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Research on the Impact of Technology on Policing Strategy in the 21st Century

Final Report

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1. ABSTRACT

Over the past several decades, policing agencies have implemented an array of technological advancements to improve operational efficiency and outcomes, especially in times of diminished resources and enhanced public attention on and scrutiny of law enforcement activity. However, much remains to be known about the prevalence and utility of technology among the nation's law enforcement agencies and the factors that influence its selection and implementation. To address these issues, we need to build the knowledge base of why and how police select, implement, and integrate new technology; how that technology is being used; and whether new technology improves policing in a meaningful way for both the agency and the community.

RTI International and the Police Executive Research Forum were funded by the National Institute of Justice to examine more closely the types of technology that U.S. law enforcement agencies (LEAs) are acquiring and implementing, and the degree to which the use of technology is linked to strategy development and larger organizational change within policing organizations. Three specific objectives were examined. The first objective was the prevalence of police technology on a national level; the second objective examined a group of selected "high-technology implementer" and "mixed-technology implementer" agencies. The combined findings from the national- and site-level data were used to develop the final objective: a research-based framework to guide police agencies in future selection, implementation, and use of technology.

Findings show that for most technologies, a greater proportion of large agencies (250 or more sworn officers) had adopted the technology than those from the entire sample. A notable exception, however, is that large agencies were less likely to have used some technological devices, such as body-worn cameras, in the past 2 years. Site-level data illuminated the difference in how ingrained different technology is from agency to agency; two agencies may have implemented the same technology, but the level of sophistication and use can be widely divergent. Finally, the findings suggest that the success or failure of technology can be multidimensional and can rarely be traced back to a single issue. Instead, technology identification and adoption are complex processes and the factors that support technology success or failure are similarly multifaceted.

In general, across U.S. LEAs, a strong association between policing strategy and technology uses was not found. In other words, at a national level, agencies are not making decisions to acquire technology based on dominant policing philosophies or the activities they prioritize. Instead, agencies appear to adopt technology ad hoc in response to a constellation of factors that includes executive staff decisions, perceived needs, community demands, and available funding.

2. EXECUTIVE SUMMARY

Technology and policing have been interconnected for decades, dating back to the advent of the telephone, the automobile, and the two-way radio. Today, technology seems to be advancing at an ever-accelerating pace, as seen through the propagation of mobile and wireless technology, high-powered computing, visual and audio technology, advanced analytics, and other technological advancements. Many departments are implementing these and other technologies to increase efficiency and to improve outcomes, especially in times of diminished resources and enhanced public attention to and scrutiny of law enforcement tactics and outcomes. However, much remains unknown about the prevalence and utility of technology among the nation's law enforcement agencies (LEAs) and the factors that influence its selection and implementation. To address these issues, we need to build the knowledge base of why and how police select, implement, and integrate new technology; how that technology is being used; and whether new technology improves policing in a meaningful way for both the agency and the community.

RTI International (RTI) and the Police Executive Research Forum (PERF) were funded by the National Institute of Justice (NIJ) to examine more closely the types of technology that U.S. LEAs are acquiring and implementing, and the degree to which the use of technology is linked to strategy development and larger organizational change within policing organizations. Three objectives were specifically examined. The first objective was the prevalence of police technology on a nationally representative level; the second objective examined a group of selected high-technology implementer and mixed-technology implementer agencies. The combined findings from the national- and site-level data were used to develop the final objective: a research-based framework to guide police agencies in future selection, implementation, and use of technology.

Methodology

This project was conducted in three phases. First, an expert panel was convened to identify key policing technology and to ensure that the survey captured critical indicators of technology performance. Second, a nationally representative survey (**Appendix A**) was administered to more than 1,200 state and local LEAs. The survey explored policing strategies and activities, and technology acquisition, use, and challenges. Results from this survey were used to identify agencies that would be well suited for the final research phase: in-depth site visits. Site-visit locations were stratified so that visits were conducted with both municipal and sheriff agencies of various sizes (small, medium, and large) and experiences with technology.

Key Findings

The following sections summarize key findings from the study and their implications.

Technology prevalence. Today's state and local LEAs are heavily involved in technology. Ninety-six percent had implemented one or more of the 18 core technologies of interest, most commonly car cameras (70% of agencies), information-sharing platforms (68%), and social media (68%). One-third of agencies had body-worn cameras (BWCs), geographic information system technology (GIS), cell phone tracking software, or investigative case-management software. Notable among large agencies (250 or more sworn officers) was the prevalence of analytical and visual-based technology. About 81% of large agencies reported using GIS (compared with 31% overall) and 70% were using license plate readers (LPRs; compared with 20% overall). Use of predictive analytics software was reported by 28% of large agencies.

Technologies expected to increase in use. Results demonstrate that technology use is expected to increase not only among the largest agencies but across most U.S. LEAs. The technologies expected to increase most sharply were predictive analytics software (15% of all agencies and 22% of large agencies have plans to obtain and use within 2 years), BWCs (15% and 17%, respectively), and in-car electronic ticketing (11% and 38%, respectively). Also notable were the intentions to acquire next-generation 9-1-1 (14% and 11%, respectively) or unmanned aerial vehicles (UAVs, or drones) (7% and 9%, respectively).

Links between policing strategies and technological adoption. Nationally, we found little relationship between the policing strategies that agencies most closely adhere to and the number of technologies used. The exception was zero-tolerance policing; greater emphasis on zero-tolerance was associated with less technology use. However, among large agencies (250 or more officers), there were stronger connections between strategy and technology adoption. Agencies aligned most closely with community policing, intelligence-led policing, or hot-spot policing philosophies implemented and used more technology. In contrast, agencies that emphasized professional policing, problem-oriented policing, or zero-tolerance policing implemented and used less technology.

Policing activities and strategies and technology selection. Nationally, LEAs are generally not making technology decisions based on their dominant policing philosophies. An exception were agencies that emphasized community policing which were more likely to use social media. In addition, agencies that emphasized predictive policing were more likely to use LPRs than those that did not. Among large agencies, however, we found stronger connections between the policing philosophies agencies adopt and the technology choices they make. Agencies that emphasized hot-spot policing were more likely to have used BWCs. The use of GIS was positively associated with community policing, hot-spot policing, and offender targeting. LPR and social media use was positively associated with community policing and hot-spot policing.

Agency decision-making regarding technology acquisition and implementation. As a whole, our findings demonstrate that law enforcement technology adoption is often ad hoc and not based on longer-term planning. The tendency to purchase technology without a clear, strategic plan can result in limited integration within the agency and a failure to recognize the primary or secondary benefits of the technology. These factors can lead to disillusionment and a lack of continuation funding for maintaining or updating particular types of technology.

Impact of technology on policing activities. Perhaps not surprisingly automated records management systems (RMS) and computer-aided dispatch (CAD) were the technology credited with having the greatest impact on police agencies nationwide. This technology is central for carrying out the most fundamental professional policing activities, responding to calls for service and information management. The RMS/CAD technology is also crucial for generating the data that other activities and technology applications rely on, such as GIS, hot-spot policing, and other location-based activities.

Because of its highly flexible nature, GIS was reported to have the greatest impact on identifying and analyzing crime and disorder problems. Social media and data mining were both considered to successfully impact an agency's ability to generate intelligence from the community (intelligence-based policing). Among the agencies that identified tracking officer conduct as a key activity, the use of BWCs was seen as more critical than the use of car-mounted cameras.

Conclusions and Recommendations

Technology can produce various positive outcomes relative to improvements in policing practices and the establishment of trust and legitimacy with communities. The President's Task Force on 21st Century Policing (2015) summarizes these points and acknowledges that technology is changing at an increasingly rapid pace. As the rate of technology adoption accelerates it becomes increasingly important for police agencies to consider how they select and implement technology and what strategic objectives these technologies will help them achieve.

Overall, our study found that technology is having a positive impact on U.S. law enforcement agencies in terms of increasing efficiency, providing communication, enhancing information-sharing practices, and improving informational and analytical capacities.

As highlighted above, some of these impacts are greatest for particular types of technology. Yet, the findings also demonstrate that, as a whole, technology has not had a game-changing impact on policing in terms of dramatically altering the philosophies and strategies used for preventing crime, responding to crime, or improving public safety.

Based on our finding, we determined that the adoption and impact of technology within an agency are often conditional upon three general types of factors: community, agency, and technology. Community factors may include local community priorities, state laws, or national sentiment (e.g., the push for BWC use after a high-profile incident). At the agency-level, organizational climate will influence how technology is approached and integrated into the department. Finally, the factors intrinsic to the technology itself will influence success and adoption. For example, a certain technology may be more successful when it more closely parallels successful technology in the market (e.g., predictive analytics software can be seen as a natural extension of GIS use).

The following summarizes recommendations for developing a more successful national model for technology implementation in today's law enforcement community.

Evidence-based research is needed in policing technology. Our research suggests that there needs to be greater emphasis on evidence-based, informed decision-making about new technology.

Strategic planning should include technology considerations. The strategic planning process appears to be severely overlooked in many agencies despite being integral to the success or failure of a technology.

Decision makers and technology experts should better collaborate on technology decisions. Many technologies are not broadly deployed in an agency, which can result in diverse problems in terms of buy-in and organizational impact.

Past experience with technology contributes to future behavior. Each agency and its community context are unique and there is often heavy emphasis placed on each agency's own historical performance of technology identification, acquisition, and implementation.

Strategic planning and pre-implementation should be emphasized when an agency planning to obtain a new technology. Plans should be specific to an agency's mission or preferred policing strategy, with clearly outlined goals. Specific personnel and knowledge requirements to reach those goals should be incorporated in the strategic plan. Agencies should consider how to quantify success, while concurrently working with researchers who can evaluate effectiveness of both processes and outcomes. Not only will this help agencies understand what needs to be changed but it will also inform the field of policing on how to increase sustainability and maximize the effects of their technology use.

3. INTRODUCTION

Technology has been considered a significant driver to law enforcement strategies and tactics for as long as can be remembered. In the 20th century, the introduction of the telephone, the automobile, and two-way radios created seismic shifts in what police do, pushing departments toward a strategy of rapid response to citizens' request for police assistance (Harris, 2007). These technological capabilities provided closer connections and information sharing between police and the citizens they serve. Now, in the 21st century, powerful technological advancements have emerged, including closed-circuit television, automatic license plate readers (LPRs), in-car cameras, and body-worn cameras (BWCs), predictive policing software, and social media communication and monitoring tools. The proliferation of computer technology, communication technology, and other major technological advancements over the last several decades have made numerous technologies available to law enforcement officers that were virtually unheard of by their predecessors. Many departments are implementing these and other technologies to increase efficiency and improve outcomes, especially in times of diminished resources and enhanced public attention on and scrutiny of law enforcement tactics and outcomes.

Despite the theoretical connections between technology and policing tactics and outcomes, it is not well understood how technological devices are selected among police agencies or the ways in which agency characteristics give shape to their technological portfolios. Moreover, police agencies vary in philosophy, culture, management strategies, and agency goals (Weiss, 1997); therefore, technological priorities and modes of use may differ depending on these characteristics. Existing theoretical perspectives on understanding how technology is adopted in organizations seem out of touch with the reality of technology acquisition in law enforcement agencies (LEAs), and they do not incorporate the idiosyncratic differences across LEAs when it comes to decision-making processes or perceptions of impact (e.g., see Rogers, 1962). Likewise, limited information is available about the process by which technology is implemented, including the unique challenges encountered by LEAs, which often translates into fewer resources through which LEA decisions to acquire and implement a technology can be guided. Given that technology can have a dramatic impact on how policing is done, on community relations, and the extent to which public safety is protected, it is imperative that police executives and civilian policymakers have sound empirical evidence about the presence, role, and impact of technology in contemporary policing.

To gain a better understanding of how police strategy is enhanced by technology or even how technology fosters the adoption of new strategy, we need to build the knowledge base of why and how police select, implement, and integrate new technology; how that technology is being used; and whether new technology improves policing. This National Institute of Justice (NIJ) report details the methods, results, and recommendations from a

research project that more closely examined the types of technology that U.S. LEAs are getting and using, as well as the degree to which technologies are linked to strategy development and larger organizational change within policing organizations. The use of specific technological devices within law enforcement is often credited with helping police personnel perform certain functions or activities more efficiently and, at times, more effectively. There is little empirical or transferable evidence on the extent to which technology has led to changes in overall agency practice or has affected policing outcomes, including responding to calls for service, community relations, and public safety. There is also limited information on the extent to which the adherence and dedication to particular strategic philosophies and models is linked to the purchase and use of particular technological devices.

Project Goals and Objectives

Technology refers to the tools and machines that LEAs may use to conduct policing activities or to enhance policing outcomes. The goal of this project is to assess the interaction between technology and policing characteristics, strategic philosophies, and activities. To achieve this goal, we will address the following objectives:

- **Objective 1:** At a nationally representative level, describe what technological advancements are most prevalent in LEAs; how they were selected; what implementation issues agencies encountered; and what level of technology integration into policing practices has been achieved.
- **Objective 2:** At an agency level, conduct detailed assessments for a select group of high-technology implementer agencies and mixed-technology implementer agencies to determine how specific technological advancements were selected and implemented, and what the impact of those technological advancements has been on policing activities and strategies.
- **Objective 3:** Use the findings from combined national- and site-level data collection and analyses to develop a research-based framework that guides police agencies in future selection, implementation, and use of technology.

Research Questions

Our primary research questions were as follows:

- What is the prevalence of key technological advancements in LEAs?
- How does the prevalence of various technological advancements in LEAs vary by agency characteristics (e.g., size, region, type)?
- How and to what extent are different technological advancements associated with strategic policing philosophies designed, developed, and implemented to control and prevent crime?
- How important are specific types of technology for the perceived success of policing activities?

- Which technological advancements have been seen as most important in achieving agency goals?
- What technologies are expected to increase in adoption by agencies?
- Which aspects of technology identification, acquisition, and adoption are associated with successful technology implementation?

Methodology

This project was conducted in three phases. During the first phase, an expert panel was convened to identify key aspects of policing technology and to inform the development of a nationally representative survey (**Appendix A**) designed to capture critical indicators of technology use and performance. Second, a nationally representative survey was administered to more 1,200 state and local law enforcement agencies. The survey explored policing strategies and activities; technology acquisition, use, and challenges; and perceived impact of technology on the success of policing activities. Results from the survey were used to identify agencies that would be well suited for in-depth site visits conducted during phase 3. These police agencies were selected to represent an assortment of agency types, sizes of jurisdictions served, and experience with prioritized technological innovation. The site visits were designed to further explore agency experience with technology identification, acquisition, implementation, and perceived impact overall and with respect to the specific technological advancements.

For the analysis, we first examine the prevalence of technology among agencies. Based on a review of the literature and in collaboration with the expert working panel, we identified 38 technological innovations that were expected to have an impact on police activities, were recent innovations, or were already widely used by police. We consider both the prevalence of technology across agencies and how the stages of adoption vary between agencies.

Second, we consider the determinants of technology acquisition. The survey was designed to assess how agency orientation toward dominant policing strategies (e.g., community oriented policing, problem-oriented policing) influence the adoption of specific kinds of technology (e.g., LPRs, car cameras). We also analyze how agency structural characteristics, such as size and type, influence technology adoption. Qualitative data from site visits are used to provide further contextual information about how local situational characteristics, such as crime issues, prompt the adoption of specific technologies.

Third, we describe the process of technology identification, acquisition, and implementation. Technology adoption by agencies is a multiphase process that often involves dozens of individuals and technical systems. In both the survey and site visits, we asked respondents to tell us about how technology was identified for the agency and their vetting process for determining if the technology would work in their existing environment. We use these data to understand how the process of obtaining technology influences future technology success.

Fourth, the impact of technology was assessed by asking agencies how specific technology supported key policing activities. Among those 38 technological devices that were included on the survey, 18 were identified as *core technology* because their use was expected to be associated with policing strategies, goals, or activities. For example, agencies were asked how important geographic information system (GIS) technology was in implementing directed patrols in hot-spot areas. We expand upon these impact metrics with qualitative data. Results from site data suggest that technology is often implemented without a clear plan to measure the technology's success or impact. However, a wider variety of technology, including emerging technology, and issues related to the implementation and use of technology was also emphasized in both the survey and site-level data collections. Regression models were used to examine predictors of technology use, for which we prioritized six technological advancements that were emerging or prevalent among LEAs, according to the literature review, input from experts in the field, and survey responses. These technological advancements included the following:

Social media: Web sites or applications that allow users to generate content, share information with other users, and consume content and information created by other users. Common types of social media include Facebook, Twitter, Pinterest, and YouTube. This was prioritized by the expert panel because of recent public and policymaker attention on the use of social media among police agencies.

Car cameras: Also known as dashboard cameras, car cameras provide video evidence for calls for service and are typically attached to the interior windshield or to the top of the dashboard in a police vehicle. This technology was prioritized by the expert panel because knowledge gained may be informative for understanding nuances related to up-and-coming surveillance and event-capture technology such as BWCs.

Data mining tools: Also known as data discovery tools, data mining tools are typically software packages or applications that allow users to process, analyze, and summarize various types of data. These were prioritized by the expert panel because agencies are increasingly becoming consumers and producers of extensive amounts of data, but much remains to be known about the effects of data mining on policing strategy (and vice versa) and its prevalence across agencies.

Crime mapping: Software or applications used by law enforcement to map, visualize, and analyze crime incidents. This was prioritized by the expert panel because it is perceived to be integral for the deployment of patrol officers and to the CompStat policing strategy.

Body-worn cameras: AA video recording system worn by police officers to record their interactions with members of the public and to accumulate video evidence for calls-for-service. This technology was prioritized by the expert panel because of recent public and policymaker attention on the use of BWCs among police agencies.

License plate readers: A type of surveillance technology mounted on police vehicles or on stationary objects (e.g., bridges) that use small, high-speed cameras to photograph license plates of passing motorists. Prioritized by the expert panel because of recent public and policymaker attention on the use of LPRs among police agencies.

Finally, we synthesize results to identify common lessons learned and the most important factors in the success or failure of technology. In the remainder of the report, we provide a literature review of our six prioritized technological advancements, followed by a discussion of our research design and findings.

4. REVIEW OF RELEVANT LITERATURE

Technology use among law enforcement can spark animated debates that ultimately relate to the role and power of the police in contemporary society. For example, technology such as LPRs has generated much debate about privacy, whereas BWCs have been heralded as a method of improving police–community relationships by promoting more civil interactions. The present study sought to better understand fundamental questions about the prevalence of various technologies in the nation’s police departments, the key factors that encourage their acquisition, processes of implementation, and the perceived impact of technology on policing activities.

We examine an extensive array of law enforcement technological advancements and use a mixed-methods approach that includes national survey and site-level data, which sets this study apart from many before it. Results are presented for nearly 40 technological advancements that detail prevalence of use and emerging technologies that agencies are thinking about getting. Given the breadth of our analysis, six prioritized technological advancements are focused on heavily in both the quantitative and qualitative results. Prioritized technology includes crime mapping, social media, data mining, car cameras, LPRs, and BWCs, which are emphasized in the literature review. The section below first briefly describes research that has accrued on law enforcement technology more generally before it discusses in more detail what is known about the prevalence and determinants of use, implementation, and impact of these six prioritized technological advancements.

Technology Acquisition

Generally speaking, the processes by which technology is acquired within LEAs are not well understood. However, the existing literature on organizational choice provides a useful starting point and an overarching theoretical framework because it describes four perspectives of understanding how organizations identify and achieve agency goals.

The rational perspective suggests that organizations behave rationally by identifying official goals, designing strategies to accomplish those goals, and then implementing technology that supports and facilitates the strategies that they have designed (Cyert & March, 1963). It is well understood, though, that rationality is limited; goals can be fuzzy, knowledge about the best way to accomplish them is often incomplete, and organizations are constrained by resources and human limitations (Simon, 1997). The contingency perspective emphasizes that each organization operates in a particular environment and its choices may depend on external factors and events (Lawrence & Lorsch, 1967). The institutional perspective argues that organizations have their own interests as well, including survival, status and prestige, maximizing resources, and protection from threats (Scott, 2008). One additional perspective depicts organizations more as anarchies than as well-oiled machines, and notes that they often identify solutions (strategies, technology) before

they have a specific problem demanding to be solved (Cohen, March, & Olsen, 1972). Thus, organizational options (such as use of technology) are frequently just waiting for an opportunity to be adopted.

Another commonly invoked theoretical perspective for understanding technology acquisition within organizations is the diffusion of innovation model, which classifies adopters of technology as innovators, early adopters, early majority, late majority, and laggards (Rogers, 1962). Although there is some intuitive appeal to this taxonomy, the diffusion-of-innovation model is limited in its ability to accurately describe how technologies are acquired by police departments. For example, the bespoke categories are not mutually exclusive in practice. Police agencies do not easily fit into one subgroup when considering a specific type of technology, let alone across different types of technology. An agency could be considered both an early adopter and a laggard when it comes to GIS technology if mapping is done at an aggregate level but without incident-based geocoding. In addition, the same agency may be a clear laggard in regard to LPR usage, but may be an innovator when it comes to the use of BWCs. Thus, although the diffusion of innovation model may be a useful starting point, a more comprehensive conceptual framework is needed to define the process of technology acquisition in law enforcement.

Additional work is also needed to understand the key factors that influence agencies' decisions to acquire specific forms of technology. Although it would be logical to assume that departments make decisions regarding what technology to acquire based on what has been shown to be effective for achieving key policing goals (e.g., enhanced efficiency, higher arrest rates, fewer crimes), there is reason to believe this is not necessarily the case. Some studies suggest that LEAs select, implement, and integrate technology independent of existing empirical evidence or support for how these systems affect departmental operations, strategic decisions, or crime outcomes. In essence, it is argued that law enforcement adopts technology before adequately evaluating the potential impact (Weisburd & Neyroud, 2011). Further research is needed to understand the accuracy of this description, and the extent to which it applies to all or only select types of technological advancements.

Moreover, much remains to be known about agency characteristics and their potential impact on the acquisition of particular forms of technology. There is some evidence to suggest that the size of an agency and its geographic location can influence its likeliness of adopting select types of technology (e.g., Chamard, 2002, 2003, 2006), although the mechanisms that explain why this is the case are not entirely understood. Some believe that organizational size is an indicator of other characteristics that would facilitate the adoption of new technologies. For instance, agencies that tend to be larger could reasonably be expected to have more slack resources with which to invest in new technologies (Mastrofski, Parks, and Wilson, 2003). Additionally, larger organizations may have a greater diversity of job functions, indicated in prior research as a higher degree of specialization

within the larger organization, that would presumably lead to more adoption, as specialized units (i.e. crime analysis units, investigations, auto theft units, etc.) require certain technologies to perform their function at the highest level (e.g. see King, 1998; Randol, 2012; Skogan and Hartnett, 2005). Associations between higher numbers of employees in technical positions and greater capabilities in computerization and information technology (IT) have also been identified (Nunn, 2001). The idea that agencies with larger numbers of specialized units are positively associated with technological innovations is consistent with prior findings in innovation research (Damanpour, 1991; King, 1998).

Some scholars also argue that agencies with specializations are more likely to be characterized as "cosmopolitan," or "in the know" of the newest research, practices, and technologies available to best achieving agency goals (Weisburd and Lum, 2005). Weisburd and Lum (2005) found in their survey of 125 police agencies that adoption of computerized crime mapping was related to the "cosmopolitanness" of the police organization (Weisburd and Lum, 2005). That is, early adopters of this technology tended to have officers with more knowledge of and interaction with research surrounding crime mapping and hot spots policing. Skogan and Hartnett (2005) found a similar association in their study of the adoption of a centralized data warehouse that the Chicago Police Department made available to 122 other police agencies. Agencies who were involved in "cosmopolitan networks" as measured by the departments' association with various professional agencies (e.g. Police Executive Research Forum (PERF), the International Association of Chiefs of Police (IACP)), were more likely to adopt the centralized data warehouse.

According to Schuck (2015), the adoption of technology can be understood as a complex interaction between several factors, including characteristics of the technology, organizational culture, and features of the larger social-structural environment. Using data from multiple iterations of the Law Enforcement Management and Administrative Statistics (LEMAS), Schuck examined key factors that could explain why agencies adopt dash and mobile cameras, including characteristics of the technology (i.e., design, functionality, and congruency with agency goals), organizational traits (i.e., hierarchical structure, formalization, spatial differentiation), characteristics of the community (i.e., income and demographic composition), and features of the political environment in which the agency operates. Findings indicated that while the strongest predictor of mobile camera adoption in large agencies was the level of crime in the community, organizational size and spatial differentiation (sprawl) were positively associated with mobile camera adoption in smaller and medium-sized agencies. Additionally, agencies that were situated in communities with higher levels of poverty, inequality, and crime operated more in-car cameras.

Despite discussions within the criminal justice arena about policing models and their impact on law enforcement activities (Moore & Trojanowicz, 1988; Weisburd & Braga, 2006), our review indicated that very little research has been conducted on associations between different views about common policing strategies and the acquisition or perceived impact of

technology. There is reason to believe that associations exist between an agency's devotion to a particular policing model (e.g., community or problem oriented) and the types of technology they use and perceive to be effective for achieving certain outcomes. Namely, technology could make a new strategy possible, provide a new tool for an existing strategy, or allow for a combination of both scenarios. For instance, according to Koper et al. (2015) and Lum (2010), the 9-1-1 system has played a critical role in shaping and reinforcing reactive policing, whereas a different set of technological advancements has been associated with supporting community policing (Dunworth et al., 2001). In addition, it seems that offender-targeting, hot-spot, and other policing models would be largely impossible without recent technological advances that have allowed police to better collect, manage, and analyze data, including records management systems, GIS, and predictive analytics software.

Impact of Technology

Technological advances in recent years have changed the nature of policing so significantly that many methods and tools from just a decade ago have become antiquated and incompatible with current technology (Goodison, Davis, & Jackson, 2015). Some of these advances include location-monitoring devices for the tracking of high-rate offenders, predictive analytics and crime mapping software for the deployment of officers into locations that cause or are likely to cause crime, crime scene technology that enhances the collection and processing of evidence, and interoperable Web-based and other communication devices that facilitate connections between police and the communities they serve. As discussed by Koper et al. (2015), research suggests that technological improvements have increased police capabilities, but it is not certain that they have enabled law enforcement to do their jobs more effectively (see Danziger & Kraemer, 1985; Ioimo & Aronson, 2004; Roman et al., 2008; Roth, Koper, White, & Langston, 2000; Lum, 2010). For example, despite dramatic advances in DNA technology and computer databases for handling forensic data, clearance rates for violent and property crime have remained relatively stable since the mid-1990s (Federal Bureau of Investigation, 1996, 2011).

In addition, improved efficiency does not always translate to effectiveness. Historically, police use of radios, 9-1-1 systems, computer-aided dispatch, and GIS has provided a way to deploy officers to the scenes of crimes quicker and have been hypothesized to clear more cases at the scene through arrest. Yet, the idea that 9-1-1 systems result in more arrests has been contradicted by empirical research. For example, a study by Sherman and Eck (2002) indicated that reducing response times does not impact the number of arrests, primarily because there are often delays in the reporting of crimes. Furthermore, the burden of answering 9-1-1 calls, roughly half or more of which are not urgent but require rapid response times (Mazerolle, Rogan, Frank, Famega, & Eck, 2002, p. 98), puts pressure on

limited resources and tends to leave police with less time to engage in proactive or community-oriented policing.

Prevalence, Determinants, Process, and Impact: A Review of Six Technologies

The remainder of the literature review is focused on six types of technology that were prioritized in both the nationally representative survey and site visits. These are crime mapping, social media, data mining, car cameras, LPRs, and BWCs. For each technology, we provide an overview of available literature or research that provides a background for what is known relative to our key research questions.

Crime Mapping

Computerized crime mapping software via GIS is used by police agencies to map, visualize, and analyze quality of life complaints, crime patterns over space and time, and paths to crime displaying distances between events within an incident. Using GIS, departments can identify clusters of crime incidents or types (i.e., hot spots and habitats), generate graphic displays of crime incidents for officers or the community, and identify other patterns of local crime activity that may ultimately help inform the allocation and deployment of officers into the field (Mamalian, LaVigne, & the Staff of the Crime Mapping Research Center, 1999; Mazerolle, Bellucci, & Gajewski, 1997). In some cases, census demographics or land-use data are merged with GIS crime-incident data to better understand the contextual characteristics within which crime incidents are embedded (Mamalian et al., 1999; Rich, 1995).

Although little research has evaluated the effectiveness of computerized crime mapping across agencies or in experimental settings with pre- and postmeasurement of select outcomes (e.g., arrest clearances) within agencies, some research has demonstrated the effectiveness of specific reactive and proactive activities that depend heavily upon GIS techniques. For example, hot-spot policing, a largely reactive strategy, can reduce the number of reported criminal incidents, calls-for-service, and instances of observed physical and social disorder (e.g., see Braga & Bond, 2008; Braga, Papachristos, & Hureau, 2012; Braga et al., 1999; Sherman & Weisburd, 1995), whereas risk terrain modeling can be useful in making future deployment decisions (Caplan, Kennedy, & Miller, 2011). The use of GIS in a reactive policing framework is fairly well documented in research compared with literature on GIS-informed proactive policing, which is still largely underway.

Considerable variation in the techniques used, sophistication of methods, and frequency of use makes it difficult to establish estimates of the number of LEAs that use GIS or other forms of computerized crime mapping technology (Markovic, Bueermann, & Smith, 2006). Whereas some agencies use crime mapping primarily to generate visual displays of local crimes, others conduct more complex modes of spatial analysis to understand the

relationship between crime types or incidents and select features of the physical or social environment. Spatial analysis techniques can also vary widely depending on whether an agency is adopting a proactive rather than reactive geographic policing strategy. Likewise, the degree of penetration varies across agencies: In some departments, crime analysts have sole responsibility for crime-mapping tasks, whereas in others, it is available to personnel throughout the chain of command, often via intranet-based dashboards.

Nonetheless, a handful of studies have attempted to identify the prevalence of crime mapping in U.S. police departments. In 1995, the International Association of Chiefs of Police (IACP) conducted a poll of 280 police agencies, of which 30% reported using crime-mapping software on a regular basis. However, participating agencies represented many of the more-active users of computer technology in the U.S. at that time and, therefore, the estimate is likely inflated compared with what it would have been for a nationally representative sample. A survey of 2,004 agencies conducted by the National Institute of Justice's Crime Mapping Research Center indicated that about 13% had used computerized crime-mapping software to produce automated pin maps and to map various types of law enforcement data (e.g., offense, calls-for-service, and vehicle recovery data). Of those that had not used it, 20% planned to purchase it within the next year (Mamalian et al., 1999). A survey administered in 2003 by the Bureau of Justice Statistics indicated that nearly 18% of U.S. LEAs used computers for crime mapping, an increase of 3.5% compared with results from the same survey administered 3 years before (Markovic et al., 2006).

Few studies have examined the factors that influence agencies' decisions to acquire computerized crime-mapping software. Among those that have investigated the determinants of acquisition, agency size has been found to be robustly associated. For example, in the study by Mamalian and colleagues (1999), 36% of agencies with 100 or more sworn officers reported that they used crime-mapping technology, compared with only 3% of agencies below that threshold. Results from an analysis of the Law Enforcement Management and Administrative Statistics (LEMAS) surveys showed that 48% of smaller agencies had stopped using crime-mapping technology in a 2-year period compared with only 2.7% of larger departments (Chamard, 2002).

Likewise, in a study of 347 municipal police departments in New Jersey, Chamard (2003) found that departments that are smaller, less urban, and with lower levels of crime were more likely to discontinue crime mapping. Agency size has not only been linked to whether crime-mapping software is used but also *who* uses it within an agency. Mamalian and colleagues (1999) found that crime analysis staff perform the majority of queries in large departments, whereas GIS tasks are more likely to be shared among several staff positions in smaller agencies. Although not as widely documented, one study also found geographic region was an influential factor, in that GIS and computerized crime mapping diffused quicker throughout agencies in the Pacific, South Atlantic, and Mountain regions than it did in New England (Chamard, 2006).

A large body of literature has documented the challenges of implementing crime-mapping systems within police departments. Among early adopters of GIS in the 1980s and early 1990s, common problems were technical issues, incompatible police databases, and difficulties related to geocoding (Hirschfield, Brown, & Todd, 1995; Craglia, Haining, & Wiles, 2000; Openshaw, Cross, Charlton, & Brunsdon, 1990). Years later, many of these same issues remained. The Police Foundation (2000) conducted telephone interviews with staff from 51 police departments that had received grant funding from the Community Oriented Policing Services (COPS) office to carry out crime mapping in their departments. Respondents identified the key challenges of crime mapping to be the steep learning curve for effectively using the technology and the need for more technical assistance, problems with geocoding, and difficulty integrating crime-mapping software use with the routine activities and operation of the department.

Others find that agencies that decommission computerized crime mapping do so in response to technical difficulties, a lack of personnel or resources to train users, problems managing large amounts of data or integrating the software with other existing systems, and general disenchantment with the technology (Chamard, 2003; Mazerolle et al., 1997). Issues related to the selection of a vendor, installation and customization of the software, data access, and effective use of the technology have also been cited as barriers to successful implementation (Rich, 1995; Markovic et al., 2006). Rich (1995) describes data quality as the most serious obstacle: If the data are incomplete, inaccurate, or not up to date, analysis will produce little value and may leave users frustrated with the technology.

Social Media

As noted by Social Media the Internet and Law Enforcement (SMILE), social media use in law enforcement is in the very early stages (Cohen, 2010). Thus, although there is a lot of national discourse about its use in law enforcement, there have been few rigorous or systematic studies that have examined prevalence and determinants of use, challenges of implementation, or impact of social media on policing or community outcomes. A 2014 survey by the IACP is one of few attempts to establish the extent to which the nation's LEAs use social media in any capacity. Results from a sample of 600 agencies indicated that 96% of departments use social media, although it is not clear whether their sample was representative of U.S. police agencies more generally (Entis, n.d.). Among the 4% of agencies who did not report using social media at the time of the survey, more than half were considering it as an option.

Much of the available literature, although mostly informal or journalistic, has suggested that social media has tremendous potential in modern-day law enforcement. Many have highlighted the importance of social media for building trusting relationships between police and the local community, because social media can establish a forum for open communication (Burger, 2013). With a vested interest in community outreach, departments

can use social media to post crime prevention tips, community-related news, issues related to pedestrian and motorist safety, and information about weather or traffic-related emergencies (Stevens, 2010). Likewise, citizens from the community also have the opportunity to communicate with the police via social media, which can deliver valuable feedback and raise the department's awareness of community perceptions of local law enforcement. Recent high-profile events have underscored the potential for police departments' use of social media to promote public safety in times of unrest, and the potential for active social media use to humanize the local police force by showing that officers are also members of the community they serve has also been voiced (Stevens, 2010).

Notwithstanding widespread conjecture about how social media is used by law enforcement, there have been few attempts to address this issue systematically. A 2014 survey of law enforcement officials by LexisNexis investigated the extent to which police personnel use social media for various policing activities (LexisNexis, 2014). About 34% of the sample reported that they used social media to notify the public of emergencies, crimes, and criminal suspects, and 29% solicited crime tips from the community. Another 30% used social media to promote positive relationships with the community, and about half of the sample monitored social media for criminal activity. The most commonly used social media Web sites were Facebook (93%), YouTube (67%), and Twitter (50%) (LexisNexis, 2014; for similar estimates, see International Association of Chiefs of Police Center for Social Media, 2014). There is some anecdotal evidence indicating that some agencies also use Pinterest to "pin" photos of stolen property or to spotlight individuals with a warrant out for their arrest, or Next-door to alert neighborhoods of a nearby robbery or break-in (Ericksen, 2014).

Similarly, little is known about the perceived value of social media for specific law enforcement activities. In a survey of agencies by the IACP in 2013, 80% of the sample reported that social media was a valuable investigative tool because it had helped them to solve crimes, and nearly three-quarters of the sample reported that using social media facilitated more cooperative relationships with the community (Entis, n.d.). Similar estimates were found in the 2014 IACP survey. The 2014 survey by LexisNexis revealed that the majority of respondents (67%) perceived social-media monitoring to be an effective investigative tool and approach to anticipating future crimes, and 73% believed social media helped them to solve cases quicker.

Not much is known about the unique challenges associated with the implementation of social media within police departments. However, despite a lack of rigorous studies investigating these issues, there are several available resources online that make recommendations about how to successfully implement social media technology into the law enforcement business model. These recommendations include posting frequently, but only posting content that has real-world value; mitigating the limitations of individual platforms by using multiple types of social media; designating a team responsible for managing social

media accounts; establishing metrics to measure the impact of various platforms; and becoming knowledgeable about available social media platforms and how to use them correctly (Burger, 2013; Stevens, 2010). There has also been considerable discussion about the need for formal social media policies that protect against potential legal risks associated with using the technology. The 2014 IACP survey of law enforcement social media use found that about 72% of agencies that use social media also have a formal policy about the use of the technology, and about 12% were crafting a policy.

Data Mining

Since the 9/11 terrorist attacks, federal and local LEAs in the United States have been under pressure to become more data driven in their daily operations. However, despite a generalized shift in policing philosophy toward better resource management and an emphasis on data-driven policing, police departments face the challenge of managing and using an ever-growing amount of data. Moreover, these data can take numerous forms; for example, they may derive from the agency's RMS, census databases, mobile resources (e.g., smartphones), automated LPRs, or social media.

Data mining technology was designed to address needs related to handling large quantities of data from diverse sources. Specialized mining software allows departments to analyze massive amounts of data in a fraction of the time it would take using manual methods and, thus, are speculated to save time and personnel-related resources (Fayyad & Uthurusamy, 2002). Crime analysts may use specialized data mining software to mine text data, visualize crime networks, identify possible suspects, or recognize crime patterns and characteristics associated with them to guide the deployment of officers. Crime data can also be merged with other forms of external data, such as traffic or weather information, and analyzed to identify complex relationships between multiple variables. Most software packages also allow for the creation of automated reports and dashboards, prediction maps, and crime trends.

Data mining is often discussed in tandem with predictive policing, a strategy based on the logic that future crimes can be better anticipated, responded to, or prevented using intelligence collected and analyzed from a variety of data sources. In one example, as a result of frequent random gunfire on New Year's Eve, the Richmond Police Department in Virginia examined data collected from previous years and was able to anticipate when and where future incidents might occur on New Year's Eve in 2003. Officers were strategically deployed based on the data analyzed and, as a result, the department witnessed a 47% decrease in random gunfire and a 246% increase in weapons seized, while at the same time saving \$15,000 in personnel costs (see Pottenger, Yang, and Zantias, 2007). The potential for data mining software to uncover underlying causes of crime trends and patterns that can then inform the allocation of police resources as a crime prevention strategy is also viewed as consistent with the basic premise of predictive policing. In Arlington, Texas, the police

department studied residential burglary data to identify associated hot spots and compared these locations to areas with code violations. The analysis revealed a direct relationship between neighborhood levels of physical decay and the likelihood of residential burglaries. Based on this analysis, the department developed a Formula to identify what they termed “fragile neighborhoods” and worked with other city agencies to help prevent crime in them (Pearsall, 2010).

Our review of the literature indicated that research on the use of data mining technology in police departments is scarce. It is not clear how many agencies practice data mining, nor has much been learned to explain determinants of use or the process and challenges of implementation. Rather, much of the available literature is devoted to describing the technical capabilities of data mining technology. For example, numerous resources exist that describe various mining techniques, such as entity extraction (i.e., detection of patterns from text, image, or audio data), clustering (i.e., generating groups of data points based on similarity of characteristics), association rule and sequential pattern mining (i.e., detection of frequently occurring characteristics and sequences within a database), and deviation detection (identifying data points or cases that differ significantly from the rest of the data) (Chau, Xu, & Chen, 2002; Hauck, Atabakhsh, Ongvasith, Gupta, & Chen, 2002). However, much remains to be learned about the presence, role, and value of this technology in law enforcement.

Car Cameras

Efforts to implement video recording systems in officer patrol cars date back to the 1960s; however, it was not until the early 2000s that dashboard-mounted cameras became prevalent (Westphal, 2004). The diffusion of dash cameras throughout American law enforcement was a consequence of several historical factors that include increased attention on drinking and driving in the 1980s, the war on drugs, allegations of racial profiling against the police, and demands from within law enforcement for greater officer safety (Westphal, 2004). Recognizing the potential for in-car cameras to document the circumstances of arrests or other officer–citizen encounters and to deter assaults against police officers, the Department of Justice’s COPS initiated the In-Car Camera Incentive Program in the late 1990s to provide funding to state and highway patrol agencies to get and use in-car camera systems. The program dramatically increased the number of agencies with dash cameras in the next few years. Before disbursement of financial aid in 2000, only 11% of state and highway patrol agencies had in-car camera systems; by 2004, nearly three-quarters had such systems. Other studies have demonstrated that in-car cameras systems have also become common among local agencies. For instance, drawing from the 2013 Law Enforcement Management and Administrative Statistics survey, Reaves (2015), reported that 68% of local police departments used in-car camera systems, an increase of 7% since 2007.

In 2002, the IACP conducted a study of in-car camera systems and their use among the 47 state police agencies that had received COPS grant funding under the In-Car Camera Incentive Program. The study included a survey of agencies, on-site interviews, and a series of focus groups to inform process and impact evaluations of the technology. Results indicated that officers perceived numerous benefits of in-car camera systems, including increased agency accountability, improved community perceptions, and enhanced officer-related behaviors (i.e., professionalism). Footage retrieved from cameras was also perceived to facilitate criminal prosecutions in court and to provide a valuable resource for new recruit and in-service training. Interviews with patrol officers suggested that in-car cameras also augmented officer safety because the presence of a camera has the potential to de-escalate confrontational situations when citizens are informed of being recorded.

The 2002 IACP study also documented several challenges common to the use of in-car cameras. For instance, many agencies were described as narrow sighted in their implementation plan, designing systems that were incapable of accommodating significant demands related to storing, filing, and retrieving video evidence. Other agencies believed they had not spent enough time researching the technology and issues that should be considered when implementing in-car camera technology, such as different technology formats (e.g., analog or digital) and costs required for equipment maintenance. Respondents also reported several technical difficulties, such as poor quality and the restricted range of the cameras' audio transmitters. Some patrol officers believed they had not received adequate training for using the technology, and some worried that camera footage was being used by command staff as a way to monitor officer behavior and performance.

Although the IACP study offers considerable value for detailing the process, challenges, and perceived impact of in-car camera use, it is limited to state police and highway patrol agencies and, therefore, says little about municipal and county police departments or sheriff's offices that make up the majority of LEAs in the United States. In addition, because all agencies in their sample had received funding to implement in-car cameras, it does not attempt to unveil key factors that differentiate those agencies that do and do not use such systems.

License Plate Readers

Automatic LPRs are high-speed cameras paired with character recognition software that can read and document thousands of license plates per minute while also recording the date, time, and location of every scan. LPRs can be mobile (i.e., mounted on police cars) or stationary (i.e., mounted on structural objects such as overpasses), and information obtained can be compared with existing hotlists of license plates compiled by agencies and relevant matches can be used to send alerts to active officers on patrol. This technology has attracted controversy in recent years because license plate information collected from LPRs

can be retained by law enforcement and even merged into regional information-sharing systems. Accordingly, the American Civil Liberties Union has raised concerns related to citizens' rights to privacy and the need for tighter regulations for LPR technology. Some states have moved to limit the use of LPR based on privacy concerns. For instance, in June 2015, Louisiana Governor Bobby Jindal vetoed legislation that would have allowed law enforcement to use LPRs to apprehend uninsured drivers (Litten, 2015).

A handful of studies have estimated the prevalence of LPRs within U.S. law enforcement, although there are pronounced differences in these assessments, which are likely due to sample differences. Data analyzed from the 2013 LEMAS survey suggest that about 16% of local police departments used LPRs in the past year. Other studies indicate that the prevalence among large agencies is closer to one-third and that many more departments plan to obtain the technology in the future (Lum, Merola, Willis, & Cave, 2010; Koper, Taylor, & Kubu, 2009). A survey of 305 local, state, and tribal police departments by Roberts and Casanova (2012) identified a prevalence of 23%. Conversely, a recent estimate by the RAND Corporation is significantly higher, at approximately 70% (Gierlack et al., 2014). As with other types of technology, the prevalence of LPR use has been found to be considerably higher among large agencies (Lum et al., 2010).

The study by Roberts and Casanova (2012) is one of few that have delineated the key purposes for which LPRs are used by law enforcement. Among the 23% of agencies in their sample that had reported using LPRs, the most commonly reported uses were auto theft recovery (69%), vehicle and traffic enforcement (28%), and investigations (25%) (see Lum et al., 2010, for similar estimates). Likewise, there have been few systematic attempts to uncover the challenges of LPR implementation. According to some accounts, the substantial cost of installing LPRs and maintaining IT infrastructures to support license plate databases can present serious obstacles to successful implementation (Lum et al., 2010). False positives and duplicate license plate numbers for vehicles registered in different states have also been described as challenges (Hsu, 2014). In some studies, respondents cite technical difficulties, lack of knowledge about the technology, and insufficient information about best practices of LPRs as key barriers to effective use (Lum et al., 2010).

Research on the effectiveness of LPRs is also incomplete. Some police departments, such as the New York and Sacramento Police Departments, have reported increases in arrests for or reductions in reports of auto thefts as a function of implementing LPRs (see Hsu, 2014). In addition, 68% of agencies from the Roberts and Casanova (2012) study reported that LPRs had enabled them to increase stolen-vehicle recoveries, and 55% reported that automobile theft-related arrests had increased. However, other research raises questions about the general effectiveness of LPRs. For instance, results from a randomized controlled experiment in Mesa, Arizona, conducted by PERF indicated no relationship between the number of scanned license plates and vehicle theft rates (Taylor, Koper, & Woods, 2011). Similarly, a study by researchers from George Mason University suggested that the use of

LPRs in hot spots did not have an appreciable effect in reducing auto thefts. Hence, the authors expressed concern about the rapid acquisition of this technology by law enforcement without substantial evidence about its efficacy (Lum et al., 2010).

Body-Worn Cameras

BWCs have received increased public attention in the wake of recent high-profile police incidents, such as those in Ferguson, Missouri; North Charleston, South Carolina; New York City; and Cincinnati, Ohio. Recent estimates suggest that about one-third of local police departments use BWCs, although these numbers are expected to increase substantially in the future (Reaves, 2015). In December 2014, President Obama proposed reimbursing communities half the cost of purchasing cameras and storing data (Hermann & Weiner, 2014). However, it is important to note that there are mixed views from the field about the potential impact of BWCs on community relations.

A 2014 PERF study, conducted with support from the COPS Office, found that although police leaders who have deployed BWCs state that they have many benefits (e.g., documentation of evidence, preventing and resolving complaints brought by the public, and bolstering police accountability and transparency), others raise concerns about privacy and trust. Some have expressed concern that the constant use of BWCs may erode community relationships and hinder their community policing efforts. For example, witnesses and informants might be reluctant to pass information on to police officers if the interaction is being recorded, especially in high-crime areas where they may fear retaliation if the footage is released into the public (Miller, Toliver, & the Police Executive Research Forum, 2014).

Research into BWCs to date has focused on the impact on citizen complaints and on use of force. Both issues can severely undermine any community policing or problem-oriented policing strategy. In terms of the effectiveness of BWCs, the Rialto Police Department in California found that shifts on which BWCs were not deployed had more than twice as many use-of-force incidents than shifts that used them, and complaints against the police had decreased from 24 complaints filed during the 12 months before the trial to three during the trial (Barak, Farrar, & Sutherland, 2014). A 2013 study of the Mesa Police Department in Arizona found that camera users experienced decreases in both departmental complaints and use-of-force complaints. It also found that when policy shifted from making activation mandatory to a policy of officer discretion, there was a 42% decrease in the rate of use, with volunteer officers substantially more likely to use the BWC than officers assigned to the study (Stokes, Rankin, & Filler, 2013). In a 2015 study in Arizona of the Phoenix Police Department's use of cameras, arrests increased by 17% among officers using BWCs compared with 9% in the comparison group. Complaints also dropped sharply among the BWC group, with a 23% reduction compared with a 10.6% increase in the comparison group and a 45.1% increase among officers in other precincts that were not part of the study (Katz et al., 2015).

Summary of Relevant Research

Taken together, the literature reveals important information on the prevalence of selected technological advancements in law enforcement agencies and highlights key differences in the use of technology across various agencies. In addition, the literature brings attention to implementation challenges, lessons learned, and other barriers related to law enforcement use of technology. One major theme in existing research is that impacts realized in specific agencies are largely not generalizable to other agencies because of vast departmental differences in the implementation process, challenges faced, organizational capacity, and so forth.

A prominent concern across studies was that agencies may implement and use technology without having sound evidence about its efficacy. Similarly, it is largely unknown what factors specifically differentiate agencies that use certain types of technology from those that do not. As such, many questions remain about processes related to technology in law enforcement, particularly about how technological innovations are identified, adopted, and implemented. The impact of technology on relevant outcome measures has also been largely understudied. Furthermore, there has been no investigation into theoretical links between agency strategies, the type of technology implemented, and any outcomes related to those strategies.

The present study was designed to address many of the most prominent gaps in the literature, including those related to agency characteristics, size, and the prevalence of technology; processes related to acquisition and implementation; and the perceived impact of technology on common policing activities. We addressed limitations of past research by obtaining in-depth qualitative data from an agency-level perspective, and by using a rigorous study design that provides results that are generalizable to the large population of agencies. Specifically, the research design used and discussed below incorporates a nationally representative sample of state and local LEAs, representing the Northeast, Midwest, South, and West regions, and comprising appropriate proportions of small, medium, and large agencies. In addition, this study contains supplemental analyses that examine a subsample of large agencies to better untangle the relationships among strategy, technology, and agency size.

5. RESEARCH DESIGN

This project was conducted in three phases. First, an expert panel was convened to identify key policing technology and to ensure that the survey captured critical indicators of technology performance. Second, a nationally representative survey (**Appendix A**) was administered to more than 1,200 state and local LEAs. The survey explored policing strategies and activities, as well as technology acquisition, use, and challenges. Results from this survey were used to identify agencies that would be well suited for the final research phase: in-depth site visits. Site-visit locations were stratified so that visits were conducted with both municipal and sheriff agencies of a variety of sizes (small, medium, and large) and experiences with technology.

Expert Panel

The expert panel advised the RTI/PERF team on key components of the project, including the survey of technology implemented in LEAs and follow-up site visits to a selected group of agencies identified from their responses to the survey. In particular, the expert panel assisted with finalizing the list of technology areas to be included in the survey, additional measures related to technology implementation, strategy to select agencies for follow-up site visits, and analysis approach to provide meaningful information about how technology can support law enforcement strategies and outcomes.

In June 2013, RTI and PERF hosted a 1-day expert panel meeting in Washington, D.C. The panel consisted of nine criminal justice professionals and civilians who had expertise derived from working in law enforcement and/or experience in selecting and implementing technology in LEAs. Members of the expert panel included are listed in **Exhibit 1**.

Feedback and input from the expert panel were instrumental in the development of the framework for the survey, including developing the scope of the survey and technical details. Once the survey instrument was finalized, the expert panel had an opportunity to review and provide recommendations to ensure the RTI/PERF team was able to meet the project's goals and objectives to gain insight on how LEAs are using technology for various policing strategies. The expert panel also provided guidance on technological innovation to explore further during the site visits, as well as criteria to select agencies for site visits, including agency size, type, variation in experience with technology implementation and impact.

Exhibit 1. Expert Panel Members

Expert Panel Member	Position and Affiliation
Gary Cordner*	Professor, Department of Criminal Justice, Kutztown University
John DeCarlo	Director, Center for Advanced Policing, University of New Haven; Owner, Director of Research and Development, Nexgen Solutions, Inc.
Lt. Alan Felsen	Information Management & Technology Division Montgomery County, Maryland, Police Department
John Hollywood	Senior Operations Researcher, RAND Corporation
John Kapinos	Strategic Planner, Fairfax County, Virginia, Police Department
Christopher Koper	Associate Professor, Department of Criminology, Law and Society, George Mason University
Richard Myers	Commissioner, Commission on Accreditation for Law Enforcement Agencies, Inc.
Susan Hammen (Smith)	Director of Operations, Bair Analytics President; International Association of Crime Analysts
Craig Uchida	President and Co-Owner, Justice and Security Strategies, Inc.

*Also served as overall consultant to the project.

National Survey of Law Enforcement Agencies

Survey Instrument

The objective of the survey was to collect information on the use and impact of technology in LEAs, the experience of implementing technology, and the importance of policing strategies in state, local, and tribal agencies for identifying, acquiring, and implementing technology. The survey was divided into four parts:

Part A: Core mission and activities for achieving that mission

Part B: Recent experiences identifying, procuring, and implementing technology

Part C: Use and perceived impact of selected technology

Part D: Information about additional technology acquired

Part A asked respondents to indicate how important a series of policing strategies was for supporting the agency's core mission on a scale of 1 (not important at all) to 5 (highest importance). The policing strategies inquired about were as follows: professional, community, problem-oriented, zero-tolerance, hot-spot, offender targeting, intelligence-led, and predictive policing. Subsequently, respondents were prompted to specify how important selected activities were in helping their agency to meet its core mission, also on the same 1–5 scale. Respondents also selected their top five prioritized activities.

Part B began by asking respondents to indicate what technology had made the largest impact on their agency’s strategy and activities. Respondents were then prompted to identify the circumstances that prompted getting the most recently acquired technology. Part B ended with a series of questions that explored any problems with this acquisition.

Part C was designed to elicit information about the 18 core technological advancements that had been implemented or that the agency planned to get and implement in the next 2 years, and about the extent to which that technology is important for the success of a range of paired policing activities. Respondents that indicated their agency had used a given technology in the past 2 years were prompted to rank the importance of the technology on scale of 1 to 3 (1: not at all important, 2: somewhat important, and 3: very important) for the success of achieving specific policing activities.

It should be noted that the large number of technological devices and policing activities necessary to include in the survey made it unfeasible to ask respondents how important *each* technology was to the success of *each* policing activity. Therefore, we only asked respondents to rate the impact of implemented technology that could be directly linked conceptually to the types of activities they had prioritized. For example, the research shows that GIS is often used by agencies that make explicit efforts to target high-risk areas within their jurisdiction. Accordingly, if an agency reported that they had implemented and used GIS, they were then prompted to indicate how important GIS technology was for the success of targeting high-risk areas. A list of pairings between each core technology and its associated activities is provided in **Exhibit 2**.

Exhibit 2. Core Technologies and Associated Policing Activities

Crime mapping or GIS software

- High arrest volumes
 - Involving community members in developing police priorities
 - Involving community members in implementing strategies
 - Proactively identifying and analyzing specific crime and disorder problems
 - Implementing focused solutions to address the underlying cause(s) of identified crime and disorder problems
 - Targeting identified high-risk areas
 - Implementing directed patrols in high-risk areas
 - Implementing saturation patrols in high-risk areas
-

Predictive analytics software

- Targeting identified high-risk areas
 - Implementing directed patrols in high-risk areas
 - Implementing saturation patrols in high-risk areas
 - Conducting analyses to identify repeat offenders
 - Conducting surveillance of individuals at risk of offending
-

(continued)

Exhibit 2. Core Technologies and Associated Policing Activities (continued)

Data mining tools for massive databases

- Implementing directed patrols in high-risk areas
 - Conducting follow-up investigations
 - Generating crime intelligence from the community
 - Proactively identifying and analyzing specific crime and disorder problems
 - Implementing focused solutions to address the underlying cause(s) of identified crime and disorder problems
-

Investigation case management software

- Conducting follow-up investigations
-

Search and data sharing across silos

- Responding to calls for service in an efficient and timely manner
 - Conducting follow-up investigations
 - Targeting identified high-risk areas
 - Implementing directed patrols in high-risk areas
 - Implementing saturation patrols in high-risk areas
 - Conducting analysis to identify repeat offenders
 - Implementing systems to track officer conduct
-

Software to discover connections

- Conducting follow-up investigations
 - Proactively identifying and analyzing specific crime and disorder problems
 - Implementing focused solutions to address the underlying cause(s) of identified crime and disorder problems
 - Conducting analysis to identify repeat offenders
-

Software to track cell phones and exploit cell phone data

- Conducting follow-up investigations
 - Conducting analysis to identify repeat offenders
 - Conducting surveillance of individuals at risk for offending
 - Working cooperatively with probation and parole officers to identify and monitor individuals at risk of offending
-

Social media

- Conducting crime prevention activities in partnership with community members
 - Generating crime intelligence from the community
 - Conducting high amounts of officer–community engagement activities
-

Regional/national information sharing

- Conducting follow-up investigations
 - Stopping and questioning individuals who exhibit identified suspect behavior or characteristics
-

LPRs

- Achieving high arrest volumes
 - Arresting suspects for minor crime and disorder offenses
 - Implementing directed patrols in high-risk areas
 - Implementing saturation patrols in high-risk areas
-

Acoustic gunshot detection

- Responding to calls for service in an efficient and timely manner
 - Conducting follow-up investigations
-

Rapid DNA

- Conducting follow-up investigations
-

(continued)

Exhibit 2. Core Technologies and Associated Policing Activities (continued)

Mobile biometric devices

- Conducting follow-up investigations
-

CCTV with video content analysis

- Conducting follow-up investigations
 - Targeting identified high-risk areas
 - Implementing directed patrols in high-risk areas
 - Implementing saturation patrols in high-risk areas
-

Gun/contraband detection

- Achieving high arrest volumes
 - Arresting suspects for minor crime and disorder offenses
 - Stopping and questioning individuals who exhibit identified suspect behavior/characteristics
 - Implementing directed patrols in high-risk areas
 - Implementing saturation patrols in high-risk areas
 - Conducting surveillance of individuals at risk for offending
-

Early intervention systems

- Implementing systems to track officer conduct
-

Car cameras

- Implementing systems to track officer conduct
-

BWCs

- Implementing systems to track officer conduct
-

Part D elicited information about whether, in the past 2 years, agencies had used any of 20 other technological advancements not covered in Part C. For those technological devices that the responding agency had not yet acquired, the survey asked whether the agency planned to get them in the next 2 years. These technologies are listed in **Exhibit 3**.

Exhibit 3. Additional Technology

- | | |
|--|--|
| <ul style="list-style-type: none"> ▪ Automated traffic enforcement (e.g., red-light cameras, speed enforcement) ▪ UAVs (drones) ▪ Through-wall surveillance ▪ Ballistics/firearm tracing technology ▪ Global positioning system (GPS) tracking of suspects ▪ 2D/3D crime-scene imaging technology ▪ Computer forensic technology ▪ Car-based computers ▪ Voice-to-text application within mobile devices ▪ In-car electronic ticketing system (e.g., ETIX systems) | <ul style="list-style-type: none"> ▪ Regional interoperable radio systems ▪ Directed-energy vehicle-stopping device ▪ CAD/RMS ▪ CAD/GPS feature in cars for deployment ▪ Gun cameras/Taser cameras ▪ Reverse 9-1-1 emergency notification ▪ Next-generation 9-1-1 ▪ Body armor ▪ Reflective gear ▪ Night-vision gear |
|--|--|
-

Sampling Approach

To answer several of our key research questions, an LEA questionnaire was developed and administered to a nationally representative sample of agencies. The sampling frame was developed using the 2012 National Directory of Law Enforcement Administrators (NDLEA), an electronic list obtained from the National Public Safety Information Bureau. The 2012 NDLEA is composed of contact information for 15,847 LEAs in the United States. On the basis of a power analysis conducted using PASS 2008 software, our goal was to obtain a minimum of 949 surveys. Assuming a 74% completion rate, this would have required a sample of 1,283 LEAs.

To ensure adequate representation from each type of agency in the survey responses, the sample included all tribal (n = 69) and state agencies (n = 49).¹ The remaining desired sample count was stratified to ensure adequate representation across the following:

- Census region: Northeast, Midwest, South, and West, each further stratified by
- Agency type: Police department or county law enforcement; and
- Agency size, as defined by number of full-time sworn officers employed: 1–99, 100–249, 250–499, and 500 or more sworn officers.

The required sample size, after subtraction of the tribal and state agencies, was evenly dispersed across the 32 cells created by the cross-tabulation of region/type by size. At this point, it was clear that low cell counts would impact agencies with more than 250 sworn officers. As a result, all agencies with 250 or more sworn officers were included in the sample (n = 360). The remaining count (n = 707) was distributed across the other 16 cells of the cross-tabulation (as size ranges 250–499 and 500 or more were removed). Using this process, 45 agencies needed to be randomly selected within each remaining cell. Some cells within the 100–249 size range had fewer than 45 agencies and were fully sampled. Within each stratum, SPSS software was used to generate a random selection of agencies. The resulting sample size and attributes are described in **Exhibit 4**.

Data Collection Methodology

Survey respondents were contacted and prompted via nonresponse follow-up through multiple mailings and phone calls. The survey was initially distributed in February 2014, followed by two reminder letters sent 3 and 6 weeks after the initial survey distribution. Next, a mailed notification letter from the NIJ project officer, Dr. Brett Chapman, was sent in April 2014. To address nonresponse, we sent an e-mail to nonresponding PERF general members in May 2014, followed by a mailed reminder letter in May 2014 to all nonresponding agencies. To boost response rates among small agencies, an additional

¹Hawaii does not have a state police agency.

mailed reminder letter was sent with a targeted explanation of the importance of the project and its benefit to small agencies.

Exhibit 4. Descriptive Statistics for Sample, Sampling Frame, and Weighted Sample

	Sample (N = 776)	2012 Directory (N = 15,847)	Final Weighted Sample (N = 776)
	%	%	% (no.)
Region			
Northeast	15	20	20 (155)
Midwest	21	33	33 (256)
South	36	35	35 (272)
West	28	12	12 (93)
Agency Type			
Municipal	48	79	79 (613)
County/sheriff's offices	40	19	19 (147)
Tribal	6	1	1 (8)
State or highway	6	1	1 (8)
Sworn Officers, no.			
0-4	2	20	20 (155)
5-9	4	22	22 (171)
10-24	9	28	28 (217)
25-49	5	13	13 (101)
50-99	5	8	8 (62)
100-249	32	5	5 (39)
250+	43	4	4 (31)

After the mailed survey prompts, we conducted two waves of reminder telephone calls to the 350 nonresponding agencies (state, tribal, and those agencies serving a population of 100,000 or more) in June and July 2014. Agencies were e-mailed or faxed their online information upon request. Throughout the entire process, the project allowed for an option of conducting the survey by telephone. At the conclusion of the data collection period, we had obtained a response rate of 60.5% (N = 776). Although the response rate was a bit lower than desired, statistical techniques were used to ensure high levels of confidence in the results. Low and differential responses were addressed through sample calibration and subsample analysis.

Sample Bias, Calibration, and Subsample Analysis

Exhibit 4 demonstrates the differences between our final sample and the 2012 NDLEA for each category: region, agency type, and number of sworn officers. The final sample underrepresents agencies from the Northeast and the Midwest and overrepresents agencies from the West region. In addition, the final sample underrepresents police departments² but overrepresents county/sheriff's offices, tribal agencies, and state/highway agencies. A considerably higher percentage of the final sample is composed of agencies with at least 100 full-time sworn officers compared with the sampling frame.

To adjust these percentages so that they resemble percentages from the 2012 NDLEA, we used a procedure known as raking (also known as raking ratio estimation or sample balancing). Sample raking assigns a weight value to each survey respondent so that marginal totals of the adjusted weights on specified characteristics are in line with the corresponding totals for the population. A major advantage of raking is its ability to produce respondent weights that are based on multiple control totals (i.e., population totals and characteristics) (Battaglia, Izrael, Hoaglin, & Frankel 2004; Kalton 1983).

Past research has indicated that relationships between police activities and agency characteristics may differ significantly based on agency size (Schuck, 2015; Chamard 2002; 2003; 2006; Mamalian and colleagues 1999; Mastrofski, Parks, and Wilson, 2003; King, 1998; Randol, 2012; Skogan and Hartnett, 2005). In addition, because most of agencies in the United States have fewer than 250 officers, analytical models that have been adjusted to represent the overall population of LEAs in the United States will provide information reflective of the majority of that population (i.e., agencies with fewer than 250 officers) and say little about large agencies. Hence, in addition to our analysis with the full sample, we also present results from a supplementary analysis of a subsample of agencies with 250 or more full-time sworn officers (large agencies; $n = 302$). The raking procedure was conducted once for the full sample, and again for a subsample of large agencies.

Missing Data and Imputation

Missing data on individual items throughout the survey were minimal. For instance, on average, 2.8% and 4.2% of respondents had missing data on items related to policing strategies and policing activities, respectively. Before handling missing data, we assessed the number of agencies that had missing data for a significant number of items. Twenty-seven agencies were dropped from the analysis because they did not answer more than a few questions at the beginning of the survey. An assessment of these agencies' key characteristics as they relate to size, type, and region did not indicate any systematic bias

²The municipal police department category from the NDLEA includes a small number of city sheriff's offices in Virginia ($n = 46$).

and, thus, we had no reason to believe that dropping these cases altered the results of our analysis.

To account for missing data for the remaining sample (n = 749), we first performed a series of tests to ensure that the missing data were missing at random and not according to any specific agency characteristics. Logistic regression models were used to predict the odds of having a missing value for each of our dependent variables (i.e., the dichotomous technology use items) by key agency characteristics (region, size, type). Results did not indicate that specific agency characteristics were associated with the odds of having a missing value for various technologies. Multiple imputation was used to estimate a set of plausible values for missing data and to replace missing values with the combined results (Little & Rubin, 2002). A series of five imputations were used to predict missing values; the resulting estimates reflected statistically valid inferences with adjusted standard errors that take into account the uncertainty that derives from missing values (Allison, 2002).

Qualitative Data Collection

The second component of the study, site visits to selected LEAs, was designed to provide more information related to the technology acquisition and implementation experiences, and the impact of the select technologies on agency staff and performance indicators.³ To illustrate relatively successful experiences with technology and lessons learned or barriers to successful technology implementation, site visits were conducted with a total of 22 agencies, including those where technology was determined based on survey responses to have a high impact (n = 14) and those where technology had a mixed impact (n = 8) (**Exhibit 5**).

³Select technology is a subset of the 18 prioritized technological devices included in the survey and included crime mapping or GIS technology, data mining software, social media, LPRs, car cameras, and BWCs.

Exhibit 5. Law Enforcement Agencies that Participated in Study Site Visits

	Law Enforcement Agency	City	State
1.	Alexandria Police Department	Alexandria	VA
2.	Anne Arundel County Police Department	Millersville	MD
3.	Bethlehem Police Department	Bethlehem	PA
4.	Charlotte-Mecklenburg Police Department	Charlotte	NC
5.	Durham County Sheriff’s Office	Durham	NC
6.	Fairfax County Police Department	Fairfax	VA
7.	Fayetteville Police Department	Fayetteville	AR
8.	Fresno County Sheriff’s Department	Fresno	CA
9.	Greenbelt Police Department	Greenbelt	MD
10.	Hillsborough County Sheriff’s Office	Tampa	FL
11.	Kenosha Police Department	Kenosha	WI
12.	Laredo Police Department	Laredo	TX
13.	Manchester Police Department	Manchester	NH
14.	Milwaukee Police Department	Milwaukee	WI
15.	Mobile County Sheriff’s Office	Mobile	AL
16.	Napa County Sheriff’s Department	Napa	CA
17.	Oklahoma City Police Department	Oklahoma City	OK
18.	Riverside Police Department	Riverside	CA
19.	Rock Hill Police Department	Rock Hill	SC
20.	Tucson Police Department	Tucson	AZ
21.	Winston-Salem Police Department	Winston Salem	NC
22.	Yates County Sheriff’s Department	Penn Yan	NY

Site Visit Candidate Selection

The candidates for high- and mixed-impact sites were identified using agency survey responses. Respondents rated the degree to which each acquired technology was critical to the success of selected activities on a scale of 1 (technology was not at all important to the success of the activity) to 3 (technology was very important to the success of the activity). Technology impact score distributions were examined for all survey respondents, and cutoff scores were developed for high- and mixed-impact sites to identify a pool of agencies of sufficient size and diversity (in terms of agency size and type) to support the planned site visits. On a scale of 1 to 3, mixed-impact site visit candidates (n = 25) had an average technology impact score of less than 2, and high-impact site-visit candidates had an

average technology impact score of 2.75 or higher (n = 78). Agencies with very few technologies or a low base for calculating the technology impact score were not considered for site visits.

Site visit candidates were grouped into strata defined by technology impact level (mixed or high), agency type (sheriff's office or police department⁴) and size of population served (less than 100,000; 100,000–499,999; and 500,000 or more). Within each stratum, site visit candidates were prioritized by the number of technologies the agency had acquired overall (agencies with more core technologies were prioritized over those with fewer) and the amount of prioritized technology the site visits were designed to examine (agencies had to have at least three of the prioritized technological devices to be considered for a site visit).

Agencies were ultimately identified for site visits from the pool of site visit candidates to ensure representation across strata, geographic diversity, and in consideration of the agency's willingness and ability to host a 1- to 2-day site visit. Thirty-two agencies were contacted for site visits, and 31 agencies responded that they were willing to participate. These agencies were then screened to confirm their survey responses about the impact of the prioritized technology on the success of the agency's activities (i.e., to confirm that the agency's experience with technology did align with the study's definition of a high- or mixed-impact agency).

Screening also assessed the extent to which prioritized technology was still in use and the availability of agency staff to meet with the site visit team. Nine agencies did not pass screening, most commonly because of scheduling logistics or staffing limitations. In some instances, agencies indicated on the survey they had a technology and believed it had a significant impact, but the screening call determined that the agency could not provide sufficient information about its implementation or impact. For example, one agency reporting having implemented an LPR system on the survey, but it was learned during the screening call that they had recently decommissioned the system. We did not discover this to be a common problem, but it is further acknowledged in the limitations section of the report.

Semistructured Interviews

Interviewers used three semistructured interview guides during site visits, each customized for personnel serving three separate roles within each agency: leadership, users, and IT directors (**Appendix B**). Many of the questions differ among the guides, although some

⁴The NDLEA distinguishes among local agencies, county agencies (including sheriff's offices and county police departments), state and highway patrols, and tribal law enforcement agencies. To produce more generalizable findings, in our selection of sites we prioritized the large agencies (local law enforcement agencies and sheriff's offices).

questions were repeated to make it possible to discover diverging responses across different interviewees.

Agency leaders were interviewed about decision-making processes related to acquisition (resources, decision-making), unmet needs and emerging technology (technology with the greatest impact on the agency, technology being considered for acquisition, orientation toward BWCs), and agency mission, priorities, and leadership turnover. In general, technology-specific topics related to reasons why the technology was chosen, agency performance measures that were expected to be affected by the technology, lessons learned from acquiring and implementing the technology, and plans for the technology.

Users of technology within each agency were asked a comprehensive list of questions related to technology implementation and use. These questions pertained to why the agency chose to acquire the technology, how the interviewee was involved with decisions to acquire the technology, what training users received for the technology, whether the agency has any formal policies for use of the technology, situations in which the technology is used, obstacles to operating the technology successfully, positive and negative impacts of the technology, types of staff that use the technology, and general capabilities of the technology.

Similar to agency leadership, IT directors were also asked to discuss resources available to support acquisition, implementation, and maintenance of technology; processes pertaining to technology-related decision-making; and unmet needs and emerging technologies. For individual technological devices, IT directors were prompted to articulate the process by which a vendor was chosen, the types and numbers of staff who use the technology, activities that support initial and ongoing use of the technology, technology maintenance, agency performance metrics, lessons learned, and plans for the technology. The three interview guides are in **Appendix B**.

Analytical Plan

To explore the prevalence of technology in LEAs, we present descriptive statistics from the nationally representative survey. How the prevalence of technology varies across different types of LEAs is explored through logistic regression. These models look at the impact of agency orientation toward contemporary police strategies and agency characteristics such as sworn-officer staffing, agency type, and regional location. The importance of various technologies for carrying out prioritized activities is studied via descriptive statistics partitioned by agency size. Finally, we assess aspects related to the identification, acquisition, and adoption of technology through in-depth, semistructured discussions with agency representatives.

To assess the relationships between agency characteristics and technology use, we conducted a series of logistic regression models that predicted the odds of technology use in

the past 2 years by four agency characteristics (region, agency type, number of sworn officers, and policing style or agency orientation toward policing strategies). Four geographic regions of the United States (designated by the U.S. Census) were represented by three dummy variables: Northeast, South, and Midwest, as designated by the U.S. Census. The West region was assigned as the reference category. In the 2012 NDLEA, agency type was originally composed of four values: police department/city sheriff's offices (municipal), county police/sheriff's offices, state police or highway patrol, and tribal police departments. Because of small cell sizes for tribal and state police/highway patrol agencies, we recoded agency type into a single dummy variable comparing municipal police departments with all others. The number of sworn officers was recoded into an interval item with seven categories for the full sample (0–4; 5–9; 10–24; 25–49; 50–99; 100–249; 250 or more) based on the number of full-time sworn officers that were reported. For the subsample of large agencies, the sworn-officer variable was recoded to represent three levels (250–499; 500–999; 1,000 more full-time sworn officers).

6. RESULTS

Quantitative results from the agency survey (**Appendix A**) are presented in several subsections below. First, we describe agency characteristics of size, type, and region. Next, we present information on prioritized policing strategies and activities, followed by prevalence of selected technology across U.S. agencies. Finally, we explore the determinants of technology, the impact of technology, and the influence of technology success and failure on policing activities. Within each of these areas, we analyze findings for the national sample as well as the subsample of large agencies. Site-level findings are incorporated throughout these sections, but particularly those sections focused on technology implementation and factors that facilitate or impede full integration and successful outcomes related to technology.

Agency Characteristics, Strategies, and Activities

Exhibit 6 displays weighted descriptive statistics for the representative national sample of all agencies and subsample of large agencies. About a third of the full national sample is from the South and another third from the Midwest. The Northeast region comprises 20% and the West, 12%. A smaller percentage of agencies in the subsample are located in the Midwest compared with the full sample. Seventy percent of agencies in the full sample have fewer than 25 sworn officers. Only 4% of agencies have 250 or more officers. Of those 4% of agencies, 55% have between 250 and 499 officers, 31% between 500 and 999 officers, and 14% have more than 1,000 officers. Nearly 80% of the full sample is composed of municipal LEAs. Among the large agencies, 57% were municipal-level departments.

Policing Strategies and Activities

Much debate exists among practitioners and researchers over the labels used to identify different police strategies (Moore & Trojanowicz, 1988; Weisburd & Braga, 2006). Although most strategies are not mutually exclusive, each one places emphasis on different activities or objectives (e.g., improving police–community relations, preventing crime, or apprehending offenders) that, in turn, might lead to an emphasis on different types of technology (e.g., intelligent use of social media to improve community relations compared with increased use of closed-circuit television [CCTV] to help apprehend offenders).

- Professional policing focuses on hierarchical organizational structures, restrictions on the use of police discretion, and efficient response times.
- Community policing promotes organizational strategies, including the systematic use of partnerships and problem-solving techniques, to proactively address the immediate conditions that give rise to public safety issues, such as crime, social disorder, and fear of crime.

Exhibit 6. Weighted Descriptive Statistics by Agency Size

	Full Sample* (N = 749) %	Large Agencies (n = 302) %
Region		
Northeast	20	24
Midwest	33	14
South	35	43
West	12	19
Agency Type		
Municipal	79	57
County/sheriff's Offices	19	28
Tribal	1	9
State or highway	1	6
Full-time Sworn Officers		
Entire sample		
0-4	20	
5-9	22	
10-24	28	
25-49	13	
50-99	8	
100-249	5	
250+	4	
Large Agencies		
250-499		55
500-999		31
1,000+		14

*The number of samples remaining after 27 agencies were removed from the analysis.

- Problem-oriented policing subjects discrete pieces of police business to microscopic examination in hope that what is freshly learned about each problem will lead to discovering a new and more effective strategy for dealing with it.
- Intelligence-led policing is a business model and managerial philosophy in which data analysis and crime intelligence are pivotal to an objective, decision-making framework that facilitates crime and problem reduction, disruption, and prevention through strategic management and effective enforcement strategies that target prolific and serious offenders.
- Hot-spot policing focuses on specific locations that generate the most calls for police service.
- Offender-targeting policing focuses on identifying and prioritizing repeat offenders.

- Predictive policing uses predictive analytics and crime mapping software to pinpoint specific geographic locations most likely to be subject to crimes.
- Broken-windows policing, or zero-tolerance policing, is based on Wilson and Kelling's (1982) influential article suggesting that targeting minor disorder will reduce more serious crime.

There are differences across policing strategies. For example, the professional model of policing is typically associated with traditional police work borne out of paramilitary agencies whose activities are primarily driven by calls for service. Other models, such as community- and problem-oriented policing models seek to engage the community in the department's response to crime in a holistic, multifaceted approach, often involving civic groups and other governmental agencies to get to the root causes of crime and disorder as opposed to merely reacting to incidents.

Overall, for the full national sample, professional policing was rated as the most important policing strategy for achieving core mission goals (**Exhibit 7**). This was followed by community, problem-oriented, and intelligence-led policing. The type of strategy deemed to be the least important for achieving agency goals was zero-tolerance policing. In general, the rank ordering between the full sample and the large-agency sample relative to importance of policing strategies for achieving the agencies' core mission was the same. However, large agencies tended to have a stronger prioritization of strategies that have stronger technology demands and greater analytic capacity such as intelligence-led policing, hot-spot policing, offender targeting, and predictive policing.

Prioritization of specific policing activities for achieving the agency's mission also demonstrated notable findings (**Exhibit 7**). Among all agencies, responding to calls for service was deemed to be highest priority activity for achieving the agency's core mission (rated an average of 4.8 out of 5.0), followed by conducting follow-up investigations (4.5). Place-based activities that emphasized targeting high-risk areas and directed patrols were also prioritized relatively high among the national sample of agencies. Section 6.5 explores the relationship between prioritized activities and technology implemented; we found that the activities reported by an agency to be more central to its mission corresponded to the types of technology most often implemented.

Exhibit 7. Weighted Descriptive Statistics by Agency Size: Strategies and Activities

	Full Sample (N = 749)		Large Agencies (n = 302)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Policing Strategies				
Professional policing	4.79	0.52	4.68	0.75
Community policing	4.40	0.71	4.36	0.81
Problem-oriented policing	4.30	0.75	4.34	0.87
Intelligence-led policing	3.91	0.92	4.31	0.85
Hot-spot policing	3.74	0.96	3.94	0.94
Offender targeting	3.81	0.97	3.91	0.94
Predictive policing	3.54	1.01	3.83	1.11
Zero-tolerance policing	3.29	1.03	2.86	1.11
Policing Activities				
Respond to calls for service	4.80	0.55	4.68	0.57
Conduct follow-up investigations	4.50	0.60	4.38	0.71
Target identified high-risk areas	4.28	0.79	4.46	0.70
Implement directed patrols in high-risk areas	4.17	0.76	4.48	0.72
Identify and analyze specific problems	4.06	0.90	4.39	0.78
Conduct crime prevention with community members	3.91	0.91	4.07	0.92
Generate crime intelligence from the community	4.09	0.84	4.09	0.94
Focused solutions to underlying cause of crime	3.82	1.00	4.23	0.92
Implement saturation patrols in high-risk areas	3.98	0.87	4.16	0.93
Community-engagement activities	3.88	0.89	3.96	1.03
Involve community members in developing priorities	3.79	0.90	4.00	1.02
Conduct analysis to identify repeat offenders	3.55	1.01	3.85	1.04
Stop and question suspicious individuals	4.05	0.82	3.78	0.94
Implement systems to track officer conduct	3.55	1.01	3.87	1.03
Work with probation officers	3.80	0.93	3.83	1.00
Involve community members in implementing strategies	3.51	0.89	3.85	1.10
Arrest suspects for minor crime	3.79	0.80	3.47	1.01
Conduct surveillance of high-risk individuals	3.39	0.99	3.36	1.18
Achieve high arrest volumes	3.02	0.90	3.04	1.22

M, mean; SD, standard deviation.

Note: Respondents were asked to indicate how important these policing strategies and activities were for supporting the agency’s core mission on a scale of 1 (not important at all) to 5 (highest importance).

Large agencies ranked several activities more highly that typically require more advanced information systems and data analytics. These activities include targeting high-risk areas, identifying and analyzing specific problems, developing focused solutions to underlying crime problems, implementing saturation patrols, and conduct analysis to identify repeat offenders, as well as crime prevention and community-based practices. For example, engaging community members to conduct crime prevention activities and involving community members in developing priorities and implementing strategies were scored higher among large agencies than the national sample.

In addition to the prioritization scores assigned by agencies for each policing activity (**Exhibit 7**), agencies were also asked to identify their top five most important activities (**Exhibit 8**). Survey respondents most often identified traditional policing activities commonly associated with professional policing strategies as among the top five most important activities. For example, 86% of agencies considered responding to calls for service as a top-five priority and 53% reported that conducting follow-up investigations was. Other activities considered most critical included targeting high-risk areas (47% of respondents identified this activity in their top five), engaging the community (35%), stopping and questioning suspicious persons (31%), and arresting persons for minor crimes (25%). Interestingly, generating intelligence from the community was rated lower in large agencies than in the national sample. Sixteen percent of the large agencies ranked this as a top-five activity compared with 31% of all agencies nationally.

Large agencies were more likely to consider activities related to hot-spot and problem-oriented policing as critical compared with all agencies nationally. For example, high percentages of large agencies indicated that implementing directed patrols in high-risk areas (44% for large agencies compared with 29% in the overall sample), identifying and analyzing specific problems (53% versus 25%), and developing focused solutions to underlying crime problems (42% versus 17%) were top-five activities.

Prevalence of Technology

One of the fundamental objectives of this study was to understand how widespread specific types of technology are across U.S. LEAs, including technological devices that are considered more mature, and those that have only more recently emerged within the policing community. This section describes what technologies have been implemented among the national sample of LEAs and the sample of large agencies.

Exhibit 8. Weighted Prioritized Activities

	<i>Entire Sample (N = 749)</i>		<i>Large Agencies (n = 302)</i>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Policing Activities Prioritized				
Respond to calls for service	0.86	0.34	0.67	0.46
Conduct follow-up investigations	0.53	0.49	0.33	0.47
Target identified high-risk areas	0.47	0.49	0.42	0.49
Implement directed patrols in high-risk areas	0.29	0.45	0.44	0.49
Identify and analyze specific problems	0.25	0.43	0.53	0.49
Conduct crime prevention with community members	0.26	0.44	0.34	0.47
Generate crime intelligence from the community	0.31	0.46	0.16	0.36
Focused solutions to underlying cause of crime	0.17	0.37	0.42	0.49
Implement saturation patrols in high-risk areas	0.21	0.40	0.25	0.43
Community-engagement activities	0.35	0.47	0.37	0.48
Involve community members in developing priorities	0.15	0.36	0.29	0.45
Conduct analysis to identify repeat offenders	0.01	0.12	0.03	0.16
Stop and question suspicious individuals	0.31	0.46	0.05	0.22
Implement systems to track officer conduct	0.06	0.23	0.06	0.24
Work with probation officers	0.16	0.37	0.15	0.35
Involve community members in implementing strategies	0.11	0.31	0.19	0.39
Arrest suspects for minor crime	0.25	0.43	0.07	0.25
Conduct surveillance of high-risk individuals	0.07	0.25	0.02	0.14
Achieve high arrest volumes	0.03	0.18	0.02	0.15

M, mean; SD, standard deviation.

Q1. What is the prevalence of various technologies in law enforcement agencies?

There are few estimates of the prevalence of police technology in the United States. To address this issue, our study explored which technologies agencies were using or had used in the preceding 2 years (**Exhibit 9**). Nationally, agencies most commonly reported implementing and using car cameras (70% of all agencies), information sharing platforms (68%), and social media (68%). There was an identifiable gap between the prevalence of these technological devices and other core technology examined through the survey. About one-third of agencies had used cell phone tracking software, investigative case management software, GIS, or BWCs.

Exhibit 9. Weighted Percentages of Agencies that Used Core and Other Technology in the Past 2 Years, by Agency Size (N = 749)

	Percentage	
	Entire Sample	Large Agencies
Core Technology		
Car cameras	70	69
Regional or national information sharing programs/databases	68	92
Social media for public communication	68	81
Software to track cell phones/cell phone data	39	73
Investigation case-management software	39	76
BWC	33	25
GIS	31	81
LPRs	20	70
CCTV with video content analysis	17	40
Mobile biometric devices	16	41
Search and data sharing across silos	14	60
Early intervention systems concerning officer behavior	14	61
Data-mining tools for massive databases	10	47
Software to discover connections	5	54
Predictive analytics software	4	28
Gun/contraband detection system	3	7
Rapid DNA technologies	2	11
Acoustic gunshot detection system	1	15
Other Technology		
Body armor	87	94
Car-based computers	72	78
Reflective gear	55	69
Computer-aided dispatch with RMS	49	69
Regional interoperable radio systems	43	57
Night-vision gear	39	72
Computer-aided dispatch/GPS feature in cars for deployment	32	53
Reverse 9-1-1 emergency notification	28	55
In-car electronic ticketing system	30	45
GPS tracking of suspects	22	57
Computer forensic technology	19	61

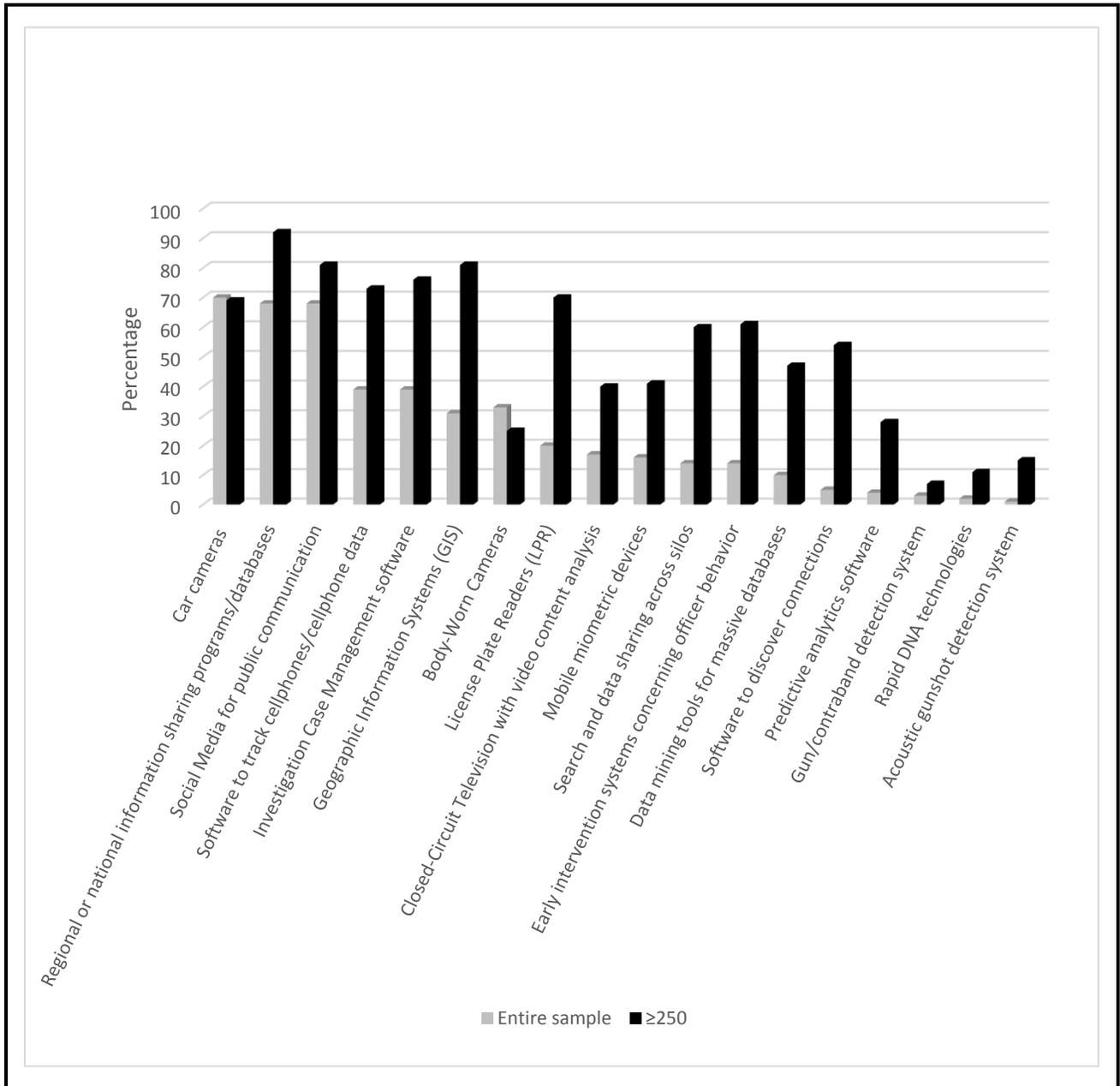
(continued)

Exhibit 9. Weighted Percentages of Agencies that Used Core and Other Technology in the Past 2 Years, by Agency Size (N = 749) (continued)

	Percentage	
	Entire Sample	Large Agencies
Next-generation 9--1-1	12	14
2D/3D crime-scene imaging technology	10	41
Automated traffic enforcement	9	29
Gun cameras/Taser cameras	9	28
Voice-to-text application with mobile devices	8	13
Ballistics/firearm tracing technology	1	24
Through-wall surveillance	1	7
UAVs (drones)	0	3
Directed-energy vehicle-stopping device	0	1
Sum of all technologies (ranges from 1 to 38)	9.81 (5.46)	18.07 (5.97)

A greater proportion of large agencies had adopted most core technologies compared with the entire sample (**Exhibit 10**), and, in some cases, the differences are quite substantial. Specifically, GIS and LPRs show large differences in adoption by agency size. Eighty-one percent of the large agencies reported using GIS compared with 31% in the overall sample, and 70% of the large agencies reported using LPRs compared with 20% for all agencies nationally. Similar differences by agency size were also reported for technology focused on increasing investigative capacity (e.g., software to track cell phones, case-management software) and technology designed to improve analytic capacity (e.g., those focused on searching and sharing data across silos, data mining for large databases, or discovering connections). In a few cases (e.g., BWCs), the large agencies were less likely to have used the technology in the preceding 2 years. Other types of technology, such as car cameras, were used at similar levels in both groups.

Exhibit 10. Comparison of Technology Use by Agency Size



Within-Agency Variation in Prevalence

Technology use is certainly an important measure to assess relative penetration of a particular technology at an agency level; however we also recognize that aggregate technology prevalence can conceal a great deal of variability in how agencies actually deploy technology and the subsequent benefit to activities. How technology has been deployed within an agency is arguably more important than simply having the technology. For

example, an agency might have used car cameras in the past 2 years, but if use was confined to a single car or a specific group of officers, then the technology's impact on the agency's overall goals could be limited.

Our site visits uncovered wide variation in technology implementation and impact among agencies that indicated they had used a specific technology in the past 2 years. Technology "use" ranged from one staff member testing out a new technology or a crime analyst accessing a data-sharing system, to full deployment of a technology to all patrol staff. As described in the highlighted case study, agencies that had purchased LPRs could vary greatly in terms of deployment number and strategy.

We found that prevalence of technology also varied within departments depending on the unit. Agencies may deploy technologies, but their use may be constrained to specific units within the agency. This may be because of strategic decision-making about the perceived impact of that technology or because limited resources mean the agency cannot fully deploy the technology. For example, BWC technology deployment has started to expand to officers in a wide range of positions, due, in part, to the recent public attention on BWC use and expanded resources to implement BWCs. However, early adopters had generally deployed these devices to specialized positions such as traffic details or during major events (e.g., protests, sporting events). LPR is another technology that is often deployed to particular units or vehicles within patrol and, for smaller agencies, may be implemented only with patrol officers who demonstrate a proclivity and interest in using this type of technology to improve their performance.

CASE STUDY: LICENSE PLATE READERS

Agency A: After seeing scant use and spotty results from LPRs, this large city agency invested new funds to greatly expand its LPR capacity from four mobile cameras to 90 fixed cameras in 20 locations. The agency strategically assigned LPRs to different units, areas, and times throughout the city to understand the movements of suspects and criminal elements.

Agency B: After learning about fixed LPR strategies in other agencies, this large city agency purchased two fixed LPR units and mounted them in high-crime areas. The agency uses alerts from the system to strategically direct patrols and decrease crime in hot spots.

Future Technology Acquisition

Q5. What technologies are agencies considering adopting in the next 2 years?

Technology is a rapid and constantly evolving field. As such, we were interested in agencies' plans to acquire and implement technology (**Exhibit 11**). Agency responses were classified into four categories: (1) agency already has the technology, (2) agency does not have the technology but plans to acquire in the next 2 years, (3) agency does not have the

technology and does not plan to acquire in the next 2 years, and (4) respondent does not know of plans to acquire the technology or did not respond.⁵

Survey results suggest that some technology has reached a saturation point in the market, with relatively few agencies that do not use these technologies considering adoption in the next 2 years. For example, agencies that do not have car cameras indicated little interest in deploying such systems in the next 2 years. In contrast, BWC responses were fairly evenly distributed across response options. About half of agencies either did not know or did not have plans to acquire BWC technology. About 15% (slightly higher for the large agencies) did not currently have BWC technology but intended to acquire it in the next 2 years. However, the survey was administered before recent national focus on the use of BWC technology, so we expect the findings related to BWCs might be different if the survey were conducted today.

Other technology with low levels of current adoption also had a low likelihood of future adoption. Technologies such as firearm and contraband detection systems, gunshot detection systems, and through-wall surveillance had low adoption rates and respondents indicated that there were few plans to acquire them in the next 2 years.

According to national survey results, several technological advancements are expected to increase within the next few years. These include predictive analytics software (15% of all agencies have plans to acquire and implement within 2 years; 22% plan to acquire among the large agencies of 250 or more sworn officers), BWCs (15% and 17%, respectively), and in-car electronic ticketing (11% and 38%, respectively). Also notable were the reported intentions to acquire next-generation 9-1-1 (14% and 11%, respectively) or UAV/drones (7% and 9%, respectively) within the next 2 years.

Despite not being on our prioritized technology list, computer-aided dispatch CAD automated records management system (RMS) technology became a frequent topic of discussion during site visits when agencies were asked about planned technology acquisitions, even if they already had a CAD/RMS system in place. Agencies viewed the adoption of a new CAD/RMS system to replace an existing one as the same way they view acquisitions of technologies that they had never previously adopted. While certainly not perceived as being a newsworthy technology in the same way as BWCs or drones, CAD/RMS will always be an important technology for LEAs because they serve as the technological foundation for nearly all of their core operations. Furthermore, the use of CAD/RMS throughout an agency is ubiquitous, making staff extremely familiar with the technology and comfortable discussing it. Many of the agencies visited had recently completed a CAD/RMS upgrade, were actively working on an upgrade, or were in the early phases of identifying departmental needs for their next system. A consistent message was that CAD/RMS system

⁵Results for this portion of the analysis are unweighted.

upgrades were necessary, but expensive, time-consuming, and frequently disruptive to routine activities.

Site visit data also explored the next “big” technology that agencies anticipated getting in the near future. Not surprisingly, one of the most frequently discussed was BWCs. Not all agencies said they planned to fully deploy this technology, but three agencies were engaged in active testing or piloting of BWCs at the time of site visits. Nevertheless, most agencies reported some pressure, internal or external, to explore the use of this technology. Public demand for transparency and accountability from law enforcement led many agencies to prioritize at least exploring the acquisition this relatively new, and costly, technology. Although BWCs are a priority acquisition for many LEAs, there appears to be a high level of awareness around the political, policy, technology, and personnel challenges associated with these devices. Based on our research, agencies are taking a relatively more cautious and deliberate approach to BWC adoption than with other kinds of technology.

This more structured approach to technology acquisition noted in many of the agencies considering BWCs could stem from a variety of factors. Much police technology is focused on improving the ways in which law enforcement officers conduct activities that they have historically done. Fewer acquired technologies result in a fundamental shift in policing activity or strategy; previously conducted activities are simply done more efficiently and/or effectively. The implementation of BWCs may be perceived by law enforcement agencies as having the potential for a more profound effect on their policing activities. This perceived impact is one of the factors that influence a more cautious approach to identification, acquisition, and implementation of this particular technology.

Several agencies expressed the desire to resolve legal or policy concerns before they would be willing to deploy BWC on a large scale. Visited agencies considering BWCs almost uniformly perceived the technology as new and unfamiliar, which warranted a more structured and thorough identification, acquisition, and implementation plan (see the box: Case Study: Body-Worn Cameras). Some of the chief concerns about BWC technology are data storage issues, public privacy questions, and a lack of specific policies for their use. As with many technologies, officer buy-in was also described as another important consideration during this specific technology acquisition. Although visited agencies perceived these considerations as unique to this technology, the adoption and implementation of BWCs have considerable overlap with technologies that may be perceived as being more established, like CCTV, in-car cameras, and LPRs. Many of the questions for agencies about data storage issues, public privacy concerns, and a lack of specific policies for their use may have been addressed in some form in the past, either by their own agency or by an agency of a similar composition.

Although not discussed as commonly during agency site visits, several other emerging technologies were noted as being considered for adoption in the near future. These technologies include mobile biometric devices, UAV/drones, and predictive analytics.

Many agencies indicated during the site visits that they planned to upgrade or expand the use of current technology. For technology such as LPRs or car cameras, several agencies wanted to deploy more devices to the field. A lack of funding was often cited as the reason that full deployment had not been reached. Agencies also discussed the desire to expand capabilities that were technology centric but not associated with specific hardware purchase or acquisition. Increasing analytical capacity and hiring staff to support the use of technology was highlighted by several agencies. Some technology, such as BWCs, were seen as highly resource intensive and necessitated hiring more staff to compensate for the new workload. The increasing prevalence of event-recording technology in general was cited as a driver for the development of more robust data storage and management capabilities.

Technology Prevalence and Policing Strategies

Next, we take a nuanced view of technology adoption and explore whether agency characteristics, prioritized activities, and orientation toward strategic policing philosophies may influence technology adoption.

Q2. How does the prevalence of technology in LEAs vary across different types of agencies (size, region, type, and orientation toward policing strategies)?

We used logistic regression to explore the impact of strategy orientation and other agency characteristics on the likelihood of having used the six technological advancements

CASE STUDY: BODY-WORN CAMERAS

One agency visited was in the process of evaluating BWCs after a high-profile incident. To tackle funding and policy issues, the agency convened a working group of officers to review existing policies for dash cameras and compile procedures developed at other agencies. At the time of the visit, the agency had

- Drafted an initial version of procedures with input from the police union;
- Begun work on an updated draft incorporating legal considerations for open records laws and expectations of privacy;
- Released a request for proposal to vendors, invited a limited number of vendors for presentations, and planned hardware tests; and
- Created a plan for incremental rollout throughout the force, beginning with the patrol divisions.

of focus over the past 2 years (**Exhibit 12**).⁶ The coefficients displayed are odds ratios with standard errors in parentheses. Variance inflation factor and tolerance levels were assessed for all models to ensure there were no issues related to collinearity.

Across the full national sample, we see little relationship between strategy and technology use. One exception is that higher levels of community policing are associated with a greater likelihood that the agency had used social media in the past 2 years. Alternatively, for every one unit increase in zero-tolerance policing, the odds of an agency having used social media decreased by 60%. The odds of LPR use were about 1.67 times higher for every one unit increase in predictive policing.

Sworn-officer staffing levels were more consistently related to technology use. Having more sworn officers was associated with greater use of GIS, data mining, social media, and LPR technology in the last 2 years. Findings previously discussed indicated that large agencies are more likely to prioritize strategies that rely on technology and analytic capacity (i.e., intelligence-led, hot-spot, offender-targeting, and predictive policing), which may help explain the variation in technology prevalence. Similarly, type of agency was statistically significant in two models, revealing that municipal agencies were less likely to use GIS or data mining than the reference group (i.e., county, Sheriff, state, highway patrol, and tribal agencies). We find only one regional effect: Midwestern agencies were considerably more likely to use car cameras than the reference category (West). As discussed in more detail below, this effect may be directly due to differences in political climate and differences in funding received, and indirectly related to prevalence of alcohol-impaired driving (Schuck, 2015; Jewett, Shults, Banerjee, & Bergen, 2015).

We also conducted logistic regressions predicting various types of technology use by agency characteristics for large agencies (**Exhibit 13**). Before discussing individual technological advancements, we make a few observations looking across models. First, unlike the full sample, larger agencies tended to have stronger relationships between strategy and technology adoption. More specifically, the implementation and use of GIS, social media, LPRs, and BWCs were all associated with at least one policing strategy. Second, when considering only the large agencies, there was no relationship between agency size and technology adoption. It appears agency size is important mainly for agencies with fewer than 250 sworn officers. This differs from the results with the national sample that suggested sworn staffing size was a significant factor, and may indicate there is a threshold after which the number of sworn officers is no longer a predictor for technology adoption.

⁶ Initially, our models included controls for agency budgets and local crime rates; however, serious concerns related to collinearity meant that we had to drop these items from the models. There were few instances in which these items were statistically significant.

Third, significant regional impacts were seen only with car cameras. Midwestern and Southern agencies were more likely, and Northeastern agencies less likely, to have adopted car cameras than the reference Western states. The difference may be related to the strength of unions in politically liberal regions, as union representatives are also more likely to resist policies that reduce officer discretion, such as in-car cameras. It is also important to note that federal and state funding initiatives may be more likely to deploy in-car cameras in areas with greater need of such technology, particularly regions with higher proportions of arrests for driving under the influence and alcohol-related crashes, such as the Midwest (Schuck, 2015; Jewett et al., 2015). Although we did not see a similar trend among BWC systems, this difference may develop as that technology matures.

Looking at individual technology models, the use of GIS was positively associated with several strategies, including community policing, hot-spot policing, and offender-targeted policing. For instance, the odds of GIS use were nearly four times higher for every one-unit increase in the importance of community policing. Counterintuitively, an emphasis on predictive policing activities and tactics was negatively associated with GIS. None of the regional variables were statistically significant, but municipal agencies were much more likely to use GIS than their county, state, or tribal counterparts.

Greater emphasis on community-oriented policing and hot-spot policing was associated with greater use of social media. For example, the odds of social media use were about 117% higher for every one-unit increase in the importance of hot-spot policing. Agency size, region, and type did not have a statistically significant relationship with social media. LPR use was positively associated with community policing and hot-spot policing but had a negative relationship with offender targeting. Agency size, region, and agency type were not significantly associated with the use of LPRs. Agencies that placed greater emphasis on hot-spot policing were also more likely to have used BWCs over the past 2 years. Agency size, region, and agency type were not significantly associated with the use of BWCs.

Exhibit 11. Technology Acquisition Plans in the Next 2 years (Unweighted)

Technology	Used Technology in Past 2 Years	Has Not Used Technology in Past 2 Years		
		Plan to Acquire in Next 2 Years	Do Not Plan to Acquire	Plans to Acquire Unknown
Directed-energy vehicle-stopping device	2/3	1/1	96/95	1/1
UAVs (drones)	2/3	7/9	90/87	1/1
Through-wall surveillance	5/9	2/2	92/89	1/0
Acoustic gunshot detection system	6/13	2/4	70/61	22/22
Gun/contraband detection system	8/9	3/2	60/56	29/33
Rapid DNA technologies	10/15	3/5	51/39	36/41
Ballistics/firearm tracing technology	12/23	2/1	86/75	0/1
Voice-to-text application with mobile devices	15/18	5/6	79/75	1/1
Next-generation 9-1-1	18/17	14/11	67/71	1/1
Gun cameras/Taser cameras	19/22	2/1	78/77	1/0
Automated traffic enforcement	21/33	2/2	76/64	1/1
Predictive analytics software	22/36	15/22	33/17	30/25
Software to discover connections	30/57	4/5	36/15	24/23
CCTV with video content analysis	32/40	4/5	40/29	24/26
2D/3D crime-scene imaging technology	32/45	4/5	63/50	1/0
BWCs	33/31	15/17	26/26	26/26
Data-mining tools for massive databases	36/53	5/7	31/17	28/23
Mobile biometric devices	37/53	9/14	32/17	22/16
Search and data sharing across silos	41/63	6/7	29/15	24/15
Early intervention systems concerning officer behavior	43/68	6/7	28/10	23/15
In-car electronic ticketing system	45/52	11/10	44/38	0/0
Reverse 9-1-1 emergency notification	50/58	3/2	47/40	0/0
Computer forensic technology	51/70	3/2	45/27	1/1
GPS tracking of suspects	53/66	1/1	45/33	1/0
LPRs	54/77	6/4	29/13	11/6
CAD/GPS feature in cars for deployment	55/63	9/10	35/27	1/0
Regional interoperable radio systems	59/67	5/5	36/28	0/0
Night-vision gear	63/69	3/1	34/30	0/0
Investigation case-management software	64/76	6/7	17/8	13/9
Software to track cell phones/cell phone data	66/80	4/3	17/8	13/9
Reflective gear	68/73	1/0	30/27	1/0
Integrated CAD/RMS	70/75	4/6	25/19	1/0
GIS	71/88	7/4	13/4	9/4
Car cameras	74/72	4/3	15/19	7/6
Car-based computers	82/86	4/2	14/12	0/0
Social media for public communication	83/91	5/2	5/2	7/5
Regional/national information-sharing programs	84/92	3/3	6/2	7/3
Body armor	90/91	1/0	9/9	0/0

Note: Results are presented in this table as percentage of all agencies (N = 749)/percentage of large agencies (n = 302). Values are unweighted and thus may differ slightly from those in Exhibit 9.

Exhibit 12. Logistic Regression Predicting Technology Use in the Last 2 years, Full Sample (Weighted) (N = 749)†

	GIS	Data Mining	Social Media	LPR	Car Camera	BWC
Strategies						
Professional	0.74 (0.25)	1.23 (0.32)	0.62 (0.34)	1.14 (0.37)	0.84 (0.34)	0.74 (0.27)
Community	1.06 (0.35)	0.98 (0.28)	2.73* (1.17)	1.38 (0.43)	0.69 (0.26)	0.69 (0.26)
POP	1.35 (0.39)	0.51 (0.17)	0.85 (0.35)	0.58 (0.21)	1.27 (0.46)	0.75 (0.28)
Zero tolerance	1.07 (0.23)	0.79 (0.13)	0.40** (0.12)	0.77 (0.15)	1.05 (0.21)	1.00 (0.22)
Hot spot	0.62 (0.17)	1.17 (0.25)	1.01 (0.29)	1.07 (0.38)	0.64 (0.20)	0.88 (0.24)
Offender targeting	0.95 (0.22)	1.41 (0.30)	1.71 (0.51)	0.78 (0.21)	1.22 (0.32)	0.76 (0.18)
Intelligence-led	1.40 (0.35)	1.15 (0.33)	0.50 (0.19)	1.11 (0.31)	1.31 (0.55)	1.34 (0.41)
Predictive	1.02 (0.26)	1.28 (.30)	1.75 (0.57)	1.67* (0.31)	0.87 (0.36)	1.13 (0.33)
Sworn Officers	1.87*** (0.29)	1.98*** (0.15)	1.49** (0.20)	2.16*** (0.26)	1.03 (0.12)	0.87 (0.11)
Region						
Midwest	0.76 (0.43)	0.36 (0.20)	0.74 (0.49)	0.57 (0.39)	7.19** (5.03)	0.60 (0.34)
South	0.72 (0.48)	0.88 (0.55)	0.87 (0.58)	0.71 (0.45)	2.55 (1.40)	1.31 (0.74)
Northeast	0.71 (0.46)	0.26* (0.17)	5.61* (4.07)	0.79 (0.45)	0.46 (0.28)	0.57 (0.36)
Type						
Municipal	0.45* (0.17)	0.21*** (0.08)	0.95 (0.38)	0.94 (0.36)	0.97 (0.42)	0.96 (0.36)
<i>F</i>	2.73***	14.69***	2.95***	6.76***	2.43**	0.94
Pseudo R ²	0.25	0.30	0.22	0.29	0.18	0.09

Note: Data given as odds ratio (standard error).

†An odds ratio (OR) greater than 1 indicates that the odds of the outcome variable occurring are higher for every one unit increase in the levels of the independent variable, holding all other variables constant. An OR less than 1 indicates that the odds of the outcome variable occurring are lower for every one unit increase in the levels of the independent variable, holding all other variables constant.

*P<.05; there is a 95% chance that the relationship is true (i.e., the observed OR would fall within the specified confidence intervals if we were looking at the entire population of LEAs in the United States.

**P<.01, reflecting a 99% confidence level that the relationships would be found if looking at the entire population.

***P<.001, reflecting a 99.9% confidence level that the relationships would be found if looking at the entire population.

We also conducted ordinary least squares regression to predict the total number of technological devices (ranges from 0 to 38) with agency strategy and other agency characteristics (**Exhibit 14**). We use a stepwise model-building process to first consider the impact of strategy alone (model 1) and add other agency characteristics later (model 2). Consistent with the preceding tables, within the full sample there was little relationship between strategy and overall number of technological devices used in the past 2 years. Only zero-tolerance policing was statistically significant; greater emphasis on zero-tolerance strategies was associated with less technology use overall. More specifically, for every one-unit increase on the zero-tolerance policing scale, there is a 0.86 predicted decrease in the total number of technologies used in the past 2 years (model 1b). An assessment of the predicted probabilities at each level of the zero-tolerance policing scale, holding all other variables at their mean, indicates that the predicted number of technologies used in the past 2 years when zero-tolerance policing is equal to one is 11.82, compared with 8.33 when zero-tolerance policing is equal to five. Higher levels of sworn-officer staffing were associated with greater levels of technology adoption. Region and agency type were not significantly associated with technology in the full-sample models.

Models run on the large agency subsample (models 2a and 2b) demonstrate a stronger connection between strategy and overall technology adoption. Greater emphasis on community, hot-spot, and intelligence-led policing among large agencies was associated with more technology. For instance, for every one-unit increase in the importance of community policing, model 2b predicts the use of 2.75 additional technologies. Greater emphasis on professional policing, problem-oriented policing, or zero-tolerance policing, by contrast, was associated with less use of technology.

Overall, with few exceptions, our analyses do not suggest that agency orientation toward policing strategies is directly or consistently related to technology use. As will be demonstrated in the following section, interviews conducted with agency personnel during the site visits bolster the results of our analytical models. Many of the questions in our interview guide (**Appendix B**) were open ended and allowed respondents to describe the process by which technology is identified, acquired, and implemented, and to delineate the primary driving factors that resulted in the adoption of a new technology.

Although there was some indication that technology adoption may correspond with agency plans to engage in or modify specific policing activities, in general, respondents did not say the process of technology acquisition and implementation was driven by their agencies' orientation toward a specific policing model. Likewise, they did not frequently suggest that specific technologies were adopted so that the agency would be more capable of engaging in a particular mode of policing or to reinforce an existing policing philosophy. Rather, key factors that influenced technology adoption were more commonly related to community issues (i.e., local political climate, government policies, demands for transparency), agency leadership, and technical infrastructure and capabilities.

Exhibit 13. Logistic Regression Predicting Technology Use in the Last 2 years (Large Agencies) (n = 302)

	GIS	Data Mining	Social Media	LPR	Car Camera	BWC
Strategies						
Professional	0.77 (0.28)	1.06 (0.22)	0.76 (0.33)	0.90 (0.24)	1.42 (0.29)	0.88 (0.18)
Community	3.79*** (1.50)	1.51 (0.41)	2.13* (0.78)	2.30** (0.73)	0.80 (0.24)	1.50 (0.40)
POP	0.52 (0.21)	0.88 (0.23)	0.59 (0.18)	0.73 (0.19)	0.83 (0.24)	0.87 (0.21)
Zero tolerance	0.62 (0.16)	0.84 (0.14)	0.73 (0.15)	0.83 (0.15)	0.78 (0.19)	0.77 (0.13)
Hot spot	2.40** (0.76)	1.16 (0.27)	2.17** (0.66)	2.52*** (0.63)	0.78 (0.19)	1.77* (0.44)
Offender targeting	2.43* (1.00)	1.09 (0.29)	0.90 (0.33)	0.48* (0.14)	1.39 (0.31)	1.04 (0.21)
Intelligence-led	1.91 (0.85)	1.62 (0.49)	1.44 (0.74)	1.56 (0.52)	0.82 (0.24)	0.83 (0.21)
Predictive	0.38* (0.17)	0.81 (0.17)	0.58 (0.22)	0.80 (0.17)	1.41 (0.29)	1.07 (0.21)
Sworn officers						
	1.81 (0.77)	1.12 (0.25)	0.84 (0.27)	1.60 (0.42)	1.33 (0.37)	1.03 (0.26)
Region						
Midwest	3.31 (3.06)	1.65 (0.87)	1.84 (1.41)	2.69 (1.72)	9.67** (6.80)	0.79 (0.41)
South	2.42 (1.51)	1.23 (0.53)	2.65 (1.38)	2.01 (0.87)	3.16** (1.33)	1.54 (0.64)
Northeast	0.67 (0.55)	1.79 (1.04)	0.72 (0.56)	3.13 (1.84)	0.28* (0.14)	0.20 (0.18)
Type						
Municipal	4.85** (2.55)	1.33 (0.42)	2.15 (1.07)	1.60 (0.59)	0.71 (0.29)	1.35 (0.49)
Model F	3.43***	1.23	2.03*	2.22**	3.62***	1.41
Pseudo R ²	0.49	0.09	0.35	0.25	0.26	0.12

Note: Data given as odds ratio (standard error).

*P < .05; **P < .01; ***P < .001.

The Process of Technology Identification, Acquisition, and Implementation

Q6. How do agencies identify, acquire, and implement technology?

For the purposes of our analysis, we divided these procedures into three phases: identification, acquisition, and implementation. We defined identification as the period of time in which agencies developed an awareness of technology and decided to move forward with its purchase. We defined acquisition as the processes related to the pursuit of funding and purchasing in contract with a specific technology. Finally, implementation was defined

as the manner in which agencies integrated the technology into police practice. Our study examined issues such as staff involvement and decision-making as related to an agency's most recently acquired technology.

We also explored who was involved with the acquisition process, what sources were considered during this phase, and satisfaction with the technology once deployed (**Exhibit 15**). For these analyses, we focused on four core technological devices. Data-mining and information-sharing software were omitted because of the low number of respondents that had prioritized activities directly linked to this technology. Social media was excluded because its acquisition process is substantially different from other technology (e.g., the start-up costs are typically minimal; they do not require integration into secure data systems).

Across most agencies and most technologies, the chief or deputy chief played a central role in the decision to purchase. This number was lower in large agencies, perhaps suggesting that chiefs in large agencies are less directly engaged in the technology acquisition process. This may be attributed to the presence of other staff in large agencies such as chief information officers, IT directors or others with specific responsibilities associated with technology acquisition. In fact, for all of the four technological devices examined within this analysis, large agencies had significantly more IT directors or other technical experts compared with agencies as a whole. The differences were especially high for GIS and car-camera acquisitions. In addition, large agencies were also more likely to have a departmental task force involved in the decisions to purchase new technology.

In general, agencies considered a number of sources when deciding on the technology they would acquire. Consideration of advertisements and vendor content was relatively low for most technology except for BWCs. For BWC acquisition decisions, 36% of agencies cited advertisements and 45% cited vendor Web sites as sources used for decision-making. This may be partially attributed to BWCs being a relatively new technology and information from other sources still being more limited. In addition, vendors may be pushing especially hard to market and sell BWCs, given their recent surge in the marketplace and the attention of this technology within the media and at all levels of government. It should be noted that reliance on BWC vendor content, however, was much lower among the large agency subsample, which most commonly scanned the state of practice or consulted with other agencies when making decisions on BWC purchases.

Exhibit 14. Ordinary Least Squares Regression Predicting Overall Use of Technology in the Past 2 Years (Weighted) (N = 749)†

	Full Sample (N = 749)		Large Agencies (n = 302)	
	Model 1a	Model 1b	Model 2a	Model 2b
Strategies				
Professional	-0.59 (0.72)	-0.35 (0.47)	-1.27** (0.45)	-0.77* (0.41)
Community	0.85 (0.74)	0.35 (0.44)	3.38*** (0.86)	2.75*** (0.56)
Problem-oriented	.48 (0.61)	.74 (0.45)	-1.62* (0.63)	-1.55** (0.55)
Zero tolerance	-1.55** (0.48)	-0.86* (0.34)	-0.96** (0.34)	-0.99** (0.30)
Hot spot	.04 (0.62)	-0.58 (0.50)	1.25* (0.58)	1.26** (0.45)
Offender targeting	-0.31 (0.51)	0.14 (0.40)	0.18 (0.63)	-0.00 (0.56)
Intelligence-led	0.78 (0.77)	0.29 (0.50)	1.42 (0.72)	1.58* (0.59)
Predictive	0.22 (0.75)	0.38 (0.46)	-0.18 (0.51)	-0.26 (0.44)
Sworn officers		2.20*** (0.19)		-0.15 (0.54)
Region				
Midwest		-0.11 (0.95)		1.56 (1.33)
South		-0.71 (1.04)		2.00 (1.07)
Northeast		-0.86 (1.09)		-1.73 (1.33)
Type				
Municipal		-0.57 (0.58)		1.76** (0.65)
Model F	2.32*	19.64***	4.57***	6.39***
R ²	0.08	0.47	0.36	0.43

Note: Standard errors are given in parentheses.

†As with the logistic regression models, attention in the ordinary least squares regression models should be given to statistically significant coefficients. In the fourth column, there are several statistically significant effects. For example, community policing is positively associated with total number of technologies used in the past 2 years. The beta coefficient of 2.75 indicates that for every one-unit increase on the community policing scale, the predicted number of technologies used in the past 2 years increases by 2.75. The statistically significant effect of municipal agencies (1.76) suggests that, on average, municipal agencies have used 1.76 more technologies in the past 2 years than all other types of agencies (e.g., county, highway patrol).

*P < .05; **P < .01; ***P < .001.

Most technology met agency demands and performed as expected. Large agencies were somewhat less likely to be highly enthusiastic (i.e., indicating a technology greatly exceeded expectations) about their technology acquisitions. The cost of technology and implementation also generally met expectations. However, large agencies were typically more likely than agencies as a whole to report that the cost of car cameras and BWCs were greater than anticipated.

Problems during implementation were common but not overwhelming. Large agencies were more likely to report problems with vendor support than the overall sample. This may reflect their need for greater support because of the typically larger and more complicated implementation demands. GIS technology and LPRs had more reported resistance from users than the other types of technology. Resistance from users about the deployment of car cameras and BWCs in large agencies was notably higher than that of the overall sample. Other kinds of internal barriers, including poor management support, lack of agency preparation, and staff resistance, were less frequently reported.

Survey results demonstrate that consulting with individuals from other agencies is a primary way that agencies identify relevant technology, which dovetails with some past research (see Weiss, 1997). Site visit data were able to shed further light on the identification and acquisition process used by agencies. For instance, five agencies, all categorized as high-impact sites, reported that the general technology acquisition and implementation process of other departments had an effect on their own technology acquisition decision-making and implementation processes. Municipal police departments and sheriff's offices reported considering other agencies' acquisitions and implementation processes when making their own technology choices. Sites also described this effect related to specific technology, including BWCs, crime-mapping systems, data mining, and LPRs.

During site visits, agencies were asked to speak about their general acquisition and implementation process for new technology, and their experiences purchasing prioritized technology. In discussions with officers, IT personnel, and department leadership (see **Appendix B**), individuals described the push to pursue a technology as coming from either the top down or the bottom up. Although the leaders within the agency often drove identification and final decision-making, they would also solicit the input of officers or potential users at times. In other agencies, the identification of technology needs came from sources throughout the agency and were then presented to senior leadership, who held the ultimate decision about whether to purchase. Before making final decisions, most agencies would vet the idea through IT departments or staff with technical knowledge to research the product or vendors. Six of the large agencies we spoke with and two of the small agencies, which were mostly high-impact agencies, reported forming internal working groups to explore a technology or to guide pilot studies or the field testing of specific technology.

Acquisition processes varied by technology and department. Some technologies, such as LPRs and BWCs, have lengthy procurements, and agencies would release requests for proposals to solicit bids from vendors. Other technology, such as social media, require relatively little effort to set up. In some jurisdictions, city or county governments are heavily involved in acquisition, either because their approval is required or they directly handle procurement. Agencies also reported having to coordinate with other local agencies that may share use of the technology or be affected by its use.

Implementation procedures also varied widely for different technology and departments. Some agencies used an organized scheme for deploying and integrating new technology, whereas others approached implementation on a case-by-case basis. Implementation of specific technology may not be centralized but handled by the unit that operates that system. For example, at one agency, use of LPRs was generally limited to their auto theft and criminal intelligence units. IT support for implementation also came from a variety of sources within the agencies we spoke to. Three agencies stressed the importance of building ongoing relationships with vendors and ensuring vendor support during the initial implementation phase. However, four agencies described the importance of having knowledgeable technical staff in house to support implementation. While agencies mentioned trainings often throughout discussions, there were not formalized training procedures for every agency or technology.

The reality of implementation also involved disuse of technology that fell into disrepair or was underused by officers. Although discussions on site visits may have been biased toward

Case Study: Careful Acquisition

Command staff at a site visit agency outlined their careful and deliberate procedure for testing, getting, and implementing new technology in four steps:

- 1) **Due diligence:** Test and evaluate all technology in the day-to-day policing environment of your agency.
- 2) **Agency fit:** Even if a technology tests well, determine agency fit for cost, complexity, integration with existing systems, and need.
- 3) **Future challenges:** Determine the long-term utility of certain technologies and whether they have any recurring costs.
- 4) **Communication:** Collect input from stakeholders, including users, city decision-makers, and community members.

Despite their careful procedure, this agency reported mixed impact of technology on their key policing activities. The agency was working to incorporate more technologies into their daily functions but had a general focus on community needs and interactions rather than a focus on incorporating technology to achieve departmental goals. This case points to the diversity of factors that influence the impact of technology in a department.

technology being actively used, several agencies reported an initial period of disuse or eventual abandonment of certain technology. The benefits or fallbacks of these various implementation approaches and their relationship with successful use of technology will be discussed in more detail later in this report.

Impact of Technology

Perceived Importance of Technology for Success of Prioritized Activities

Q3. What is the perceived importance of various technologies for the success of prioritized policing activities?

Analyzing perceived importance of technology on prioritized activity required analysis of several survey questions. First, prioritized activities were assessed with a question that asked agency respondents to select the top five activities that contribute to the agency meeting its core mission. Second, we asked agencies to report how important a technology was to achieving an activity. Third, we selected agencies that reported an activity in their top five and calculated the average importance score for the technology-activity combination.

Our analysis examined (1) the prevalence of technology for agencies that prioritize specific activities, (2) the success of a prioritized activity in relation to different technology, and (3) the importance of technology on different prioritized activities. Results are presented in **Exhibit 15** and **Exhibit 16**. As explained previously, not all technological devices were associated with every activity. The percentage values can be interpreted as “Of the agencies that prioritized *x* activity, *y*% had that technology.” For example, of the large agencies that prioritized identifying and analyzing specific crime and disorder problems, 80% had GIS and only 23% had BWCs.

GIS was the technology associated with the greatest number of policing activities. Beginning with the overall sample, GIS was seen as being more important to the success of identifying and analyzing crime and disorder problems (2.63) than achieving high arrest volume (2.14).⁷ Data mining was most closely associated with carrying out solutions to address underlying crime problems and was less associated with carrying out directed patrols at problem places. Social media and data mining scored very similarly in their impact on generating crime intelligence from the community. Of the agencies that identified tracking officer conduct as a key activity, the use of BWCs was seen as more important than the use of car-mounted cameras.

⁷Respondents were asked to rank the importance of the technology on scale of 1 to 3 (1: not at all important, 2: somewhat important, and 3: very important) for the success of achieving specific policing activities.

Considering individual strategies, GIS was seen as more important than data mining for identifying and analyzing crime and disorder problems and more important than both data mining and LPRs for implementing directed patrols in high-risk areas. Data mining was also seen as less important than GIS for implementing solutions to address the underlying causes of crime.

Patterns among large agencies were similar to the overall sample (**Exhibit 17**). GIS was seen as the most important technology for identifying and analyzing crime and disorder problems, implementing directed patrols in high-risk areas, and implementing saturation patrols in high-risk areas. Diverging from the overall sample, large agencies ranked data mining as more important than GIS for implementing solutions to the underlying causes of crime. This may reflect that fact that the large agencies were more likely to have adopted data-mining technology. Large agencies placed a slightly greater emphasis on using social media to gather crime intelligence from the community. Large agencies also ranked LPRs as less important to implementing directed patrols than did the overall sample.

Exhibit 15. Weighted Percentages for Latest Acquisition of Core Technologies

Variable	GIS	Car Camera	LPR	BWC
Agencies, no.	86/33	97/29	87/41	81/27
Time since purchase				
Within the past year	42/38	16/27	40/19	68/52
More than 1 year but less than 2 years ago	41/8	12/35	29/55	27/31
More than 2 years but less than 5 years ago	16/42	31/32	31/26	4/17
More than 5 years ago	1/12	41/6	0/0	1/0
Type of purchase				
New	66/51	65/47	86/100	97/87
Upgrade	34/49	35/50	14/0	3/13
Missing	0/0	0/3	0/0	0/0
Staff involved in decision to purchase				
IT director or other technical expert	40/77	13/78	27/40	19/36
Chief or deputy chief	71/61	79/48	73/59	74/51
Command staff	28/51	34/64	48/68	23/59
Departmental task force	9/17	2/26	6/22	10/57
Other	25/19	5/16	26/8	17/7
How decisions about purchases were made				
Scan of practice	38/47	30/43	36/41	16/51
Consulted with someone from another department	50/40	57/52	44/40	36/48
Vendor exhibit at conference	46/33	21/31	5/6	37/40
Advertisement	0/2	2/2	17/3	36/6
Vendor Web site	27/27	13/18	19/4	45/20
Government of professional association publication/Web site	2/24	5/15	2/9	14/27
Approached by vendor	5/13	11/10	18/4	3/23
Product was specified by a grant/external funding	8/15	12/8	18/8	11/4
Other	16/30	13/19	23/28	8/10

(continued)

Exhibit 15. Weighted Percentages for Latest Acquisition of Core Technologies (continued)

Variable	GIS	Car Camera	LPR	BWC
Technology met expectations				
Greatly exceeded expectations	23/13	24/6	3/12	38/18
Somewhat exceeded expectations	25/35	21/21	47/44	30/17
Performed as expected	37/42	50/53	33/37	32/53
Somewhat below expectations	13/6	5/17	14/6	0/9
Greatly below expectations	0/0	0/0	2/0	0/3
Missing	2/4	3/3	1/0	0/0
Cost of purchase and expectations				
Cost greatly exceeded expectations	2/0	14/10	0/1	6/5
Cost somewhat exceeded expectations	12/14	4/14	14/13	14/16
Cost was about as expected	61/69	82/73	78/86	73/79
Cost was somewhat below expectations	5/15	0/0	5/0	2/0
Cost was greatly below expectations	18/2	0/0	2/0	5/0
Missing	2/0	0/3	1/0	0/0
Cost of implementation and expectations				
Cost greatly exceeded expectations	2/3	0/10	0/2	6/10
Cost somewhat exceeded expectations	8/16	19/36	13/7	16/29
Cost was about as expected	69/79	79/51	86/89	69/61
Cost was somewhat below expectations	0/0	0/0	1/2	9/0
Cost was greatly below expectations	18/2	0/0	0/0	0/0
Missing	3/0	2/3	0/0	1/0
Problems during implementation				
Poor vendor support	2/8	9/15	2/13	1/18
Inadequate training of technical staff	23/9	13/32	19/2	12/10
Inadequate training	23/20	23/28	14/8	8/11
Resistance from users	23/36	8/46	20/8	9/42
Poor management support	2/9	1/5	0/3	0/3
Lack of preparation within the agency	10/15	3/5	13/8	8/15
Staff resistance	3/8	2/9	0/3	0/6

Note: Data are given as % entire sample/% large agencies unless otherwise indicated.

Q4. Which technologies have been seen as most important in achieving agency goals?

Agency respondents were also asked to indicate the technology they thought was most important in achieving their overarching agency goals (**Exhibit 18**). This question was open ended. Responses were manually coded and similar responses were collapsed to form key technology groupings. Among all agencies, mobile-centric technologies were seen as the most important. This included car-based computers, RMS/CAD systems, and other mobility solutions (e.g., cell phones and tablets). This finding may reflect the highly mobile nature of

police patrol practices. BWCs, despite being a relatively new technology, were rated as most important by 7% of the sample.

Exhibit 16. Top Five Activities by Technology and Perceived Importance*: Entire Sample (N = 749)

Activity	No.	Sample	Car Camera	Social Media	GIS	BWC	LPR	Data Mining
Identifying and analyzing specific crime and disorder problems	295	39.38	58	90	44	31	27	16
Importance of technology for achieving activity					2.63 (0.49)			2.39 (0.50)
Implementing directed patrols in high-risk areas	298	39.79	66	77	52	38	29	11
Importance of technology for achieving activity					2.46 (0.66)		2.28 (0.76)	2.15 (0.75)
Targeting identified high-risk areas	332	44.32	75	66	32	39	22	08
Importance of technology for achieving activity					2.56 (0.53)			
Conducting follow-up investigations	338	45.13	70	66	24	28	15	8
Importance of technology for achieving activity								2.51 (0.66)
Implementing solutions to address underlying causes of crime	229	30.57	76	67	39	34	22	21
Importance of technology for achieving activity					2.56 (0.51)			2.35 (0.50)
Conducting officer–community engagement activities	212	28.30	76	78	31	33	23	7
Importance of technology for achieving activity				2.29 (0.63)				
Conducting crime prevention activities with community	307	40.99	73	70	44	21	21	16
Importance of technology for achieving activity				2.48 (0.52)				
Involving community members in developing priorities	142	18.96	77	76	41	40	24	14
Importance of technology for achieving activity					2.45 (0.57)			
Implementing saturated patrols in high-risk areas	188	25.10	66	76	37	28	13	5
Importance of technology for achieving activity					2.70 (0.46)		2.32 (0.66)	

(continued)

Exhibit 16. Weighted Top Five Activities by Technology and Perceived Importance: Entire Sample (n = 749) (continued)

Activity	No.	Sample	Car Camera	Social Media	GIS	BWC	LPR	Data Mining
Generating crime intelligence from the community	184	24.57	70	66	28	29	20	10
Importance of technology for achieving activity				2.31 (0.49)				2.36 (0.53)
Involving community members in implementing strategies	106	10.15	83	86	34	61	18	26
Importance of technology for achieving activity					2.71 (0.45)			
Arresting suspects for minor crime and disorder offenses	70	9.34	70	54	12	33	08	06
Importance of technology for achieving activity							1.59 (0.79)	
Implementing systems to track officer conduct	60	8.01	44	48	46	27	27	17
Importance of technology for achieving activity			2.56 (0.51)			2.71 (0.45)		
Achieving high arrest volumes	26	3.47	62	53	19	7	18	8
Importance of technology for achieving activity					2.14 (0.59)		1.99 (0.56)	
Number and percentage of agencies reporting each technology in the past 2 years			524 (70)	509 (68)	232 (31)	247 (33)	150 (20)	75 (10)

Note: Data in rows with headings in bold type are percentages unless otherwise indicated. Shaded data are given as mean (SD).

*Because of the time and space constraints of the survey, technological advancements were associated with only a subset of strategies that were believed to be most relevant.

There were some differences between large agencies and the overall sample (**Exhibit 19**). Although RMS/CAD was ranked as most important, analytical software was ranked higher than car computers and mobile solutions. Car computers were ranked several positions lower than the overall sample. Unlike the overall sample, BWCs were ranked last among the top 10 technological devices.

Exhibit 17. Top Five Activities by Technology and Perceived Importance*: Large Agencies (Weighted) (n = 302)

Activity	No.	Sample	Car Camera	Social Media	GIS	BWC	LPR	Data Mining
Identifying and analyzing specific crime and disorder problems	159	52.65	73	77	80	23	66	49
Importance of technology for achieving activity					2.90 (0.32)			2.68 (0.51)
Implementing directed patrols in high-risk areas	132	43.71	80	72	70	19	64	38
Importance of technology for achieving activity					2.74 (0.44)		1.96 (0.73)	2.56 (0.58)
Targeting identified high-risk areas	125	41.39	65	89	91	34	80	48
Importance of technology for achieving activity					2.78 (0.43)			
Conducting follow-up investigations	100	33.11	66	80	88	31	75	70
Importance of technology for achieving activity								2.43 (0.66)
Implementing solutions to address underlying causes of crime	125	41.39	69	70	73	21	58	45
Importance of technology for achieving activity					2.78 (0.47)			2.84 (0.42)
Conducting officer–community engagement activities	111	36.75	71	69	71	26	64	43
Importance of technology for achieving activity				2.58 (0.56)				
Conducting crime prevention activities with community	102	33.77	62	88	88	31	72	55
Importance of technology for achieving activity				2.60 (0.56)				
Involving community members in developing priorities	87	28.81	76	65	66	15	45	37
Importance of technology for achieving activity					2.62 (0.57)			
Implementing saturated patrols in high-risk areas	77	25.50	65	82	84	23	79	35
Importance of technology for achieving activity					2.70 (0.47)		2.12 (0.82)	
Generating crime intelligence from the community	46	15.23	71	93	80	22	82	55
Importance of technology for achieving activity				2.57 (0.59)				2.57 (0.59)
Involving community members in implementing strategies	56	18.54	65	94	96	28	75	53
Importance of technology for achieving activity					2.71 (0.45)			

(continued)

Exhibit 17. Top Five Activities by Technology and Perceived Importance*: Large Agencies (Weighted) (n = 302) (continued)

Activity	No.	Sample	Car Camera	Social Media	GIS	BWC	LPR	Data Mining
Arresting suspects for minor crime and disorder offenses	22	7.28	80	78	61	35	64	53
Importance of technology for achieving activity							1.96 (0.64)	
Implement systems to track officer conduct	19	6.29	69	81	85	22	81	71
Importance of technology for achieving activity			2.37 (0.59)			2.78 (0.44)		
Achieving high arrest volumes	8	2.65	67	79	44	24	59	56
Importance of technology for achieving activity					2.09 (1.21)		2.12 (0.70)	
Number and percentage of agencies reporting each technology in the past 2 years			208 (69)	244 (81)	246 (81)	76 (25)	210 (70)	141 (47)

Note: Data in rows with headings in bold type are percentages unless otherwise indicated. Shaded data are given as mean (SD).

*Because of time and space constraints of the survey, technological advancements were associated with only a subset of strategies that were believed to be most relevant.

Exhibit 18. Technological Innovations Identified as Most Important to Achieving Agency Goals Among Entire Sample* (Weighted) (N = 749)

Technological innovation	Agencies that Identified Technological Innovation as Most Important, No. (%)
Car computers	165 (22)
RMS/CAD	112 (15)
Mobile solutions	90 (12)
Information-sharing software	60 (8)
BWCs	52 (7)
Car cameras	45 (6)
LPRs	45 (6)
Analytics	37 (5)
Social media	30 (4)

*Some respondents did not provide an answer to this question, whereas others indicated that one or multiple technologies had the greatest impact.

A majority of the sites that we visited did not have performance metrics in place to track the impact of their technology or systems. The lack of metrics across sites meant that agencies measured success largely via informal assessments from individual technology users. Of the core technological devices focused on during site visits, agencies with successful

implementation of LPRs spoke most expansively about their positive impact. Because overall agency goals and use of particular technology differed between sites, the technology that agencies described as most important or impactful are diverse and cannot be generalized. However, agencies described common areas of impact. Sites most often spoke about the ways in which use of a technology affected efficiency, community relations, or specific policing activities related to use of that technology. Some examples of technology's impact on specific policing activities include car-camera use during traffic stops, as it reportedly helps with reducing complaints, reduces the time that officers spend in court, influences suspect behavior, and helps manage community relationships. Also discussed was the ability of GIS to enhance crime analysis and improve the efficient deployment of police resources, information-sharing programs and their utility during investigations, and the use of social media for facilitating suspect identification.

Exhibit 19. Technological Innovations Identified as Most Important to Achieving Agency Goals Among Large Agencies* (Weighted) (n = 302)

Technological innovation	Agencies That Identified Technological Innovation as Most Important, No. (%)
RMS/CAD	84 (28)
Analytics	44 (14)
Mobile solutions	36 (12)
GIS	31 (10)
Car computers	29 (10)
CCTV	26 (9)
LPRS	24 (8)
Car cameras	17 (6)
Information-sharing software	15 (5)
BWCs	11 (4)

*Some respondents did not provide an answer to this question, whereas others indicated that one or multiple technologies had the greatest impact.

Influences on the Success or Failure of Technology

Site visit data collection centered on an agency's current use of core technology and the barriers encountered when identifying, getting, and implementing new technology. Based on the analysis from these data, six themes have emerged as having a facilitative or prohibitive influence on implementation: degree and timing of planning, budget, capacity of personnel, communication and buy-in, attitude and investment of leadership, and local government and community climate.

Degree and Timing of Planning

During site visits, agencies referenced planning both before and after acquisition as an important facilitator of smooth implementation. Although agencies may not have had cohesive, long-term acquisition plans, many agencies reported taking time for in-depth planning before acquisition and during implementation. These agencies conducted product research, vetted vendors, and explored the impact that technology would have in the field before acquisition. Agencies examined many factors, including cost, integration, complexity, shelf life, efficiency, effectiveness, and other technology-specific concerns. At least nine of the agencies we visited, most of which were high-impact agencies, formed working groups to explore particular technology and conducted pilot studies or testing in the field. Several high-impact agencies emphasized the importance of researching or vetting different vendors. The mixed-impact sites we visited often qualified their acquisition and implementation processes as “opportunistic” or “reactive.” These sites, if they formulated a strategy, would often begin planning after acquisition. One mixed-impact agency described its technology implementation strategy as a “solution looking for a problem.” Another department reported identifying needs for training or modification of policies after the initial implementation phase, which improved use of their technology over time but not during early adoption. In contrast, one agency with a similar opportunistic acquisition strategy, but successful technology use, planned implementation of new technology very carefully. This agency described its motto as “don’t turn it on until it is right,” and took time before implementation to gather resources and train officers.

Unexpected and Long-Term Costs

The initial, hidden, and ongoing cost of technology unsurprisingly emerged as a theme on site visits. Despite taking advantage of various funding sources, agencies reported that high initial costs were prohibitive, but these costs also prevented agencies from purchasing as many units as they wanted. Three large agencies discussed budgetary issues as a primary concern surrounding BWCs. Two of those agencies began implementation with a small number of units, but the cost of purchasing more units was an obstacle to more widespread use and impact. Hidden costs during or after the initial purchase also affected agencies’ ability to use the technology successfully.

Two agencies noted that the high installation costs of LPRs were not included in the original quote and that they went through a lengthy procurement process. Other ongoing costs also served as a barrier to full or continued implementation. Costs associated with data storage and handling for particular technology (e.g., car cameras, BWCs, LPRs, GIS) came up as a common concern on many site visits. Agencies noted that some technology broke down more frequently or easily, required periodic licensing fees, or had short shelf lives—especially newly emerging technologies such as BWCs. These issues led to high maintenance costs that consumed the internal IT budgets of certain agencies or the

abandonment of technology that could no longer be supported. At least two of the agencies that had purchased LPRs had discontinued or were considering discontinuing their use, because of high ongoing cost.

While high-impact agencies may be more adept at securing funds to support greater technology use, several sites we visited also described successful strategies to address budgetary obstacles. A number of agencies recommended investing more money in the initial purchase to create a robust system with lower maintenance costs and longer shelf life. Five agencies attributed the success of their GIS systems to their department's willingness to invest in high-quality software. Another successful agency used a beneficial preventive maintenance strategy, performing routine work on their car cameras to avoid high repair costs.

Capacity of Personnel

Technical staff within LEAs can play an important role in each step of the technology acquisition and implementation process. Four sites that we visited explicitly attributed their overall success or difficulties to the support of IT staff or lack thereof in their agencies. However, not all LEAs have an internal IT department. Some of our site agencies had to work with city or county IT departments that, in at least one case, had limited capacity to support their officers or systems. Having in-house technical capacity at different levels

Case Study: Technology Disuse

Many factors can lead agencies to abandon purchased technology. In one case of technology disuse, a department pursued a less costly model of in-car camera against the express recommendation of knowledgeable staff. Facing a slew of implementation and vendor issues, including poor installation, frequent malfunction, and slow upload, the department was left with a system that had limited functionality and use. Although officers had responded positively to the equipment, the cameras broke down so often that they fell into disuse.

facilitated implementation across sites but was also discussed as a particularly important factor for certain technology. Eight agencies with crime-mapping systems described the abilities of their analytic staff as a key reason for their success. Two sites, specifically with the effective deployment of police resources, reporting limited success with data mining and spoke of their department's lack of analytic capacity. Many agencies running large systems associated with complex data, like those required for car cameras, BWCs, crime mapping and data mining, had dedicated staff working full time in support of that technology or, if they lacked these resources, described their need for more dedicated IT support.

Attitudes and Investment of Leadership

Another common theme across site visits was the influence that police chiefs and other senior staff have throughout technology acquisition and implementation. In most of the jurisdictions visited, the police chief acted as the gatekeeper for new technology. Leadership's perspective on new purchases and the importance they placed on technology's role shaped acquisition and implementation. Disconnect between senior staff and users or IT personnel led to failed implementation at several sites.

Conversely, upfront investment from leadership can open doors to vendors and external funding streams. One small, rural sheriff's office had a well-informed core command staff who saw technology as a way to multiply their force and overcome staffing shortages. Their sheriff leveraged professional networks to stay aware of current technology trends and identify opportunities for grant funding. At this agency, and other sites with invested leadership, care and emphasis was placed on the acquisition process, leading to the purchase of robust systems that eased implementation. Technologically savvy leaders in departments also guided staffing decisions that led to successful adoption, implementation, and maintenance of technology. Three large agencies, all classified as having high-impact technology use, noted that they considered a technology's impact on labor and staffing when deciding to acquire a new technology.

In some instances, the chief recognized that they were not the most technologically savvy person and designated someone to act as the key technology strategist for the department. In these instances, the designee would often identify and explore the possibility of using a technology before bringing it to the attention of the chief/executive staff. Although this method was somewhat less direct, agencies that operated in this manner did not indicate that it was problematic.

Communication and Buy-In

A common message from agencies was that communication to officers and other users about the intended use and benefits of an acquired technology facilitates successful uptake. Eight agencies, seven of which were classified as high impact, described clear communication to officers or officer buy-in as a crucial element of successful implementation. Agencies that experienced difficulties during implementation cited officer resistance as a barrier and spoke of generational differences that came into play as older officers were less willing to accept new technology into their routine duties. For example, several agencies reported that officers initially attached a stigma to the installation of car cameras.

During implementation, these sites had to address officers' belief that camera installation signified suspicion or punishment. Poor communication not only amplified resistance in these types of circumstances but also led to confusion about the purpose of a technology.

Several agencies found that their crime-mapping systems were underused by officers who did not understand its direct benefits. A few agencies stressed officer accountability as a tool to set expectations for a technology and prevent disuse. In one agency, this meant having the chief mandate that all officers use a technology. For their system of BWCs, another site increased accountability by ensuring that each officer was responsible for the use and care of a specific camera unit. Other agencies used additional strategies, such as incremental roll-out of technologies, to bring officers on board.

Local Government and Community Climate

Agencies navigate many constraints and pressures from their local governments and communities when acquiring and deploying new equipment and software. Site visit data illustrated that public pressure can drive the initial consideration of new technology, particularly for car cameras or BWCs, which are tied to contemporary discussions around community-based policing. Discussions with agencies revealed that these types of purchases could make the technology vulnerable to underuse because the acquisition was not associated with a specific goal or strategy within the department. In some circumstances, the public pressure led to financial support for the initial purchase, but ongoing funds were not available to maintain its use. Local pressures and policies also presented a challenge for sites during implementation. For example, three sites using social media for investigations had to develop an understanding of the legal implications of its use, working with city attorneys to review policies or ensuring that warrants were in place in certain circumstances. Three sites deploying or considering BWCs spoke of contending with the issue of citizen privacy, with one site receiving pushback on recording within homes. Sites with successful implementation of technology conducted research on these issues during their identification and acquisition process or created policies addressing concerns during their implementation. Agencies also leveraged use of new technology like social media, BWCs, and car cameras to improve goodwill and community relations.

7. CONCLUSIONS AND RECOMMENDATIONS

As summarized in the final report of the President's Task Force on 21st Century Policing (2015), technology can produce a variety of positive outcomes relative to improvements in policing practices and the establishment of trust and legitimacy with communities. Yet, the task force report also acknowledges that technology changes very rapidly. At no time is that more true than in today's society.

Law enforcement has witnessed significant advancements recently in many different types of technology. Although new technology has added new capabilities to police agencies, it was not clear how particular types of technology have affected, or would affect, the strategies and activities of law enforcement. This study sought to determine how technology has impacted law enforcement, including to what extent agency culture and strategy influence technology selection and implementation decisions, and how technology has driven strategic or organizational changes within police agencies. The following summarizes some of the key findings from the study (**Appendix A**) and their implications.

How prevalent is technology in modern policing? The nation's LEAs are heavily involved with technology daily. Overall, 96% of agencies reported having implemented one or more of the core technological devices specified and the prevalence of technology acquisition and use increased substantially among large agencies. This finding was not surprising given that large agencies tend to have more resources, both financially and in terms of staffing. Similar to technology adoption in other areas, the base of adopters for a specific type of technology rapidly expands as users become more familiar with the technology, as the cost of acquisition decreases, and as the benefits of the particular technology are more clearly defined. As such, we can expand technology adoption, including the breadth of technologies implemented within small and mid-sized agencies, to continue to increase in coming years.

Nationally, agencies most commonly reported implementing and using car cameras (70% of all agencies), information-sharing platforms (68%), and social media (68%). Other core technology was less frequently used and agency adoption dropped quickly. At the time of the survey, about one-third of agencies had used BWCs, GIS, cell phone tracking software, or investigative case-management software. However, there were some stark differences when comparing the full sample with the large-agency subsample.

Notable among large agencies was the prevalence of analytical and real-time visual-based technology. The prevalence of these technologies may be a function of necessity related to the volume of data collected by larger agencies. Eighty-one percent of the large agencies reported using GIS (compared with 31% in the overall sample) and 70% of the large agencies reported using LPRs (compared with 20% for all agencies). Similar differences by agency size were also reported for technology focused on increasing investigative capacity.

Specifically, software to track cell phones was used in 73% of large agencies, compared with 39% of the whole sample; and case-management software was used in 76% of large agencies, compared with the full sample at 39%. Large agencies were also more likely to incorporate analytical technology, such as that used for searching and sharing data across silos, data mining, or discovering connections such as link analysis software. More than one-quarter of large agencies reported using predictive analytics software (28%). Among forensic technologies, 41% of large agencies reported using mobile biometric devices and 11% reported using rapid DNA technologies.

What types of technology are expected to emerge in the next several years?

There are clear signs that technology will continue to grow not only in the large agencies but also across most LEAs. However, what is less clear is whether plans for acquiring new technology within the next 2 years is attributed to evidence-based results or the extensive attention paid to promising technology. According to national survey results, use of several technologies was expected to increase sharply within the next several years. These include predictive analytics software (15% of all agencies have plans to acquire and implement within 2 years; 22% of the large agencies plan to acquire this technology), BWCs⁸ (15% and 17%, respectively), and in-car electronic ticketing (11% and 38%, respectively). Also notable were the reported intentions to acquire next-generation 9-1-1 (14% and 11%, respectively) or UAV/drones (7% and 9%, respectively) within the next 2 years.

What is the relationship between policing strategies and the number of technological advancements an agency implements?

Consistent with other results, within the full sample, there was little relationship between strategy and overall number of technological devices used by an agency. Only zero-tolerance policing was statistically significant; greater emphasis on zero-tolerance strategies was associated with less technology use overall.

However, for the large-agency subsample, there were stronger connections between strategy and technology adoption. Among these agencies, those that aligned most closely with community policing, intelligence-led policing, or hot-spot policing philosophies implemented and used more technology. In contrast, agencies that emphasized the principals and activities of professional policing, problem-oriented policing, or zero-tolerance policing were likely to implement and use less technology. These results, as they pertain to professional and zero-tolerance policing, are not surprising. Both of these strategies are rooted in tactics that do not emphasize technology. This is because both strategies were either implemented at or a direct descendent of a time when the scope of police technology

⁸Note that our data collection and subsequent conclusions were conducted before the Ferguson incident, which may impact agencies' plans to implement this technology in the near future.

was an automobile and radio. In contrast to newer strategies like predictive policing, these strategies do not require extensive technology. Predictive policing and hot-spot policing strategies would be very difficult, if not impossible, to conceptualize without leveraging modern technology like computers, GIS, and robust CAD/RMS systems able to record relevant data. However, as the results also show, modern strategies do not require these technologies to fully operationalize, though it is possible this result is an artifact of differential strategy definitions. For example, just because an agency thinks it is doing community policing does not necessarily make that so. This research suggests that obtaining better measures of agency orientation toward policing strategy should be a key goal of future research.

What types of technology are most closely associated with specific types of policing strategies and activities?

In general, across agencies, there were not strong direct links between policing strategy and technology use. In other words, at a national level, agencies are not making decisions to acquire technology based on their dominant policing philosophies or the activities they prioritize. The exception was the use of social media, which was significantly associated with community policing and hot-spot policing.

For large agencies, however, we found much stronger connections between the policing philosophies agencies adopt and carry out for preventing and responding to crime and the technology choices they make. In some instances, the emphasis on these types of activities and policing strategies by large agencies ties directly to their technology choices associated with analytically based technology. For example, the use of GIS was positively associated with several strategies, including community policing, hot-spot policing, and offender targeting. LPR use was positively associated with community policing and hot-spot policing but had a negative relationship with offender targeting. In addition, agencies that placed greater emphasis on hot-spot policing were more likely to have used BWCs over the past 2 years. Finally, as found for all agencies nationally, greater emphasis on community-oriented policing and hot-spot policing was associated with more use of social media.

Policing strategies are guiding philosophies which are supported by more readily identifiable policing activities. An agency's prioritization of policing activities may be more telling than their self-identification with a policing strategy. As previously noted, automated records management systems (RMS) and computer-aided dispatch (CAD) were the technology credited with having the greatest impact on police agencies nationwide. This technology is central for carrying out the most fundamental professional policing activities: responding to calls for service in a rapid fashion and information management. Clearly these activities will always be of paramount importance to an agency. As the activities that agencies prioritize expand beyond professional policing, we can expect the types of technologies that agencies view as central to their mission to also expand.

How do agencies make decisions about technology acquisition and implementation?

As a whole, our findings demonstrate that law enforcement technology adoption is more ad hoc than anticipated. This tendency for agencies to purchase and implement technology without a clear, strategic plan for why and how the technology will be used for specific purposes can result in limited technology integration within the agency and in failure to recognize the primary or secondary benefits of the technology. These factors, in turn, can lead to disillusionment and also to a lack of continuation of funding for maintaining or updating particular types of technology.

Combining our research with other relevant literature, we find that the adoption and impact of technology is conditional on numerous factors. We combine these factors into three domains (community, agency, and technology) and describe how these factors interact to influence the adoption and, ultimately, the impact of technology on key agency outcomes (***Exhibit 20***).

First, the community factors can influence both what technology is adopted and how successful that technology is in producing key agency outcomes. Community factors incorporate a wide range of influences from local laws to national sentiment. Community influences might be episodic and topical (e.g., the recent push for BWC use after a high-profile police misconduct incident) or it may be structural (e.g., the ability of the community to support expensive technology).

Second, structural and cultural factors of agencies will influence technology adoption and success. Culture and organizational climate will influence how technology is approached and integrated into the department. Organizational climate will influence people's willingness to integrate new information into existing processes. Openness to innovation and, perhaps more importantly, openness to failure will influence how agencies approach new technologies and integrate them into key work processes.

Exhibit 20. Interaction of Factors That Influence the Adoption and Impact of Technology on Agency Outcomes



Third, the factors intrinsic to the technology will influence success and adoption. Technology has a perceived potential impact and organizational reach that vary. Some technology might be useful but would be used very infrequently (e.g., acoustic gunshot-detection systems in relatively low-crime jurisdictions). Technology may be more successful when it more closely parallels existing technology in the market (e.g., predictive analytics software can be seen as a natural extension of GIS use).

These domains are not exclusive. Community and agency characteristics converge to set funding priorities and identify primary crime concerns. Community and technology may overlap to identify certain expectations about the use or adoption of technology. This can be seen in the recent push to make agencies more open and transparent by expecting the use of BWCs or the expectation that police data should be made available to the public. The opposite may also be true. Technology may have a legitimate public safety goal, but the social price of the technology, commonly a reduction in privacy, may be too high to bear. Recent local and national backlash against the use of tracking technology and advanced surveillance systems are prime examples of legitimate public safety objectives tempered by their high cost to expectations of privacy.

Finally, agency characteristics and technology will overlap in the form of strategy and history. Agency strategy may help guide technology selection and, ultimately, its success. History or past experience with similar technology may mean that agencies are more willing or able to adopt some kinds of technology (e.g., an agency proficient in the use of dash cameras may experience less trouble when attempting to integrate BWCs).

These factors cannot be thought of as static, because they are likely to change over time in response to social movements, organizational changes, and technological development. Agencies may develop a more liberal approach toward new technology with changes in senior leadership. Communities may demand more accountability via technology after high-profile incidents. Technology may lower the barrier to entry or reduce costs. These changes over time may alter the perceived need or value of a technology and make adoption or expansion of certain technology more feasible.

How is technology impacting and changing modern policing?

As a whole, technology is having a positive impact on many agencies in terms of increasing efficiency, improving informational and analytical capacities, providing communication and information-sharing practices among other benefits. Yet, the collective findings of our study demonstrate that technology has not yet had a game-changing impact on policing in terms of dramatically altering the philosophies and strategies used for preventing or responding to crime and improving public safety.

Interestingly, policing strategies may not have been significantly impacted by technology use, because they were typically not part of the decision to adopt new technology. Rather, it

seemed as though technology was being acquired without knowledge of how it would help the organization reach its goals or fulfill key strategic needs. Simply put, technology acquisition seemed rather disparate and was not necessarily obtained for part of a greater purpose, which partially explains why strategies for preventing or responding to crime respond remained largely unaltered.

It is difficult to pinpoint exactly why policing philosophies were not consistently related to the use of technology. Agencies were extremely diverse on a variety of factors, making it hard to disentangle whether success depended on agency characteristics, certain aspects of the implementation process, geographic region, or political climate, just to name a few. This is an important implication going forward in both policing and research, and stresses the importance of developing performance metrics that are monitored and regularly evaluated.

Due to its highly flexible nature, GIS was one technology reported to have the greatest impact on allowing agencies to successfully carry out prioritized activities such as identifying and analyzing crime and disorder problems. Data mining was most closely associated with implementation of solutions to address underlying crime problems, and social media and data mining were both considered to affect an agency's ability to successfully generate intelligence from the community (intelligence-based policing). Among the agencies that identified tracking officer conduct as a key activity, the use of BWCs was seen as more important than the use of car-mounted cameras.

One of the key findings from the study is the recognition that CAD/RMS had the greatest impact on agencies nationwide. This technology is central to professional policing and responding to calls for service and information management. Despite the long-term integration of CAD/RMS systems in most LEAs, this technology was a frequent topic of discussion during the site visits. Popular attention has turned toward more trendy technology, such as drones and BWCs, but software found in the CAD/RMS systems still represents a critical technology to a broad range of agencies. The technology is also central to generating the data that other activities and technology applications rely on, such as GIS, hot-spot policing, and other location-based activities. CAD/RMS may also present major challenges to agencies in terms of cost and complexity during implementation. CAD/RMS upgrades consume considerable resources and often create substantial disruptions in the routine operations of an agency.

Going forward, agencies would benefit from implementing technology based on a previously defined policy framework with purposes and goals clearly delineated. Agencies will need to have a solid understanding of their goals to stay apprised of new technology and how it might benefit their particular agency. In other words, as an agency's goals and activities expand, its need or potential use of technology may change. Having a clear vision of what an agency wishes to achieve will help guide the decision of what technology to acquire and how to implement it in a way that balances the organizational mission and goals. However,

this concept is useful only to the extent to which agencies can identify, assess, and evaluate both “mature” and “emerging” technology. This idea again highlights the importance of continuously assessing and evaluating whether technology is truly helping an agency achieve its mission, or how implementation could be altered to improve results.

How do agency characteristics effect technology adoption?

This project contributes to the literature by exploring the impact of technology in small and mid-sized agencies. Discussions with agencies suggested that technologies affect agencies differently depending on their size. Smaller agencies often reported having fewer resources (both financial and staffing) to acquire and implement cutting-edge technology. However, smaller agencies also reported that there were sometimes fewer barriers to deployment because effort can often scale with agency size. For example, the implementation of a BWC system for an agency of 10 officers may face far fewer implementation hurdles than an agency with 1,000 officers.

Other kinds of technologies were not as important or were used in different ways in smaller agencies. We heard from smaller agencies that information-sharing platforms, for example, were more important for sharing information with other agencies rather than sharing information intra-agency. Smaller agencies also reported the ability to implement decentralized, low-cost solutions to issues that would require much more complex solutions in large agencies. For example, tracking activities in a desktop database may be possible in a smaller agency but would require a customized solution in a large agency.

Technology Adoption and Impact in Agencies

Many different types of identification, acquisition, and implementation strategies were used by agencies contacted during the site visits. The most relevant themes for technology adoption strategies include similar technology adoption processes that lead to different impacts, different technology adoption processes that lead to similar impacts, size and composition of the technology user group, the effect on the adoption process and technology impact, perceived future impact of technology and the effect on the technology adoption process, and, finally, the differences between the adoption of emerging and established technologies related to their effect on the adoption process.

Many of the sites discussed similar identification, acquisition and implementation strategies, but sites did not always have similar perceptions about the impact of the adopted technology. Considering alternative factors that may have affected the impact of technology on an agency’s operations would be informative for law enforcement practitioners interested in using another agency’s acquisition strategy as a model for their own. Some of these potential factors outside the adoption process itself include the quality of the technology adopted, the characteristics of the community in which the technology was implemented,

the level of buy-in from users, and the actual need for a technology solution in the agency. In other words, was the technology specifically meant to complement an agency's strategy, or was it merely purchased just for the sake of having it, with no formal integration into the agency's strategy? Conversely, many of the visited sites discussed different identification, acquisition, and implementation strategies that still resulted in similar outcomes in terms of the impact of the adopted technology. Again, considering some of the alternative factors that may have had an effect on the impact of technology is useful.

Certain technologies are deployed much more broadly throughout a policing agency than others. For example, crime-mapping software is probably used by only select staff members, likely the crime analysis unit. Although the analytical products are distributed throughout the agency, the user of the technology and the institutional knowledge about that technology and its use are concentrated and isolated within an agency. This is similar to acquisition, implementation, and use of social media in an LEA; this technology is likely localized to a handful of users. BWCs and in-car cameras, alternatively, are generally deployed broadly throughout the agency on patrol officers and in patrol cars. During the site visits, agencies discussed the concentration of users for more-focused technology as being potentially problematic; it would be difficult for an agency to have a continued impact from a technology if the isolated institutional knowledge were to be lost. This also has an effect on the identification, acquisition, and implementation process of a new technology, particularly if the technology would be used by a narrow portion of the department. Key decision-makers in agencies struggle to properly identify, acquire, and implement potentially impactful technology if they are not aware of a technology and how it is used broadly throughout the agency.

The perceived impact of different technologies that are identified, acquired, and implemented in a policing agency varies tremendously and this variation has an effect on the adoption process. For example, the perceived impact of social media differs from a technology like BWCs, despite having a similar desired effect: improved community interaction (i.e., social media as an outreach tool and BWCs as an accountability tool). Despite this, the perceived impact of BWCs is significantly higher than the perceived impact of social media. Some of the reasons that the perceived impact may be higher for BWCs would be the effect of the size of the user base, external pressures for implementation, and the perceived value to the agency (specifically for transparency, accountability, and reduced citizen complaints). At almost all sites where BWCs were discussed, the adoption plan was described as organized, methodical, and deliberate regardless of how the identification, acquisition, and implementation differed. Conversely, technology like social media, which may have less of a perceived future impact, had a far less organized and deliberate approach during acquisition and implementation.

Agencies reported they were more comfortable acquiring established technology than emerging technology. This notion was colorfully phrased as wanting to be "on the leading

edge, not the bleeding edge.” This comfort, or lack thereof, had a consistent impact on the technology adoption process at the agencies participating in site visits. This applies not only to different technology but newer versions of established technology. Good examples of emerging technology include BWCs, mobile biometric devices, and data-mining tools. Commonly expressed concerns about the emerging technology included rapidly improving hardware and software that made early adoption risky, acquiring technology that was of poor quality because of the lack of field testing, and an overall lack of knowledge about the technology and its potential impact. Agencies appear to be less concerned about identifying, acquiring, and implementing more established technology like in-car cameras, GIS, social media, and information sharing. There was a time, as with BWCs now, when acquiring in-car cameras was met with the same apprehension from law enforcement agencies. It would be useful for agencies to look to similar technology in the past and learn from those experiences.

One barrier to implementing technology in many agencies is that the agencies do not have adequate resources to perform preliminary research to help them understand how technology can be associated with policing strategies. There is little written about how technology can support strategy nor about technology tools that are capable of supporting a particular goal. Often, as discussed elsewhere in this report, this may lead to agencies acquiring technology simply for the sake of doing so or as a reaction to public pressure, without clear thought given to how this may assist their overall strategy. As a result, technology purchases are not always fully implemented and soon fall out of use, thus agencies may become discouraged about getting technology in the future. Given the importance of obtaining buy-in from officers when making changes in policing, it seems equally important to fully integrate any technological changes into the established strategies and actions of officers.

The Trouble with Impact Metrics

A goal of this project was to determine how agencies evaluate the success or failure of technology initiatives. Conceptually, impact metrics should play a critical role in assessing the utility of a technology and if the technology’s utility exceeds its acquisition and maintenance costs. Despite this importance, our research suggests that agencies largely do not identify or track appropriate success metrics that could be used to determine the effectiveness of technology. Across 22 site visits and interviews with dozens of stakeholders, we received little information on frequently used performance metrics or benchmarks. In the few instances in which metrics were discussed, interviewees tended to focus primarily on use metrics (e.g., the system was accessed 200 times) rather than substantive outcomes (e.g., reduced crime by x amount or improved accurate offender identification by $y\%$).

Despite not having reasonable performance metrics, stakeholders were frequently willing to point out which technology they believed had the biggest impact on operations. These

perceptions were largely based on anecdotal evidence and the availability of high-profile success cases. Agencies that had fully embraced technology such as BWCs, LPRs, and car cameras were often able to point out cases where the use of this technology was able to make a substantial difference in event outcomes. BWCs and car cameras were often associated with exonerating officers from false complaints, and LPR use was associated with the capture of a high-profile wanted fugitive. Several stakeholders requested that users document and e-mail technology success stories to keep track of these events.

A few agencies did acknowledge the need to document technology use and success more formally. When we did hear about success metrics, it was often in the context of being able to justify the purchase or continued maintenance of a system. In one instance, tracking use metrics was undertaken with a bottom-up approach. The unit supervisor was wary about losing funding for a piece of technology he felt was highly useful and implemented a logbook to track use. The unit supervisor had used this information during later budget meetings to justify the continued maintenance of this equipment.

The lack of appropriate technology success metrics seems to be associated with the following:

- **Lack of incentive.** Agencies often do not have incentive to track performance or use metrics. Funding sources are often not directly associated with the future ability to support existing or acquire new technology.
- **Not easily achieved within technology.** Technologies may not have native methods of assessing their impact. Systems may not track usage or, in the case of some LPRs, may track hit rates but may not track the more important “successful hit” metric.
- **Unclear success metrics.** Success metrics for technology may not be clear because the technology has a diverse sphere of influence. The success metrics for technology such as CAD/RMS may be difficult to identify in advance without carefully considering how the technology will impact the agency.
- **Unclear responsibility for tracking and assessing success.** In many agencies, a single person is not responsible for the deployment of a technology. This may make it difficult to find a champion in the department who is willing to push for developing or recording useful metrics.

Looking forward, there is a clear need for research to help establish better metrics for evaluating the success of technology. The availability and viability of success metrics vary considerably between types of technology. Part of developing these metrics is acknowledging that there are numerous ways technology can affect a department. A first useful step may be to identify the various ways that technology can positively affect a department. These dimensions are not exclusive and a technology may have an impact in multiple areas. Based on discussion with stakeholders, we have identified some common dimensions.

- **Technology use metrics.** Basic use metrics, such as tracking the number of times users logged in or number of queries performed, can serve as the basis for improving or identifying technology that is underused. It may also be useful in identifying problems within technology that is preventing full adoption.
- **Crime reduction.** Technology such as LPRs may have a direct impact on crime reduction that could be measured through careful evaluation efforts.
- **Facilitating suspect identification.** Technology such as social media and LPRs may improve agencies' ability to identify and locate suspects. Technology's impact on investigations could be measured through evaluation of arrest rates or time to arrest.
- **Supporting community policing.** Technology such as public crime mapping may enhance police transparency, thereby supporting core tenets of community-oriented policing.
- **Supporting fair and equitable policing.** Technology such as early-warning systems may help agencies promote better practices and identify problems before they harm community relations.
- **Protect agencies from unfounded complaints or accusations.** Technology such as BWCs and dash cameras may protect officers and agencies from unwarranted complaints.
- **Improving the efficiency of operations.** Technology such as CAD/RMS or electronic ticketing systems may be best assessed in terms of their impact on operational efficiency.

Limitations and Avenues of Future Research

We call attention to a few limitations of our study. Our survey measure of technology use was relatively insensitive and only asked agencies if they had used the technology in the last 2 years. Site visit data, however, suggested that there was a great deal of variation in use among agencies that had similar kinds of data. Having a technology might mean that there was one fixed-mount LPR unit or 40 patrol vehicle-mounted mobile units. In either case, agencies may consider themselves fully deployed with no plans to implement any additional units or may think that they are only partially deployed with intention to place more units into the field. Future research should consider the depth of adoption as a continuous variable rather than a simple yes/no variable. Likewise, it may also be considered a limitation that our survey was fielded to only a single agency representative. Perceptions of the extent to which an agency is devoted to a particular policing philosophy or believes that a given activity is central to the agency's core mission may differ substantially throughout the chain of command within the same department.

Our survey response rate was about 13% lower than what was anticipated, which also may have affected which agencies received site visits. The lack of response tended to come from small agencies. One potential reason for this was the structure of the survey. The instrument was lengthy and comprehensive across a wide array of technology. However, smaller agencies use less technology and may not have seen the value in answering the

survey, given that any results would not be of direct interest to their day-to-day work. Because survey responses dictated which agencies were chosen for site visits, there may be additional selection bias stemming from the original response bias. We only considered site visits at agencies that completed the survey. We attempted to mitigate this limitation by selecting agencies that were diverse on both the type of technology used as well as their reported success with the technology.

This survey was conducted in early 2014, which was relatively early in the discussion for both BWC and drone/UAV use in LEAs. Much has been written, debated, and developed on this technology in the intervening 2 years. Given the lack of comparison data, it is unclear to what extent our findings on this technology are driven by early-adopter bias. Smaller agencies seem to have had an easier time implementing BWCs, but this result may not persist as more agencies get involved. Further research is needed to explore how the barriers to technology change as technology matures and as market saturation increases.

Recommendations

There are several recommendations for the steps the policing community can take to create an environment of more successful technology acquisition and use that stem from this project. Many of these recommendations are linked to the steps for implementing a more research-informed framework for the use of technology in policing.

Evidence-based research is needed in policing technology. Our research suggests that there needs to be greater emphasis on evidence-based, informed decision-making about new technology. Agencies commonly expressed concern about getting new technology that has not been tested for quality, and often indicated there was an overall lack of knowledge about the technology and its potential impact. This lack of knowledge made it difficult to implement technology in a way that links that technology with departmental goals, organizational culture, and policing strategies.

Strategic planning should include technology considerations. The strategic planning process appears to be severely overlooked despite being integral to the success or failure of a technology. In addition, strategic planning is quite an arduous task that is frequently minimized when considering implementation of a new technology. The agency- and community-level specificity required to adequately plan and implement a technology is often unforeseen and, therefore, comes as a shock to police stakeholders after the technology has already been acquired. This results in more hurdles and, most damagingly, can lead to deimplementation.

Organizational and cultural differences should be considered in technology planning. One specific point that is crucial to strategic plan development is consideration of the divergences among agencies, such as size, geography, type of agency, and constituents served. Because of the vast differences in organizational culture between agencies, it may

not be advisable for agencies to model another's implementation process unless they are generally similar organizations. Further, large agencies are more likely to have specialized IT staff, technical experts, or task forces who lead technological acquisition plans. In that vein, small agencies, in particular, may benefit from including officers or specialized advisory boards to assist with developing an agency-specific strategic plan to get and implement new technology. However, there are many organizational differences that exist, even among the subsample of large agencies, that affect technology acquisition and implementation. As such, the theoretical concept of *agency-specific* strategic planning extends throughout the field of law enforcement.

Decision makers and technology experts should better collaborate on technology decisions. Communication within agencies was often identified as problematic. Many technologies are not broadly deployed throughout an agency, resulting in varying degrees of familiarity and knowledge among staff. Problems arise if personnel who use and understand the benefits of the technology do not communicate with key decision makers. This suggests that agencies need to develop methods of conveying information bidirectionally: Line officers must know about the goals of technology and command staff must receive feedback on its impact and effects on operations.

Past experience with technology contributes to future behavior. Given that each agency and its community context are unique, there is often heavy emphasis placed on an agency's own historical performance relative to technology identification, acquisition, and implementation. This may yield positive results. For example, an agency exploring BWCs may be concerned about data storage capacity; however, the agency may be able to draw strong parallels with its use of other resource-intensive technology, such as dash cameras. There are downsides to this emphasis. A department that has not historically been good at implementing technology may become reluctant to take additional risks on new technology. Agencies may become paralyzed by the fear of failure. A robust program of internal evaluation may ameliorate this possibility by helping to explain why the technology was a failure and set up a roadmap for similar future technology.

Build consensus among police decision makers and technology experts regarding which technologies and policing activities are necessary to support a policing strategy. A better measure of agency orientation toward policing strategies should include the creation of a taxonomy of tangible policing activities and technologies that are required to support a policing strategy. For example, an agency that identifies with the strategy of hot-spot policing should exhibit activities like directed and saturation patrols and use technologies like GIS and predicative policing software. In doing so, police decision makers and technology experts would create a roadmap that defines and aligns technology decisions with strategic policing priorities and activities.

Independent research on technology effectiveness is desired. Even with a strictly tailored strategic plan, there is a limit to the ability of current knowledge and empirical evidence to inform decision making and planning. Among the research that does exist, very few studies examine the relationships between agency characteristics, constituents served, and the overall success of technology in policing. Even when the effectiveness of technology is evaluated, it is often done so without considering the large impact of organizational or community context. In many instances, the best available evidence will tell you if a technology is effective but will not tell you under what conditions this effectiveness was found. The National Institute of Justice has funded a lot of work on technology effectiveness and has compiled this information in the central repository known as JUSTNET, a part of the National Law Enforcement and Corrections Technology Center.

Research is needed on facilitators and barriers to successful adoption. Researchers need to better examine the black box of effectiveness to understand what factors contribute to the success or failure of a technology. Agencies need to work with experts to create performance metrics as a means to conceptualize, measure, and track success or failure. This kind of information would be helpful to inform the field as to what works in policing and why, and subsequently could be a starting point for agencies wanting to implement new technology. In addition, this may give reason to justify continued funding for new technology and potentially make the acquisition and implementation much more feasible and effective.

Consider the value of national technology clearinghouse. Results also demonstrated the need to provide technological guidance along with strategic guidance. Although many agencies are attempting to acquire new technology, it is often done in a scattershot manner, with technology not bought with a clear strategic goal in mind. In many cases, technology that is acquired and implemented without a clear goal ends up abandoned. This can lead to discouraging agencies from acquiring new technology in the future. A national law enforcement technology clearinghouse that assists agencies in purchasing relevant technology in line with their departmental strategies would be a useful resource for agencies. Such a clearinghouse would assist agencies to avoid the purchase of technology that has a high probability of failure and help agencies identify technologies that work together to produce exceptional outcomes.

In sum, strategic planning and pre-implementation should be emphasized when an agency is hoping to acquire new technology. Plans should be specific to an agency's mission or preferred policing strategy, with clearly outlined goals. Specific personnel and knowledge requirements to reach those goals should be incorporated in the strategic plan. Agencies should consider how to quantify success, while concurrently working with researchers who can evaluate effectiveness of both processes and outcomes. Not only will this help agencies understand what needs to be changed for better success but it will also inform the field of policing on how to increase sustainability and maximize the effects of technology use.

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Appendices

A. Law Enforcement Technology Survey

RTI International and the Police Executive Research Forum, with funding from the National Institute of Justice (NIJ), are conducting research to examine how the use of technology affects policing strategies and outcomes at the state, local, and tribal levels. This survey is part of a larger project which will provide law enforcement agencies with recommendations and guidelines for how best to implement and use specific types of technologies for strategic purposes.

Your agency's responses to this survey will help build the base for evidence about which technologies have the most positive impact on successfully achieving desired police outcomes. The survey will take approximately 30 minutes to complete, and is divided into four sections:

- Section A** asks about your agency's core mission and the activities your agency emphasizes to achieve that mission;
- Section B** focuses on your agency's recent experience identifying, acquiring and implementing technologies; and
- Section C** asks whether your agency currently has or plans to implement selected technologies, and how critical these technologies are to achieving agency goals and objectives.
- Section D** asks about any other technologies you may have acquired and any additional information you'd like to provide about your experience acquiring or implementing various technologies.

Respondent Contact Information. In most cases, this survey will require inputs from multiple respondents within your agency. Please enter the name of the primary contact person who is responsible for getting the survey completed. This information is collected solely for follow-up (if necessary) or if your agency is chosen to participate in a site visit.

Agency:	<input type="text"/>
Title:	<input type="text"/>
First Name:	<input type="text"/>
Last Name:	<input type="text"/>
Email:	<input type="text"/>
Phone:	<input type="text"/>

Section A: STRATEGIES AND ACTIVITIES

The questions in this section are about your agency’s policing strategies and primary activities.

A3. A2. First, we are interested in how important each of the following **policing strategies** support your core mission? In the table below, please rate each activity on a scale of 1 to 5. One (1) means your agency considers the activity not important at all to achieving its core mission. Five (5) means your agency considers the activity to be of the highest importance to achieving the core mission. Please select all strategies that apply.

*	Strategy	<i>Not important at all</i> <i>Highest importance</i>				
		1	2	3	4	5
A	Professional policing					
B	Community policing					
C	Problem-oriented policing					
D	Zero-tolerance policing					
E	Hot-spot policing					
F	Offender targeting					
G	Intelligence-led policing					
H	Predictive policing					

A4. Next, we are interested in how important various **activities** are in helping your agency meet its core mission. In the table below, please rate each activity on a scale of 1 to 5. One (1) means your agency considers the activity not important at all to achieving its core mission. Five (5) means your agency considers the activity to be of the highest importance to achieving the core mission.

* Activity	<i>Not important at all</i> <i>Highest importance</i>				
	1	2	3	4	5
A Work cooperatively with probation and/or parole officers to identify and monitor individuals at-risk for re-offending					
B Respond to calls for service in an efficient and timely manner					
C Involve community members in developing police priorities					
D Involve community members in implementing strategies					
E Target identified high-risk areas					
F Conduct crime prevention activities in partnership with community members					
G Proactively identify and analyze specific crime and disorder problems					
H Implement focused solutions to address the underlying cause(s) of identified crime and disorder problems					
I Arrest suspects for minor crime and disorder offenses					
J Conduct surveillance of individuals at-risk for offending					
K Achieve high arrest volumes					
L Implement systems to track officer conduct					
M Conduct high amounts of officer-community engagement activities					
N Implement saturation patrols in high-risk areas					
O Conduct analysis to identify repeat offenders					
P Implement directed patrols in high-risk areas					
Q Conduct follow-up investigations					
R Generate crime intelligence from the community					
S Stop and question individuals who exhibit identified suspicious behaviors or characteristics of a known suspect					

A5. Next, we are interested in learning about how your agency prioritizes the activities you rated on the previous screen. From the list below, please check the activities that are the **top five** priorities for your agency to achieve its core mission.

*	Check box	Activity
A	<input type="checkbox"/>	Work cooperatively with probation and/or parole officers to identify and monitor individuals at- risk for re-offending
B	<input type="checkbox"/>	Respond to calls for service in an efficient and timely manner
C	<input type="checkbox"/>	Involve community members in developing police priorities
D	<input type="checkbox"/>	Involve community members in implementing strategies
E	<input type="checkbox"/>	Target identified high-risk areas
F	<input type="checkbox"/>	Conduct crime prevention activities in partnership with community members
G	<input type="checkbox"/>	Proactively identify and analyze specific crime and disorder problems
H	<input type="checkbox"/>	Implement focused solutions to address the underlying cause(s) of identified crime and disorder problems
I	<input type="checkbox"/>	Arrest suspects for minor crime and disorder offenses

*	Check box	Activity
J	<input type="checkbox"/>	Conduct surveillance of individuals at-risk for offending
K	<input type="checkbox"/>	Achieve high arrest volumes
L	<input type="checkbox"/>	Implement systems to track officer conduct
M	<input type="checkbox"/>	Conduct high amounts of officer-community engagement activities
N	<input type="checkbox"/>	Implement saturation patrols in high-risk areas
O	<input type="checkbox"/>	Conduct analysis to identify repeat offenders
P	<input type="checkbox"/>	Implement directed patrols in high-risk areas
Q	<input type="checkbox"/>	Conduct follow-up investigations
R	<input type="checkbox"/>	Generate crime intelligence from the community
S	<input type="checkbox"/>	Stop and question individuals who exhibit identified suspicious behaviors or characteristics of a known suspect

Section B: EXPERIENCES ACQUIRING AND IMPLEMENTING NEW TECHNOLOGY

The next few questions are about your agency's experience acquiring and implementing new technologies. Implementing a new technology can include purchasing a new technology or making significant upgrades to an existing technology.

Ba1. Please think about your agency's experience acquiring and implementing new technologies. Over the past two years, what technology has made the biggest impact on your agency's strategy and activities?

B1. We are interested in learning about your agency's **most recent** experience acquiring and implementing a new technology. What type of technology was most recently acquired and implemented in your agency?

1. Crime mapping or geographic information system (GIS) software
2. Predictive analytics software
3. Data mining tools for massive databases
4. Investigation case management software
5. Search and data sharing across silos (e.g., I2, Sharepoint)
6. Software to discover connections (e.g., Analyst Notebook)
7. Software to track cellphones and exploit cellphone data
8. Regional/ national information sharing (e.g., NLETS, COPLINK)
9. License plate readers (LPR)
10. Acoustic gunshot detection
11. Rapid DNA instruments
12. Mobile biometric devices
13. Closed-caption television (CCTV) with video content analysis (VCA)
14. Gun/ contraband detection
15. Early intervention systems concerning officer behavior
16. Car cameras
17. Officer-worn cameras
18. Other (please specify): Our most recent technology acquisition was: ____

B2. How long ago was that purchase made?

1. Within the past year
2. More than 1 year, but less than 2 years ago
3. More than 2 years, but less than 5 years ago
4. More than 5 years ago

B3. Is this a new system or upgrade to an existing system in your department?

1. New
2. Upgrade

- B4. Who participated in the decision of the specific make and model to purchase (Please check all that apply):
1. IT director or other technical expert
 2. Chief or deputy chief
 3. Command staff
 4. Departmental task force
 5. Other (please specify: _____)
- B5. How did you decide which specific products to consider? (Please check all that apply)
1. Conducted scan of practice, such as an informal poll of other agencies' practice
 2. Consulted with someone in another department
 3. Vendor exhibit at conference
 4. Advertisement in trade magazine
 5. Vendor website
 6. Publication or website of government or professional association, such as the BJA, NIJ, IACP, or PERF.
 7. Approached by vendor
 8. Product was specified by a grant or other external funding source
 9. Other (please specify: _____)
- B6. Are there published industry or professional association standards for this technology?
1. Yes
 2. No
 3. Don't know
- B6a. [IF B6 = YES] Did the technology your agency purchased meet those standards?
- Yes
 - No
 - Don't know
- B7. To what extent did the performance of the technology meet your expectations?
1. Greatly exceeded expectations
 2. Somewhat exceeded expectations
 3. Performed about as expected
 4. Somewhat below expectations
 5. Greatly below expectations
- B7a. [IF B7 = SOMEWHAT BELOW OR GREATLY BELOW EXPECTATIONS] Did you ask the vendor to correct the problem(s) or adjust the technology to meet your expectations?
1. Yes
 2. No

B7b. [IF 7a = YES] On a scale of 1 to 5, where 1 is not at all satisfied and 5 is completely satisfied, how satisfied were you with the vendor’s ability to correct the problem?

<i>Not at all satisfied</i>				<i>Completely satisfied</i>
1	2	3	4	5

B8a. To what extent was the cost of **purchasing** the technology in line with your agency’s expectations?

1. Cost greatly exceeded expectations
2. Cost somewhat exceeded expectations
3. Cost was about as expected
4. Cost was somewhat below expectations
5. Cost was greatly below expectations

B8b. To what extent was the cost of **implementing** the technology in line with your agency’s expectations?

1. Cost greatly exceeded expectations
2. Cost somewhat exceeded expectations
3. Cost was about as expected
4. Cost was somewhat below expectations
5. Cost was greatly below expectations

B9. In implementing this technology, did your agency experience any of the problems described below?

*		Yes	No
A	Poor vendor support		
B	Inadequate training of technical staff		
C	Inadequate training of end users		
D	Resistance from end users		
E	Poor management support		
F	Lack of preparation within the agency		
G	Staff resistance		

[PROGRAMMER: SHOW ONLY THOSE ITEM FROM B12 THE RESPONDENT INDICATED THE AGENCY EXPERIENCED A DIFFICULTY WITH.]

B9 (cont). Was the **poor vendor support** your agency experienced a minor problem or major problem?

1. Minor problem
2. Major problem

B9 (cont). Was the **inadequate training of technical staff** your agency experienced a minor problem or major problem?

1. Minor problem
2. Major problem

B9 (cont). Was the **inadequate training of end users** your agency experienced a minor problem or major problem?

1. Minor problem
2. Major problem

B9 (cont). Was the **resistance of end users** your agency experienced a minor problem or major problem?

1. Minor problem
2. Major problem

B9 (cont). Was the **poor management support** your agency experienced a minor problem or major problem?

1. Minor problem
2. Major problem

B9 (cont). Was the **lack of preparation within the agency** your agency experienced a minor problem or major problem?

1. Minor problem
2. Major problem

B9 (cont). Was the **staff resistance** your agency experienced a minor problem or major problem?

1. Minor problem
2. Major problem

B10. Did you experience any other difficulties implementing this technology?

1. Yes
2. No

B11. [IF B10 = YES] What were they?

Section C: TECHNOLOGIES IMPLEMENTED

Next, we are interested in the technologies your agency has implemented or plans to acquire in the next two years.

Crime mapping or geographic information systems (GIS) software

C1a. Has your agency used **crime mapping or geographic information systems (GIS) software** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C1a=NO, SKIP TO C1I. ELSE ASK C1b.]

C1b. [IF C1a = YES] Was the first time your agency used **crime mapping or geographic information systems (GIS) software** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C1c. [IF C1a = YES] Has your agency upgraded the **crime mapping or geographic information systems (GIS) software** it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C1d. [IF C1a=YES AND A4= K] How important is **crime mapping or geographic information systems (GIS) software** to the success of achieving **high arrest volumes**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C1e. [IF C1a=YES AND A4= C] How important is **crime mapping or geographic information systems (GIS) software** to the success of **involving community members in developing police priorities**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C1f. [IF C1a=YES AND A4= D] How important is **crime mapping or geographic information systems (GIS) software** to the success of **involving community members in implementing strategies**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C1g. [IF C1a=YES AND A4= G] How important is **crime mapping or geographic information systems (GIS) software** to the success of **proactively identifying and analyzing specific crime and disorder problems**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C1h. [IF C1a=YES AND A4= H] How important is **crime mapping or geographic information systems (GIS) software** to the success of **implementing focused solutions to address the underlying cause(s) of identified crime and disorder problems?**

- a. Not at all important
- b. Somewhat important
- c. Very important

C1i. [IF C1a=YES AND A4= E] How important is **crime mapping or geographic information systems (GIS) software** to the success of **targeting identified high risk areas?**

- a. Not at all important
- b. Somewhat important
- c. Very important

C1j. [IF C1a=YES AND A4= P] How important is **crime mapping or geographic information systems (GIS) software** to the success of **implementing directed patrols in high risk areas?**

- a. Not at all important
- b. Somewhat important
- c. Very important

C1k. [IF C1a=YES AND A4= N] How important is **crime mapping or geographic information systems (GIS) software** to the success of **implementing saturation patrols in high risk areas?**

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C2a.]

C1l. [IF C1a = NO] Does your agency plan to acquire **crime mapping or geographic information systems (GIS) software** within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Predictive analytics software

C2a. Has your agency used **predictive analytics software** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C2a=NO, SKIP TO C2i. ELSE ASK C2b.]

C2b. [IF C2a = YES] Was the first time your agency used **predictive analytics software** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C2c. [IF C2a = YES] Has your agency upgraded the **predictive analytics software** it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C2d. [IF C2a=YES AND A4= E] How important is **predictive analytics software** to the success of **targeting identified high risk areas**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C2e. [IF C2a=YES AND A4= P] How important is **predictive analytics software** to the success of **implementing directed patrols in high risk areas**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C2f. [IF C2a=YES AND A4= N] How important is **predictive analytics software** to the success of **implementing saturation patrols in high-risk areas**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C2g. [IF C2a=YES AND A4= O] How important is **predictive analytics software** to the success of **conducting analyses to identify repeat offenders**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C2h. [IF C2a=YES AND A4= J] How important is **predictive analytics software** to the success of **conducting surveillance of individuals at risk for offending**?

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C3a]

C2i. [IF C2a = NO] Does your agency plan to acquire **predictive analytics software** within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Data mining tools for massive databases

C3a. Has your agency used **data mining tools for massive databases** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C3a=NO, SKIP TO C3h. ELSE ASK C3b.]

C3b. [IF C3a = YES] Was the first time your agency used **data mining tools for massive databases** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C3c. [IF C3a = YES] Has your agency upgraded the **data mining tools for massive databases** it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C3d. [IF C3a=YES AND A4= P] How important are **data mining tools for massive databases** to the success of **implementing directed patrols in high-risk areas**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C3e. [IF C3a=YES AND A4= Q] How important are **data mining tools for massive databases** to the success of **conducting follow-up investigations**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C3f. [IF C3a=YES AND A4= R] How important are **data mining tools for massive databases** to the success of **generating crime intelligence from the community**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C3g. [IF C3a=YES AND A4= G] How important are **data mining tools for massive databases** to the success of **proactively identifying and analyzing specific crime and disorder problems**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C3h. [IF C3a=YES AND A4= H] How important are **data mining tools for massive databases** to the success of **implementing focused solutions to address the underlying cause(s) of identified crime and disorder problems**?

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C4a]

C3i. [IF C3a = NO] Does your agency plan to acquire **data mining tools for massive databases** within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Investigation case management software

C4a. Has your agency used **investigation case management software** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C4a=NO, SKIP TO C4e. ELSE ASK C4b.]

C4b. [IF C4a = YES] Was the first time your agency used **investigation case management software** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C4c. [IF C4a = YES] Has your agency upgraded the **investigation case management software** it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C4d. [IF C3a=YES AND A4= Q] How important is **investigation case management software** to the success of **conducting follow up investigations**?

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C5a]

C4e. [IF C4a = NO] Does your agency plan to acquire **investigation case management software** within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Search & data sharing across silos (I2, Analyst Notebook)

C5a. Has your agency used **search and data sharing software, such as Sharepoint**, in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C5a=NO, SKIP TO C5j. ELSE ASK C5b.]

C5b. [IF C5a = YES] Was the first time your agency used **search and data sharing software, such as Sharepoint**, within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C5c. [IF C5a = YES] Has your agency upgraded the **search and data sharing software, such as Sharepoint**, it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C5d. [IF C5a=YES AND A4= B] How important is **search and data sharing software, such as Sharepoint**, to the success of **responding to calls for service in an efficient and timely manner**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C5e. [IF C5a=YES AND A4= Q] How important is **search and data sharing software, such as Sharepoint**, to the success of **conducting follow-up investigations**?

- a. Not at all important
- b. Somewhat important
- c. Very important

- C5f. [IF C5a=YES AND A4= E] How important is **search and data sharing software, such as Sharepoint**, to the success of **targeting identified high-risk areas**?
- a. Not at all important
 - b. Somewhat important
 - c. Very important
- C5g. [IF C5a=YES AND A4=P] How important is **search and data sharing software, such as Sharepoint**, to the success of **implementing directed patrols in high-risk areas**?
- a. Not at all important
 - b. Somewhat important
 - c. Very important
- C5h. [IF C5a=YES AND A4= N] How important is **search and data sharing software, such as Sharepoint**, to the success of **implementing saturation patrols in high-risk areas**?
- a. Not at all important
 - b. Somewhat important
 - c. Very important
- C5i. [IF C5a=YES AND A4= O] How important is **search and data sharing software, such as Sharepoint**, to the success of **conducting analysis to identify repeat offenders**?
- a. Not at all important
 - b. Somewhat important
 - c. Very important
- C5j. [IF C5a=YES AND A4= L] How important is **search and data sharing software, such as Sharepoint**, to the success of **implementing systems to track officer conduct**?
- a. Not at all important
 - b. Somewhat important
 - c. Very important

[SKIP TO C6a]

C5k. [IF C5a = NO] Does your agency plan to acquire **search and data sharing software, such as Sharepoint**, within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Software to discover connections (I2 and Analyst Notebook)

C6a. Has your agency used **software to aggregate and analyze large amounts of data from multiple sources, such as I2 and Analyst Notebook**, in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C6a=NO, SKIP TO C6h. ELSE ASK C6b.]

C6a. [IF C6a = YES] Was the first time your agency used **software to discover connections, such as I2 and Analyst Notebook**, within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C6b. [IF C6a = YES] Has your agency upgraded the **software to discover connections, such as I2 and Analyst Notebook**, it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C6d. [IF C5a=YES AND A4= Q] How important is **software to discover connections, such as I2 and Analyst Notebook**, to the success of **conducting follow-up investigations**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C6e. [IF C5a=YES AND A4= G] How important is **software to discover connections, such as I2 and Analyst Notebook**, to the success of **proactively identifying and analyzing specific crime and disorder problems**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C6f. [IF C5a=YES AND A4= H] How important is **software to discover connections, such as I2 and Analyst Notebook**, to the success of **implementing focused solutions to address the underlying cause(s) of identified crime and disorder problems**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C6g. [IF C5a=YES AND A4= O] How important is **software to discover connections, such as I2 and Analyst Notebook**, to the success of **conducting analyses to identify repeat offenders**?

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C7a]

C6h. [IF C6a = NO] Does your agency plan to acquire **software to discover connections, such as I2 and Analyst Notebook**, within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Software to track cellphones & exploit cellphone data

C7a. Has your agency used **software to track cellphones or exploit cellphone data** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C7a=NO, SKIP TO C7h. ELSE ASK C7b.]

C7b. [IF C7a = YES] Was the first time your agency used **software to track cellphones or exploit cellphone data** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C7c. [IF C7a = YES] Has your agency upgraded the **software it uses to track cellphones or exploit cellphone data** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C7d. [IF C7a=YES AND A4= Q] How important is **software to track cellphones or exploit cell phone data**, to the success of **conducting follow-up investigations**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C7e. [IF C7a=YES AND A4= O] How important is **software to track cellphones or exploit cell phone data**, to the success of **conducting analyses to identify repeat offenders**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C7f. [IF C7a=YES AND A4= J] How important is **software to track cellphones or exploit cell phone data**, to the success of **conducting surveillance of individuals at risk for offending**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C7g. [IF C7a=YES AND A4= A] How important is **software to track cellphones or exploit cell phone data**, to the success of **working cooperatively with probation and parole officers to identify and monitor individuals at risk for offending**?

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C8a]

C7h. [IF C7a = NO] Does your agency plan to acquire **software to track cellphones or exploit cellphone data** within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Social media for public communication

C8a. Has your agency used any **social media platform (e.g., Twitter, Facebook) for public communication** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C8a=NO, SKIP TO C8g. ELSE ASK C8b.]

C8b. [IF C8a = YES] Was the first time your agency used any **social media platform for public communication** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C8c. [IF C8a = YES] Has your agency initiated use of additional social media platforms **for public communication** it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C8d. [IF C8a=YES AND A4= F] How important is the **use of social media platforms** to the success of **conducting crime prevention activities in partnership with community members**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C8e. [IF C8a=YES AND A4= R] How important is the **use of social media platforms** to the success of **generating crime intelligence from the community**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C8f. [IF C8a=YES AND A4= M] How important is the **use of social media platforms** to the success of conducting **high amounts of officer-community engagement activities**?

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C9a]

C8g. [IF C8a = NO] Does your agency plan to initiate use of additional **social media platforms for public communication** within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Regional/ national info sharing (NLETS, COPLINK)

C9a. Has your agency used **regional or national information sharing programs or databases, such as NLETS, LinX or COPLINK**, in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C9a=NO, SKIP TO C9e. ELSE ASK C9b.]

C9b. [IF C9a = YES] Was the first time your agency used **regional or national information sharing programs or databases, such as NLETS, LinX or COPLINK**, within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C9c. [IF C9a=YES AND A4= Q] How important are **regional or national information sharing programs or databases, such as NLETS, LinX or COPLINK**, to the success of **conducting follow-up investigations**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C9d. [IF C9a=YES AND A4= S] How important are **regional or national information sharing programs or databases, such as NLETS, LinX or COPLINK**, to the success of **stopping and questioning individuals who exhibit identified suspect behavior/characteristics**?

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C10a]

C9e. [IF C9a = NO] Does your agency plan to acquire any **regional or national information sharing programs or databases, such as NLETS, LinX or COPLINK**, within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

License Plate Readers

C10a. Has your agency used **license plate readers (LPR)** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C10a=NO, SKIP TO C10h. ELSE ASK C10b.]

C10b. [IF C10a = YES] Was the first time your agency used **license plate readers (LPR)** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C10c. [IF C10a = YES] Has your agency upgraded the **license plate readers (LPR)** it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C10d. [IF C10a=YES AND A4= K] How important are **license plate readers (LPR)** to the success of **achieving high arrest volumes?**

- a. Not at all important
- b. Somewhat important
- c. Very important

C10e. [IF C10a=YES AND A4= I] How important are **license plate readers (LPR)** to the success of **arresting suspects for minor crime and disorder offenses?**

- a. Not at all important
- b. Somewhat important
- c. Very important

C10f. [IF C10a=YES AND A4= P] How important are **license plate readers (LPR)** to the success of **implementing directed patrols in high-risk areas?**

- a. Not at all important
- b. Somewhat important
- c. Very important

C10g. [IF C10a=YES AND A4= N] How important are **license plate readers (LPR)** to the success of **implementing saturation patrols in high risk areas?**

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C11a]

C10h. [IF C10a = NO] Does your agency plan to acquire **license plate readers (LPR)** within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Acoustic gunshot detection

C11a. Has your agency used an **acoustic gunshot detection system** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C11a=NO, SKIP TO C11f. ELSE ASK C11b.]

C11b. [IF C11a = YES] Was the first time your agency used an **acoustic gunshot detection system** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C11c. [IF C11a = YES] Has your agency upgraded the **acoustic gunshot detection system** it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C11d. [IF C11a=YES AND A4= B] How important is your **acoustic gunshot detection system** to the success of **responding to calls for service in an efficient and timely manner?**

- a. Not at all important
- b. Somewhat important
- c. Very important

C11e. [IF C11a=YES AND A4= Q] How important is your **acoustic gunshot detection system** to the success of **conducting follow-up investigations?**

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C12a]

C11f. [IF C11a = NO] Does your agency plan to acquire an **acoustic gunshot detection system** within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Rapid DNA

C12a. Has your agency used **rapid DNA technologies** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C12a=NO, SKIP TO C12e. ELSE ASK C12b.]

C12b. [IF C12a = YES] Was the first time your agency used **rapid DNA technologies** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C12c. [IF C12a = YES] Has your agency upgraded **rapid DNA technologies** it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C12d. [IF C12a=YES AND A4= Q] How important is **rapid DNA technologies** to the success of **conducting follow-up investigations?**

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C12f]

C12e. [IF C12a = NO] Does your agency plan to acquire **rapid DNA technologies** within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Mobile biometric devices (e.g., fingerprint devices)

C13a. Has your agency used any **mobile biometric devices (such as fingerprint devices)** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C13a=NO, SKIP TO C13j. ELSE ASK C13b.]

C13b. [IF C13a = YES] Was the first time your agency used any **mobile biometric devices (such as fingerprint devices)** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C13c. [IF C13a= YES] Has your agency upgraded any of the **mobile biometric devices (such as fingerprint devices)** it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C13d. [IF C13a=YES AND A4= Q] How important are **mobile biometric devices (such as fingerprint devices)** to the success of **conducting follow-up investigations**?

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C14a]

C13e. [IF C13a = NO] Does your agency plan to acquire any **mobile biometric devices (e.g., fingerprint devices)** within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Closed-circuit television with video content analysis

C14a. Has your agency used **closed-circuit television with video content analysis (CCTV with VCA) software** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C14a=NO, SKIP TO C14h. ELSE ASK C13b.]

C14b. [IF C14a = YES] Was the first time your agency used **closed-circuit television with video content analysis (CCTV with VCA) software** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C14c. [IF C14a = YES] Has your agency upgraded the **closed-circuit television with video content analysis (CCTV with VCA) software** it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C14d. [IF C14a=YES AND A4= Q] How important is **closed-circuit television with video content analysis (CCTV with VCA) software** to the success of **conducting follow-up investigations**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C14e. [IF C14a=YES AND A4= E] How important is **closed-circuit television with video content analysis (CCTV with VCA) software** to the success of **targeting identified high-risk areas**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C14f. [IF C14a=YES AND A4= P] How important is **closed-circuit television with video content analysis (CCTV with VCA) software** to the success of **implementing directed patrols in high-risk areas**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C14g. [IF C14a=YES AND A4= N] How important is **closed-circuit television with video content analysis (CCTV with VCA) software** to the success of **implementing saturation patrols in high-risk areas**?

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C15a]

C14h. [IF C14a = NO] Does your agency plan to acquire any **closed-circuit television with video content analysis (CCTV with VCA) software** within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Gun/contraband detection

C15a. Has your agency used **gun or contraband detection systems** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C15a=NO, SKIP TO C15j. ELSE ASK C15b.]

C15a. [IF C15a = YES] Was the first time your agency used **gun or contraband detection systems** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C15b. [IF C15a = YES] Has your agency upgraded the **gun or contraband detection systems** it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C15c. [IF C15a=YES AND A4= K] How important are **gun or contraband detection systems** to the success of **achieving high arrest volumes**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C15d. [IF C15a=YES AND A4= I] How important are **gun or contraband detection systems** to the success of **arresting suspects for minor crime and disorder offenses**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C15e. [IF C15a=YES AND A4= S] How important are **gun or contraband detection systems** to the success of **stopping and questioning individuals who exhibit identified suspect behavior/characteristics**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C15f. [IF C15a=YES AND A4= P] How important are **gun or contraband detection systems** to the success of **implementing directed patrols in high risk areas**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C15g. [IF C15a=YES AND A4= N] How important are **gun or contraband detection systems** to the success of **implementing saturation patrols in high-risk areas**?

- a. Not at all important
- b. Somewhat important
- c. Very important

C15h. [IF C15a=YES AND A4= J] How important are **gun or contraband detection systems** to the success of **conducting surveillance of individuals at risk for offending**?

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C16a]

C15i. [IF C15a = NO] Does your agency plan to acquire **gun or contraband detection systems** within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]? **Early intervention systems concerning officer behavior**

C16a. Has your agency used an **early intervention system to identify or track problematic officer behavior** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C16a=NO, SKIP TO C16e. ELSE ASK C16b.]

C16b. [IF C16a = YES] Was the first time your agency used an **early intervention system to identify or track problematic officer behavior** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C16c. [IF C16a = YES] Has your agency upgraded the **early intervention system it uses to identify or track problematic officer behavior** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C16d. [IF C16a=YES AND A4= L] How important is the **early intervention system** to the success of **implementing systems to track officer conduct**?

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C17a]

C16e. [IF C16a = NO] Does your agency plan to acquire an **early intervention system to identify or track problematic officer behavior** within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Car cameras

C17a. Has your agency used **car cameras** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C17a=NO, SKIP TO C17e. ELSE ASK C17b.]

C17b. [IF C17a = YES] Was the first time your agency used **car cameras** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C17c. [IF C17a = YES] Has your agency upgraded the **car cameras** it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C17d. [IF C17a=YES AND A4= L] How important are **car cameras** to the success of **implementing systems to track officer conduct**?

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C18a]

Officer-worn cameras

C18a. Has your agency used **officer-worn cameras** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

[IF C18a=NO, SKIP TO C18e. ELSE ASK C18b.]

C18b. [IF C18a = YES] Was the first time your agency used **officer-worn cameras** within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

18c. [IF C18a = YES] Has your agency upgraded the **officer-worn cameras** it uses within the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

C18d. [IF C18a=YES AND A4= L] How important are **officer-worn cameras** to the success of **implementing systems to track officer conduct**?

- a. Not at all important
- b. Somewhat important
- c. Very important

[SKIP TO C18a]

C18e. [IF C18a = NO] Does your agency plan to acquire any **officer-worn cameras** within the next two years, that is by [FILL TODAY'S DATE 2 YEARS FROM NOW]?

Section D: Additional Information on Technologies

The final section asks just a few additional questions about different technologies than those referenced in previous sections.

D1a. Has your agency used **any of these other technologies** in the past two years, that is since [FILL TODAY'S DATE 2 YEARS AGO]?

- Automated traffic enforcement (e.g., red light cameras, speed enforcement)
- UAVs (drones)
- Through-wall surveillance
- Ballistics/ firearm tracing technology
- GPS tracking of suspects
- 2D/ 3D crime scene imaging technology
- Computer forensic technology
- Car-based computers
- Voice to text application within mobile devices
- In-car electronic ticketing system (e.g., ETIX systems)
- Regional interoperable radio systems
- Directed energy vehicle stopping device
- Computer-aided dispatch with RMS
- Computer-aided dispatch – GPS feature in cars for deployment
- Gun cameras /Taser cameras
- Reverse 9-1-1 emergency notification
- Next-generation 9-1-1

- Body armor
- Reflective gear
- Night-vision gear

D1b. Does your agency plan to acquire any **of these other technologies** within the next two years, that is by[FILL TODAY'S DATE 2 YEARS FROM NOW]?

- Automated traffic enforcement (e.g., red light cameras, speed enforcement)
- UAVs (drones)
- Through-wall surveillance
- Ballistics/firearm tracing technology
- GPS tracking of suspects
- 2D/3D crime scene imaging technology
- Computer forensic technology
- Car-based computers
- Voice-to-text application within mobile devices
- In-car electronic ticketing system (e.g., ETIX systems)
- Regional interoperable radio systems
- Directed energy vehicle stopping device
- Computer-aided dispatch with RMS
- Computer-aided dispatch – GPS feature in cars for deployment
- Gun cameras/Taser cameras
- Reverse 9-1-1 emergency notification
- Next-generation 9-1-1
- Body armor
- Reflective gear
- Night-vision gear

D2. Have you acquired or are you considering any other technologies that we have not asked about? [IF NO, SKIP TO D3.]

D2a. [IF D2=YES] Please briefly describe these technologies you are considering acquiring:

D3. If you would like to provide any additional information about your experiences with technology acquisition and/or implementation, please enter it here.

Appendix 2: Interview Guides

Select 2 technologies commonly used by patrol:

- Body-worn cameras
- Car cameras
- License plate readers
- Mobile biometric devices

Select 1 technology commonly used by an analyst (can select 2 if agency only has one of the patrol technologies):

- Software to aggregate and analyze large amounts of data from multiple sources
- Crime mapping/GIS
- Regional/National information sharing programs (e.g., NLETS)

Select social media questions:

Social media

As needed (if agency doesn't have the technologies prioritized above, or if one of the following seems particularly of interest to explore:

CCTV with

VCA RMS with

CAD

Technology implementation and impact

Car cameras

1. When did your agency first acquire car cameras?
2. How were you involved with or informed of the decision to acquire and implement car cameras?
3. What training did you receive on the use of the car camera? Have you received any additional "refresher" training or ongoing support on the use of the car camera?
4. Does your agency have a formal policy on car camera use? On video transfer and storage?
5. In what situations do you activate the car camera or is the camera automatically activated?
6. What obstacles have you encountered in operating the car camera?
7. Have you had any complaints or questions from citizens regarding its use?
8. What positive impacts have you observed in relation to the use of car cameras?
9. What negative impacts have you observed in relation to the use of car cameras?

Technology implementation and impact

Body-worn cameras

1. When did your agency first acquire body-worn cameras?
2. How were you involved with or informed of the decision to acquire and implement body-worn cameras?
3. What training did you receive on the use of the body-worn camera? Have you received any additional “refresher” training or ongoing support on the use of the body-worn camera?
4. Does your agency have a formal policy on body-worn camera use? On video transfer and storage?
5. In what situations do you activate the body-worn camera or is the camera automatically activated?
6. What obstacles have you encountered in operating the body-worn camera?
7. Have you had any complaints or questions from citizens regarding its use?
8. What positive impacts have you observed in relation to the use of body-worn cameras?
9. What negative impacts have you observed in relation to the use of body-worn cameras?

Technology implementation and impact

Mobile biometric devices

1. When did your agency first acquire mobile biometric devices?
2. How were you involved with or informed of the decision to acquire and implement mobile biometric devices?
3. What training did you receive on the use of the mobile biometric device? Have you received any additional "refresher" training or ongoing support on the use of the mobile biometric device?
4. Does your agency have a formal policy on mobile biometric device use? On biometric material transfer and storage?
5. In what situations do you use the mobile biometric device?
6. What obstacles have you encountered in operating the mobile biometric device?
7. Have you had any complaints or questions from citizens regarding its use?
8. What positive impacts have you observed in relation to the use of mobile biometric device?
9. What negative impacts have you observed in relation to the use of mobile biometric device?

Technology implementation and impact

CCTV with VCA

1. When did your agency first acquire CCTV with VCA?
2. How were you involved with or informed of the decision to acquire and implement CCTV with VCA?
3. What training did you receive on the use of the CCTV with VCA? Have you received any additional “refresher” training or ongoing support on the use of the CCTV with VCA?
4. Does your agency have a formal policy on CCTV with VCA use? On CCTV with VCA data transfer and storage?
5. In what situations do you use the CCTV with VCA?
6. What obstacles have you encountered in operating the CCTV with VCA?
7. Have you had any complaints or questions from citizens regarding its use?
8. What positive impacts have you observed in relation to the use of CCTV with VCA?
9. What negative impacts have you observed in relation to the use of CCTV with VCA?

Technology implementation and impact

License plate readers

1. When did your agency first acquire license plate readers?
2. How were you involved with or informed of the decision to acquire and implement license plate readers?
3. What training did you receive on the use of the license plate reader? Have you received any additional "refresher" training or ongoing support on the use of the license plate reader?
4. Does your agency have a formal policy on license plate reader use? On license plate reader data transfer and storage?
5. In what situations do you use the license plate reader?
6. What obstacles have you encountered in operating the license plate reader?
7. Have you had any complaints or questions from citizens regarding its use?
8. What positive impacts have you observed in relation to the use of license plate readers?
9. What negative impacts have you observed in relation to the use of license plate readers?

Technology implementation and impact

Software to aggregate and analyze large amounts of data from multiple sources

1. Why did your agency first acquire software to aggregate and analyze large amounts of data from multiple sources?
2. How were you involved with or informed of the decision to acquire and implement mobile biometric devices?
3. Please describe the capabilities/ functions of your software to aggregate and analyze large amounts of data from multiple sources.
4. What staff in your agency analyze data with this software? For what purposes?
5. What sources of information are analyzed with this software?
6. What training did you receive on the use of the software? Have you received any additional “refresher” training or ongoing support on the use of the software?
7. What obstacles have you encountered in operating the software?
8. What positive impacts have you observed in relation to the use of the software?
9. What negative impacts have you observed in relation to the use of the software?

Technology implementation and impact

Crime mapping/GIS

1. Why did your agency first acquire crime mapping/GIS software?
2. How were you involved with or informed of the decision to acquire and implement crime mapping/GIS software?
3. Please describe the capabilities/ functions of your crime mapping/GIS software.
4. What staff in your agency analyze data with this software? For what purposes?
5. What sources of information are analyzed with this software?
6. What training did you receive on the use of the software? Have you received any additional
"refresher" training or ongoing support on the use of the software?
7. What obstacles have you encountered in operating the software?
8. What positive impacts have you observed in relation to the use of the software?
9. What negative impacts have you observed in relation to the use of the software?

Technology implementation and impact

Social media

1. What social media platforms does you currently use to communicate and engage with the community?
2. Who is responsible for posting messages on behalf of your agency?
3. How to you post or distribute messages on behalf of the agency?
4. How many community members do your posts reach (e.g., how many followers or subscribers do you have)?
5. Do you have a policy stipulating what can and cannot be shared on social media sites on behalf of the agency?
6. Do you receive information from the community via social media? Please describe.
7. What social media platforms do you review for evidence of criminal activity or during the course of investigations?
8. What staff regular review social media for evidence of crimes or during the course of investigations?
9. What social media platforms do these staff review?
10. Do you collaborate with the District Attorney's Office on issues related to social media searches and documenting or capturing evidence acquired via social media?
11. Have you encountered any obstacles to using social media to pursue criminal investigations or identify criminal activity?

Technology implementation and impact

Regional/National information sharing programs (e.g., NLETS)

1. Why did your agency first acquire (or access) regional/national information sharing programs?
2. How were you involved with or informed of the decision to acquire (or access) and use regional/national information sharing programs?
3. Please describe the capabilities/functions of your regional/national information sharing programs.
4. What staff in your agency analyze data with this program? For what purposes?
5. What sources of information are analyzed with this program?
6. What training did you receive on the use of the program? Have you received any additional
 "refresher" training or ongoing support on the use of the
 program?
7. What obstacles have you encountered in operating the program?
8. What positive impacts have you observed in relation to the use of the program?
9. What negative impacts have you observed in relation to the use of the program?

Technology implementation and impact

RMS with CAD

1. Why did your agency first acquire the records management system with computer-aided dispatch?
2. How were you involved with or informed of the decision to acquire and implement the CAD-RMS?
3. Please describe the capabilities/ functions of your CAD-RMS.
4. What training did you receive on the use of the CAD-RMS? Have you received any additional “refresher” training or ongoing support on the use of the system?
5. What obstacles have you encountered in operating the CAD-RMS?
6. What positive impacts have you observed in relation to the use of the CAD-RMS?
7. What negative impacts have you observed in relation to the use of the CAD-RMS?

Decision-making related to technology acquisition

1. What resources do you have available to support technology acquisition, implementation, and maintenance?
2. In general, how does your agency decide what technologies to acquire? Who is involved in that decision-making process?
3. Does your agency have any staff or a group that is responsible for technology acquisition and/or implementation?

Technology implementation and impact

Next, we'd like to talk about your agency's experience acquiring and using certain technologies.

Body-worn cameras

4. Why did you decide to acquire body-worn cameras?
5. What agency performance measures or outcomes did you expect would be impacted by body-worn camera use? Have you seen an impact on any of those measures?
6. What lessons have you learned from the body-worn camera acquisition and implementation process that might be helpful to another agency considering them?
7. What are your future plans regarding body-worn cameras? For example, do you plan to acquire more?

Car cameras

8. Why did you decide to acquire car cameras?
9. What agency performance measures or outcomes did you expect would be impacted by car camera use? Have you seen an impact on any of those measures?
10. What lessons have you learned from the car camera acquisition and implementation process that might be helpful to another agency considering them?
11. What are your future plans regarding car cameras? For example, do you plan to acquire more?

License plate readers

12. Why did you decide to explore acquisition of license plate readers?
13. What processes did your agency use to explore the utility or functionality of license plate readers?
14. What factors drove your decision to acquire, delay, or not to acquire license plate readers?

Mobile biometric devices

15. Why did you decide to acquire mobile biometric devices?
16. What agency performance measures or outcomes did you expect would be impacted by mobile biometric devices use? Have you seen an impact on any of those measures?
17. What lessons have you learned from the mobile biometric devices acquisition and implementation process that might be helpful to another agency considering them?
18. What are your future plans regarding mobile biometric devices? For example, do you plan to acquire more?

Crime mapping / GIS

19. Why did you decide to acquire crime mapping/GIS software?
20. What agency performance measures or outcomes did you expect would be impacted by crime mapping/GIS software? Have you seen an impact on any of those measures?
21. What lessons have you learned from the crime mapping/GIS software acquisition and implementation process that might be helpful to another agency considering them?
22. What are your future plans regarding crime mapping/GIS software? For example, do you plan to upgrade the software or apply it to additional sources?

Software to aggregate and analyze large amounts of data from multiple sources

23. Why did you decide to acquire software to aggregate and analyze large amounts of data from multiple sources?
24. What agency performance measures or outcomes did you expect would be impacted by software to aggregate and analyze large amounts of data from multiple sources use? Have you seen an impact on any of those measures?
25. What lessons have you learned from the software to aggregate and analyze large amounts of data from multiple sources acquisition and implementation process that might be helpful to another agency considering them?
26. What are your future plans regarding software to aggregate and analyze large amounts of data from multiple sources? For example, do you plan to upgrade the software or apply it to additional sources?

Regional/ national information sharing systems (e.g., NLETS)

27. Why did you decide to acquire or access regional/national information sharing systems?
28. What agency performance measures or outcomes did you expect would be impacted by regional/ national information sharing systems? Have you seen an impact on any of those measures?
29. What lessons have you learned from the regional/national information sharing systems acquisition (or initial access) and implementation process (or ongoing use) that might be helpful to another agency considering them?
30. What are your future plans regarding regional/national information sharing systems? For example, do you plan to upgrade your access to the system or use it to meet additional information needs?

Social media

31. Do you have a strategy for communicating with the public via social media?
32. Do you receive information from the community via social media? Please describe.
33. What agency performance measures or outcomes did you expect would be impacted by your use of social media to communicate with the public?
34. Do staff regularly review social media for evidence of crimes or during the course of investigations?
35. What agency performance measures or outcomes did you expect would be impacted by your use of social media to identify and investigate crime?

CCTV with VCA

36. Why did you decide to acquire CCTV with VCA?
37. What agency performance measures or outcomes did you expect would be impacted by CCTV with VCA use? Have you seen an impact on any of those measures?
38. What lessons have you learned from the CCTV with VCA acquisition and implementation process that might be helpful to another agency considering them?

39. What are your future plans regarding CCTV with VCA? For example, do you plan to acquire more?

Unmet needs and emerging technologies

40. What technology has had the greatest impact on your law enforcement agency over the past 2-3 years? Please describe the impact and why the technology is so critical.

41. What technologies are you considering acquiring in the next 2-3 years?

Retain only for agencies that do not have one or both of the following technologies:

42. Have you considered acquiring license plate readers? Why or why not? If you have considered acquiring license plate readers, why haven't you acquired them? Do you plan to acquire them in the future?

43. Have you considered acquiring body worn cameras? Why or why not? If you have considered acquiring body worn cameras, why haven't you acquired them? Do you plan to acquire them in the future?

Agency mission and priorities

44. How would you describe your agency's mission or primary guiding strategy?

45. Outside of technology, what tools or resources are most critical to achieving your law enforcement mission?

46. What obstacles does your agency face on a regular basis in meeting its mission? What resources or solutions would help you to meet those needs?

47. How long have you been in this position?

48. Has there been turnover in leadership either within your agency or in jurisdictional governance that has affected your ability to identify, acquire and implement technology successfully? Are there any other contextual factors that have impacted your ability to identify, acquire, and implement technology successfully (e.g., budget constraints)?

Decision-making related to technology acquisition

1. What resources do you have available to support technology acquisition, implementation, and maintenance?
2. In general, how does your agency decide what technologies to acquire? Who is involved in that decision-making process?
3. Does your agency have any staff or a group that is responsible for technology acquisition and/or implementation?

Technology implementation and impact

Next, we'd like to talk about your agency's experience acquiring and using certain technologies.

Body-worn cameras

4. Please describe the process your agency used to select a vendor to provide the necessary equipment and support for the body-worn cameras and resulting videos. Looking back (and knowing what you know now), would you have done anything different?
5. How many patrol officers have been issued body-worn cameras?
6. What activities supported initial and ongoing use of the body-worn cameras?
7. Who is responsible for maintenance of the body-worn camera equipment? Have there been any unexpected costs for maintaining the equipment?
8. Who is responsible for storage and controlling access to the video files? Have there been any unexpected costs or obstacles related to video storage or access?
9. What agency performance measures or outcomes did you expect would be impacted by body-worn camera use? Have you seen an impact on any of those measures?
Measures might include:
 - Reductions in citizen complaints against officers
 - Faster disposition of complaints or issues surrounding citizen-officer interactions
 - Improved community perceptions of police legitimacy
 - Officers spending less time in court or other proceedings related to officer-citizen interactions
10. What lessons have you learned from the body-worn camera acquisition and implementation process that might be helpful to another agency considering them?
11. What are your future plans regarding body-worn cameras? For example, do you plan to acquire more?

Car cameras

12. Please describe the process your agency used to select a vendor to provide the necessary equipment and support for the car cameras and resulting videos. Looking back (and knowing what you know now), would you have done anything different?
13. How many patrol officers have car cameras installed in their vehicles?
14. What activities supported initial and ongoing use of the car cameras?
15. Who is responsible for maintenance of the car camera equipment? Have there been any unexpected costs for maintaining the equipment?
16. Who is responsible for storage and controlling access to the video files? Have there been any unexpected costs or obstacles related to video storage or access?

17. What agency performance measures or outcomes did you expect would be impacted by car camera use? Have you seen an impact on any of those measures? Measures might include:
- Reductions in citizen complaints against officers
 - Faster disposition of complaints or issues surrounding citizen-officer interactions
 - Improved community perceptions of police legitimacy
 - Officers spending less time in court or other proceedings related to officer-citizen interactions
18. What lessons have you learned from the car camera acquisition and implementation process that might be helpful to another agency considering them?
19. What are your future plans regarding car cameras? For example, do you plan to acquire more?

License plate readers

20. Please describe the process your agency used to select a vendor to provide the necessary equipment and support for the license plate readers. Looking back (and knowing what you know now), would you have done anything different?
21. How many mobile license plate readers have been issued? To what type of staff?
22. What activities supported initial and ongoing use of license plate readers?
23. Who is responsible for maintenance of the license plate readers? Have there been any unexpected costs for maintaining the equipment?
24. Who is responsible for storage and controlling access to the data generated by the license plate readers? Have there been any unexpected costs or obstacles related to license plate reader data storage or access?
25. What obstacles have you encountered during acquisition, implementation, or use of the license plate readers?
26. What agency performance measures or outcomes did you expect would be impacted by license plate reader use? Have you seen an impact on any of those measures?
27. What lessons have you learned from the license plate reader acquisition and implementation process that might be helpful to another agency considering them?
28. What are your future plans regarding license plate readers? For example, do you plan to acquire more?

Mobile biometric devices

29. Please describe the process your agency used to select a vendor to provide the necessary equipment and support for the mobile biometric devices. Looking back (and knowing what you know now), would you have done anything different?
30. How many mobile biometric devices have been issued? To what type of staff?
31. What activities supported initial and ongoing use of the mobile biometric devices?
32. Who is responsible for maintenance of the mobile biometric devices? Have there been any unexpected costs for maintaining the equipment?

33. Who is responsible for storage and controlling access to the biometric materials? Have there been any unexpected costs or obstacles related to biometric materials storage or access?
34. What obstacles have you encountered during acquisition, implementation, or use of the mobile biometric devices?
35. What agency performance measures or outcomes did you expect would be impacted by mobile biometric devices use? Have you seen an impact on any of those measures?
36. What lessons have you learned from the mobile biometric devices acquisition and implementation process that might be helpful to another agency considering them?
37. What are your future plans regarding mobile biometric devices? For example, do you plan to acquire more?

Software to aggregate and analyze large amounts of data from multiple sources

38. Please describe the process your agency used to select a vendor to provide the necessary equipment and support for the software to aggregate and analyze large amounts of data from multiple sources. Looking back (and knowing what you know now), would you have done anything different?
39. Please describe the capabilities/functions of your software to aggregate and analyze large amounts of data from multiple sources.
40. What staff in your agency analyze data with this software? For what purposes?
41. What sources of information are analyzed with this software?
42. What activities supported initial and ongoing use of the software to aggregate and analyze large amounts of data from multiple sources?
43. Who is responsible for maintenance of the software to aggregate and analyze large amounts of data from multiple sources? Have there been any unexpected costs for maintaining the equipment?
44. What agency performance measures or outcomes did you expect would be impacted by software to aggregate and analyze large amounts of data from multiple sources use? Have you seen an impact on any of those measures?
45. What lessons have you learned from the software to aggregate and analyze large amounts of data from multiple sources acquisition and implementation process that might be helpful to another agency considering them?
46. What are your future plans regarding software to aggregate and analyze large amounts of data from multiple sources? For example, do you plan to upgrade the software or apply it to additional sources?

Crime mapping/GIS

47. Please describe the process your agency used to select a vendor to provide the necessary equipment and support for the crime mapping/GIS software. Looking back (and knowing what you know now), would you have done anything different?
48. Please describe the capabilities/functions of your crime mapping/GIS software.

49. What staff in your agency analyze data with this software? For what purposes?
 50. What sources of information are analyzed with this software?
 51. What activities supported initial and ongoing use of the crime mapping/GIS software?
 52. Who is responsible for maintenance of the crime mapping/GIS software? Have there been any unexpected costs for maintaining the equipment?
 53. What agency performance measures or outcomes did you expect would be impacted by crime mapping/GIS software? Have you seen an impact on any of those measures?
 54. What lessons have you learned from the crime mapping/GIS software acquisition and implementation process that might be helpful to another agency considering them?
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55. What are your future plans regarding crime mapping/GIS software? For example, do you plan to upgrade the software or apply it to additional sources?

Regional/ national information sharing systems (e.g., NLETS)

56. Please describe the process your agency used to select a vendor to provide the necessary equipment and support for the regional/national information sharing systems. Looking back (and knowing what you know now), would you have done anything different?
57. Please describe the capabilities/functions of your regional/national information sharing systems.
58. What staff in your agency analyze data with these systems? For what purposes?
59. What sources of information are analyzed with these systems?
60. What activities supported initial and ongoing use of the regional/national information sharing systems?
61. Who is responsible for maintenance of the regional/national information sharing systems? Have there been any unexpected costs for maintaining the equipment?
62. What agency performance measures or outcomes did you expect would be impacted by regional/national information sharing systems? Have you seen an impact on any of those measures?
63. What lessons have you learned from the regional/national information sharing systems acquisition and implementation process that might be helpful to another agency considering them?
64. What are your future plans regarding regional/national information sharing systems? For example, do you plan to upgrade the software or apply it to additional sources?

Social media

65. Do you have a strategy for communicating with the public via social media?
66. What social media platforms does your agency currently use to communicate and engage with the community?

67. Who is responsible for posting messages on behalf of your agency?
68. How many community members do your posts reach (e.g., how many followers or subscribers do you have)?
69. Do you have a policy stipulating what can and cannot be shared by agency staff on social media sites on behalf of the agency? As a private citizen?
70. Do you receive information from the community via social media? Please describe.

71. What agency performance measures or outcomes did you expect would be impacted by your use of social media to communicate with the public?
72. What social media platforms does your agency review for evidence of criminal activity or during the course of investigations?
73. What staff regularly review social media for evidence of crimes or during the course of investigations?
74. Have you encountered any obstacles to using social media to pursue criminal investigations or identify criminal activity?
75. What agency performance measures or outcomes did you expect would be impacted by your use of social media to identify and investigate crime?

CCTV with VCA

76. Please describe the process your agency used to select a vendor to provide the necessary equipment and support for the CCTV with VCA. Looking back (and knowing what you know now), would you have done anything different?
77. How many CCTV systems does your agency conduct VCA with? In what types of locations are these CCTV systems installed?
78. What activities supported initial and ongoing use of CCTV with VCA?
79. Who is responsible for maintenance of the CCTV with VCA? Have there been any unexpected costs for maintaining the equipment?
80. Who is responsible for storage and controlling access to the data or video files generated by the CCTV with VCA? Have there been any unexpected costs or obstacles related to license plate reader data storage or access?
81. What obstacles have you encountered during acquisition, implementation, or use of the CCTV with VCA?
82. What agency performance measures or outcomes did you expect would be impacted by CCTV with VCA use? Have you seen an impact on any of those measures?
83. What lessons have you learned from the CCTV with VCA acquisition and implementation process that might be helpful to another agency considering them?
84. What are your future plans regarding CCTV with VCA? For example, do you plan to acquire more?

RMS with CAD

85. Why did your agency first acquire the records management system with computer-aided dispatch?
86. Please describe the process your agency used to explore various CAD-RMS vendors and functionalities.
87. Please describe the capabilities/functions of your CAD-RMS.
88. What obstacles have you encountered in implementing or operating the CAD-RMS?
89. What positive impacts have you observed in relation to the use of the CAD-RMS?
90. What negative impacts have you observed in relation to the use of the CAD-RMS?

Unmet needs and emerging technologies

91. What technology has had the greatest impact on your law enforcement agency over the past 2-3 years? Please describe the impact and why the technology is so critical.
92. What technologies are you considering acquiring in the next 2-3 years?

Retain only for agencies that do not have one or both of the following technologies:

93. Have you considered acquiring license plate readers? Why or why not? If you have considered acquiring license plate readers, why haven't you acquired them? Do you plan to acquire them in the future?
94. Have you considered acquiring body worn cameras? Why or why not? If you have considered acquiring body worn cameras, why haven't you acquired them? Do you plan to acquire them in the future?