capability from 3 U to 29. ‘Agency 2’ is an urban sheriff’s office with over 1,500 officers serving a high-crime city. We selected Agency 2 for study because it has highly sophisticated crime analysis capabilities. Further, the agency’s command staff places a strong emphasis on the use of crime analysis in its operational decisions. This provided a unique opportunity to examine how crime analysis is received and used at both the managerial and line levels. Officers in Agency 2 also have in-field access to an exceptional amount of data, from both within and outside the agency, through an automated RMS that the agency adopted more than 15 years ago.

Using a general interview guide, we conducted interviews and focus groups with sworn and civilian personnel from various units and ranks in each agency, as well as on-site field observations. Overall, we interviewed 100 individuals in Agency 1 and 141 in Agency 2. Our discussion is also based on results from surveys conducted with all sworn personnel across all four agencies (Agencies 3 and 4 also had over 1,000 officers each). In total, ~1,700 officers responded to the survey, which focused primarily on the uses and impacts of IT and analytic technologies (i.e. crime analysis). Response rates were 40–42% in Agencies 1 and 2 and ~17–20% in the other agencies.2 Finally, though not discussed specifically, we also draw upon field studies (including experimental and quasi-experimental research) that tested the effects of IT in a number of contexts in Agencies 1 and 2.3

The challenges and limits of police technology

Our findings reinforce the notions that the effects of technology in policing are complex and that advances in technology do not always produce obvious or straightforward improvements in communication, cooperation, productivity, job satisfaction, or officers’ effectiveness in reducing crime and serving citizens. Indeed, the uses and impacts of technology can be quite variable, both within and across agencies. Implementing technology effectively and using it in the most optimal ways seem to be most challenging at the line-level in patrol, but much can depend on management practices, agency culture, and other contextual factors. Further, desired effects from technology (like improving clearance rates and reducing crime) may take considerable time to materialize, if they do at all, as agencies adapt to new technologies and refine their uses over time. From our many findings, two themes emerged which seem particularly critical.

The difficulties and complexities of technological change

The first theme concerns the difficulties and contradictory effects of technological change. Although cultural resistance to change is a common impediment to innovation in policing, technologically based changes present additional complexities. Further, desired effects from technology (like improving clearance rates and reducing crime) may take considerable time to materialize, if they do at all, as agencies adapt to new technologies and refine their uses over time. From our many findings, two themes emerged which seem particularly critical.

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2 Participation was voluntary and anonymous. We conducted the survey online over several weeks in each agency. In Agency 1, we supplemented this approach with hard-copy distribution of the survey at randomly selected roll calls. Further details are available in Koper et al. (2014). Although we rely primarily on the survey results from Agencies 1 and 2, where response rates and sample sizes were considerably better and where we have extensive qualitative data to inform our interpretation of the survey data, the survey results from the other agencies provide some confirming evidence for patterns found in Agencies 1 and 2.

3 These include an assessment of changes in crime and case clearances following Agency 1’s implementation of its RMS and the expansion of its LPR deployment, a study in Agency 1 of the uses and impacts of mobile computing technology in the context of hot spots policing, and an evaluation of the effects of an internal information sharing, social media technology on the outcomes of robbery investigations in Agency 2.
important ramifications for the acceptance, uses, and impacts of that technology. Agencies often struggle with technology implementation, particularly at the outset of using a new technology. Patrol officers’ satisfaction with how their agencies implemented new technologies was no more than 60% across our agencies (the high was for Agency 2) and ranged from 11% to 36% across most of them. Agency 1, for example, experienced many difficulties with its new RMS that stemmed from technical problems, user interfaces that officers found difficult and cumbersome to use, and the requirement that officers learn new offence codes at the same time they were learning to operate the new system. This had negative effects on officer attitudes and performance that were still evident 2–3 years later, at which time 62% of patrol officers reported that the agency’s IT had not made them more productive and 70% reported that it had not improved their job satisfaction. (In contrast, the corresponding figures for Agency 2, where the IT systems were more mature and refined, were 14 and 29%.) In Agency 1, officers commonly remarked that the difficulties of using the new RMS had even reduced proactive work like traffic stops as well as discretionary time to ‘go the extra mile’.

Agency 1 was not alone in having such problems; in another study agency, 54% of officers felt that IT had not enhanced their productivity and 68% indicated that it had not improved their job satisfaction. Moreover, it was common across agencies in our survey for patrol officers to feel that there was a need for more staff input in the development and adoption of technologies (a third or fewer of respondents felt their agency worked hard to get input from staff on new technology) and a need for more technical assistance and training in the implementation and use of technology (in most agencies, half or fewer of respondents felt technical support was sufficient). This would seem to be particularly true for IT and analytic technologies, which have the potential to substantially transform police work and greatly impact line-level officers.

The findings on productivity and job satisfaction suggest that technology’s effects can be complex and contradictory. As another illustration, many officers felt technology could improve communication across units, especially when coupled with the shared goal of reducing crime. Yet, they also recognized that technology could undermine work relationships. In the case of first-line supervisors, for example, having to sift through large amounts of data and respond accordingly drained time from other valuable activities, such as mentoring and guiding patrol officers. Technology can also worsen perceptions of inequality for line-level staff, particularly patrol officers who may feel heavily burdened and scrutinized by the reporting demands and monitoring that often come with new information and surveillance technologies (in-car and body-worn cameras provide examples of the latter). Indeed, rank and file officers were not highly inclined to believe that IT improved supervision and management in their agencies (23–58% agreed across agencies that this was true) despite its seemingly high potential to improve accountability. In discussions, officers expressed the view that quantitative, technology-driven assessments of performance need to be balanced with more qualitative, holistic evaluations that take account of multiple factors that might affect an officer’s activity counts (Willis, 2013). All of these factors can foster resistance to technology and undermine its potentially positive effects.

Limitations to the strategic uses of technology

A second critical theme that emerged from our study is that police often fail to make strategically optimal uses of technology for reducing crime or achieving other aims like improving their legitimacy with the community (for brevity, we focus on the former issue). Perceptions and uses of technology are highly dependent on the norms and culture of an agency and how officers view their function [i.e. technological ‘frames’ in the words of Orlikowski and Gash (1994)]. As officers continue
to frame policing in terms of reactive response to calls for service, reactive arrest to crimes, and adherence to standard operating procedures, they use and are influenced by technology to achieve these goals.

To illustrate, officers were much more likely to use IT to guide and assist them with traditional enforcement-oriented activities than for more strategic, proactive tasks. Across the agencies, for example, 42–74% of patrol officers reported using IT often or very often to locate persons of interest and 63–81% did so to check the call history of a location or person before responding to a call. In contrast, 14–49% used IT often or very often to determine where to patrol between calls (indicative of hot spots policing) or to determine how to respond to a crime problem (indicative of problem-oriented policing). In our interviews, it was clear that officers were much more comfortable using technology to respond, enforce, react, and arrest. When given a wide range of options for using mobile computers as part of a hot spots patrol study, for instance, officers in Agency 1 overwhelmingly used IT for the actions they understood and knew best—running license plates for suspicious vehicles and wanted persons. Similarly, we found in our interviews that supervisors were less likely to use IT to form crime prevention strategies with their subordinates and more likely to use it to check reports and assess performance measures of officers and squads.

In sum, officers and supervisors often use technology in support of discretionary activities, but they are less likely to use technology to strategically guide those activities. This was true even in Agency 2, although officers in that agency were considerably more likely to use technology for proactive and prevention-oriented tasks due no doubt to the emphasis of Agency 2’s leaders on proactivity and crime analysis.

Technology sometimes changes officers’ behaviours (such as when an LPR officer changes his or her patrol style or routine to better make use of the technology, or when an officer chooses to use crime analysis to guide his or her patrolling between calls), but this seemed to be very individualized in the agencies, as the officers received little in the way of consistent training or direction on ways to optimize technology use in their daily work and deployment habits. Our observations suggest that while technology has fostered accountability at higher managerial levels in policing (e.g. through Compstat-type management processes), the innovative use of technology as a tool by middle- and lower-level supervisors to manage the performance of line-level officers still is neither institutionalized nor clearly understood. Indeed, in most of our agencies (including Agency 2), less than half of patrol officers (25–43%) agreed that officers who use technology in creative or innovative ways are more likely to be rewarded than those who do not.

Further, some officers we interviewed expressed uncertainty about the usefulness of some technologies because their potential benefits for assisting them in how they went about doing or thinking about their daily work were not always clear. Police training for technology tends to emphasize the basics of operating the technology (such as, how to properly fill out and submit reports on their mobile computer terminals); there is less emphasis, in contrast, on how officers can use technology strategically to address crime or disorder problems or how both the organization and individual officers can benefit from use of the technology through, for instance, improved information sharing inside and outside the agency.

Hence, while basic application of IT might have marginal effects in improving police efficiency, detection capabilities in the field, and officer safety in responding to calls, these improvements may not alone be enough to discernibly enhance police performance as measured by crime reduction or even case clearances. These limitations seemed apparent in Agency 1, as implementation of the new RMS and expansion of its LPR capabilities had no clear impact on crime rates and case clearances (Koper et al. 2014).
Improving the implementation and strategic use of technology

While our study highlights some of the factors that can limit the potential of technology to improve police efficiency and effectiveness, this is not to say that technological advancement in policing is undesirable and will not bring improvement. However, technological changes may not bring about easy and substantial improvements in police performance without significant planning and effort, and without infrastructure and norms that will help agencies maximize the benefits of technology. Technological change is thus not an easy panacea for agencies struggling with financial and staffing shortages if the foundational infrastructure of the agency—cultural and organizational—is not also considered.

Technology adoption is not only a long and continuous process of its own, but one that is highly connected to many other aspects of policing, including daily routines and deployments, job satisfaction, interaction with the community, internal relationships, and crime control. Hence, management of technological change in policing is closely connected to managing other organizational reforms (such as reducing misconduct and adopting evidence-based practices). Accordingly, strategizing about technology application is essential and should involve careful consideration of the specific ways in which new and existing technologies can be deployed and used at all levels of the organization to meet goals for improving efficiency, effectiveness, and agency management. Agency 2’s commitment to the development and integration of IT and crime analysis into its daily operations illustrates some of the benefits of such a long-term strategic approach.

Our fieldwork suggests a number of ways that police can potentially smooth the process of technological change and increase receptivity to new technology. For one, police managers should allow for a broad base of participation in the technology implementation process by various personnel who will be affected by the technology. This process should provide ample opportunities for pilot testing early versions of a technology and soliciting input that can be incorporated into its final design. This process can be helpful in identifying and correcting technical problems with a technology and for determining its most effective applications. Staff at various levels should also have opportunities to offer insights on how technologies like RMS, crime analysis, and LPR might be best integrated into assessments of performance. Allowing those who are being assessed to participate rather than simply imposing new requirements upon them will likely increase levels of understanding and acceptance of the technology being used in this way (Mastrofski and Wadman, 1991).

Proper levels of training are also essential, especially for the most difficult technological changes. For example, learning how to use a RMS properly, in terms of both input and use of output, requires extensive training, follow-up, and consistent adjustment. Moreover, once basic training is done, agencies should prepare a systematic and continuous approach to follow-up, in-service training, reinforcement, ongoing technical support, and adaptation to new lessons. This should include dissemination of information about effective practices, success stories, and tips for easier or faster use of a technology (such techniques are often discovered by individuals but not shared widely or systematically).

However, to reap the full potential benefits of technology, police must also arguably address traditional and long-standing philosophical and cultural norms about the role of law enforcement (Lum, 2010a). Most fundamentally, training about proactive and evidence-based strategies—and how technology can be used in support of those strategies—is needed. Research suggests that police are most effective in reducing crime when their strategies are proactive, focused (both on high risk places and groups), and oriented towards problem-solving and prevention (Weisburd and Eck, 2004; Lum et al., 2011). However, officers
seemed to have limited understanding of how technology might help them in these regards, and their agencies lacked reward systems to encourage innovative responses to crime. As noted, officers generally focused on using technology in support of answering calls and other traditional enforcement and surveillance activities. Given that an agency is trying to reduce, prevent, and control crime (as opposed to react, respond, and manage it), training regarding technology or other tools needs to incorporate how technology might be used more comprehensively for these goals. How, for example, can officers use their agency’s information systems and crime analysis to guide their patrol activities between calls for service, identify and address problems at hot spot locations, and monitor high-risk people in their areas of responsibility? At the same time, how can managers use these technologies to encourage such work by their subordinates?

Training on the use of technology for evidence-based practices should also extend to the enhancement of police legitimacy in the community, including the application of procedural justice (e.g. Mazerolle et al., 2013). Officers working with video and audio recorders in their car or on their person, for instance, might benefit from training on how these technologies can reduce the chances of conflict in citizen encounters and maximize citizens’ sense that they have been treated respectfully and fairly. Training might also emphasize issues such as how officers can use their technologies (such as information systems) to be more helpful to citizens in their encounters and how they might explain the purpose and uses of surveillance technologies (like LPR) that may arouse privacy concerns.

Finally, there is a need for both police and researchers to make a greater commitment to a strong research and development agenda regarding technology. This is currently lacking, as police often adopt new forms of technology before their impacts and effectiveness have been demonstrated. Practitioners should review existing research about the uses, consequences, and effectiveness of technologies and also consider conducting their own pilot testing and evaluation of these technologies before making substantial investments in them (e.g. Ohio State Highway Patrol, 2005; Cohen et al., 2007). More generally, police and scholars would likely benefit from adopting a systems approach to technological change that integrates perspectives from different people and units within the organization and emphasizes experimentation, evaluation, and organizational learning towards the goal of improving overall system performance (Chapman, 2004).

A related point is that police managers should do more to systematically track the ways that new technologies are used and the outcomes of those uses. This is particularly applicable to technologies like LPRs which, based on the authors’ familiarity with several agencies, are typically deployed with no systematic tracking of how they are being used and with what results. In the case of LPR, managers could track the specific areas in which LPRs have been deployed; how specifically LPRs have been deployed (e.g. fixed or on patrol cars); the number, nature, and results of license plate matches achieved with the LPRs (e.g. vehicles recovered and arrests made); the number and outcomes of investigations for which LPRs or LPR data have been used; and whether crime was reduced in areas where LPRs were deployed. Agencies can then use these results to refine their use of this technology. One could envision similar forms of tracking and evaluation for other technologies like in-car (and body) cameras and new forensics technologies, to name a few. This would help police to evaluate the benefits of new technologies relative to their costs—an important consideration, given the costs of many new technologies and the general fiscal pressures faced by police agencies—and inform their assessments of which technologies are most beneficial.

Researchers can assist practitioners in these endeavours by collaborating on evaluation studies that carefully assess the theories behind technology adoption (i.e. how and why is a particular technology expected to improve police effectiveness), the
ways in which technology is used in police agencies, the variety of organizational and community impacts that technology may produce (both intended and unintended), and the cost efficiency of technology. Additionally, research is needed to clarify what organizational strategies—with respect to training, implementation, management, and evaluation—are most effective for achieving desired outcomes with technology and avoiding potentially negative unintended consequences. These efforts might also be boosted by comparative research that examines the technological experiences of police agencies relative to those of other public and private organizations, integrates police technology research more formally with the broader body of organizational research on technology (e.g. Davis, 1989; DeSanctis and Poole, 1994; Goodhue, 1995; Orlikowski, 2000; Boudreau and Robey, 2005), and seeks to transfer lessons about effective technology utilization strategies from other types of organizations into policing. In all of these ways, we would hope that greater attention to technology implementation and evaluation can help police agencies optimize technology decisions and fully realize the potential benefits of technology for policing.

Acknowledgements

This project was supported by funding from the National Institute of Justice (US Department of Justice) and the Center for Evidence-Based Crime Policy (CEBCP) at George Mason University (the authors thank CEBCP Executive Director David Weisburd for the latter support). The authors thank Julie Hibdon for assistance with fieldwork and survey development and staff of the Police Executive Research Forum (notably Daniel Woods and Bruce Kubu) for assistance in the collection and analysis of survey data. The authors also thank Julie Grieco, Stephen Happeny, and Jordan Nichols for additional research assistance. Finally, the authors thank the participating police agencies that provided tremendous cooperation in support of this project (their identities are kept anonymous in the article). The views expressed are those of the authors and should not be attributed to any of the aforementioned persons or organizations.

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