Police Department Investments in Information Technology Systems

Challenges Assessing Their Payoff

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Key Findings

- The potential effects of information technology (IT) systems on police productivity will be driven, in part, by the match between the technology and police activities. In modern policing, how information is used for reactive response to incidents is significantly different from proactive and community-policing activities, so we expect the effects of IT to be quite different. The authors developed a logic model of police functions to guide examination of the different expected effects of IT on productivity.
- The logic model helped guide a statistical analysis in an effort to identify productivity and budgetary effects of different IT investments in police departments. However, even the best available data were insufficient to break down police agencies' use of the technology at a sufficient level of granularity to provide meaningful results.
- Future efforts to assess the effects of IT systems on law enforcement performance can benefit from the results of the logic modeling and exploratory analysis. Specifically, it is important to collect data not just on department acquisition of IT systems, but also on how the systems are used and the activities that the use is intended to support. In considering potential productivity improvement from IT use, analysts need ways to measure relative levels of effort devoted to different police functions because the role of IT as a force multiplier means that its benefits will be driven, in part, by the force available to multiply.

In the wake of the economic downturn that began in 2007 and 2008, public service providers, including police departments, were asked to tighten their financial belts and, in some instances, do more with less. Available evidence—primarily survey and interview data—shows that cuts at some departments over the last several years have been substantial, sometimes reaching double digit percentages of the departments' annual budgets (Police Executive Research Forum [PERF], 2010; U.S. Department of Justice [DOJ], 2011).

A small number of focused analyses have examined the nature and effects of these budget cuts, aiming both to document the range of changes that have been made at different departments and to help guide practitioners as they consider making cuts in their own budgets (Irwin, 2011; Gascón and Foglesong, 2010; PERF, 2010; Wiseman, 2011). The available data suggest that a considerable share of departments have cut spending in personnel, services, and technology (PERF, 2010; DOJ, 2011).[1]

The data also indicate heterogeneity in the ways that departments have addressed fiscal pressures. In many cases, due to the large shares of police budgets devoted to personnel, uniformed officers have been cut through layoffs, furlough, or attrition (DOJ, 2011), and in other cases, training and other nonwage expenses have been cut to preserve personnel. Cuts have also led to changes in policing strategies. Some departments, seeking to preserve emergency response capabilities, have jettisoned special units and community-oriented and other proactive policing activities and have returned to something that looks more like a traditional reactive policing model (PERF, 2010).

[1] See also PERF, 2009; Gascón and Foglesong, 2010; Wiseman, 2011; and Irwin, 2011.

Whereas some departments have cut their information technology (IT) investments and staffing as a way to preserve sworn officers, others have increased their investments in IT, believing that it can serve as a *force multiplier*, increasing the efficiency and effectiveness of the department (DOJ, 2011). IT has become increasingly integrated into modern police organizations, driven by its potential to improve the effectiveness of operations and generate cost savings. Data collected in 2007 (the most recent year available) showed significant increases in the use of computers by law enforcement departments nationwide over the preceding decade (Reaves, 2010). These included records management, dispatch, crime investigation, personnel records, information sharing, fleet management, automated booking, and resource allocation systems (Reaves, 2010).

Furthermore, the experience of individual departments suggests the potential for significant productivity gains from IT. For example, departments are experimenting with new ways for officers to access and produce records in the field, with many—for instance, Redlands, California, and Washington, D.C., Metro—now making a shift from laptops installed in cars to smartphones and tablets that officers can use outside their vehicles. According to Redlands Chief Mark Garcia (Garcia, 2013), deploying mobile devices has been a particularly effective means for increasing police efficiency:

- Combined with new applications developed for the department, these devices allow officers to file reports from the field, reducing their office and drive time.
- In the past, when a child or an elderly dementia patient was lost, officers would collect a picture and drive it to the station, where it would be copied in black and white on paper and would then be slowly disseminated to all officers. Now, the officer photographs the picture with his phone and sends it to everyone in the department. What used to take a minimum of hours now takes minutes, and this has resulted in rapid recovery of lost family members.
- Previously, neither store owners nor officers knew how to download video from most closed-circuit televisions (CCTVs) in stores, meaning that it took hours or longer to disseminate images of crimes and criminals. Now, officers use their phones to record the video displays and can relay those images immediately.

Such novel applications, enabled by rapid recent advances in mobile IT in particular, highlight the potential for productivity gains from allowing officers to carry out tasks in the field or remotely that otherwise would have required travel time to department facilities.

Particularly as budgets tighten, departments might need to make trade-offs between acquiring and maintaining technology and dedicating resources to other purposes. Moreover, the other purposes, such as technical training, might play a part in determining IT's usefulness. Although costly in its own right, IT might provide departments with a means of augmenting operational capabilities and reducing costs without a loss—and perhaps with some gain—of capability, but under what conditions?

The trade-offs among personnel, technology, and costs are not straightforward. IT may be complementary to other resources or may serve as a substitute. In some cases, IT use occurs with or depends on the actions of officers or other personnel, as in the case of mobile data terminals in vehicles. In others, IT can serve functions that previously required human intervention (e.g., fixed-site speed monitoring systems and license plate readers can perform traffic duties) or replace some employee roles (e.g., electronic report systems eliminate the need for clerks to enter data from handwritten reports). For some types of IT and analytics, the value of a technology is tied inherently to adopting a specific policing approach, such as the management process CompStat, hotspot policing, and crime mapping (Manning, 2001; Garicano and Heaton, 2010).

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With this report, we explore the rationale and evidence supporting the idea that IT investments can increase efficiency and can do so cost-effectively. We start with a general, descriptive discussion of the ways in which IT can be used in law enforcement activities and consider recent trends in use. Next, we review the analytical literature on IT use. Taking a broad view, we look to studies of the economy, public administration, and policing for insight. Then, we develop a detailed schematic model—specifically, a logic model—to characterize the

operations of a representative police department. This approach enables us to flesh out the means by which IT could influence operations (and, hence, effectiveness and costs), recognizing that relationships with institutional partners, stakeholders, customers, and other external factors can shape effects. This process of breaking apart the different functions and activities provides a way to better understand the existing literature, identify its shortcomings, and determine productive paths forward and to inform law enforcement executives in making IT decisions.

POLICE USE OF INFORMATION TECHNOLOGY

To do their jobs effectively, law enforcement professionals at all levels depend on information. According to Brown (2001, p. 352), "by some accounts, roughly 92% of an officer's time is spent acquiring, coalescing, or distributing information in one form or another." While exact estimates of such percentages are difficult to make, access to and use of accurate and timely information is clearly critical to effective law enforcement. Even in traditional approaches to policing, responses to calls for service and decisions on whether to detain individuals require access to the right data to ensure that actions are appropriate. More sophisticated policing approaches pursued by many law enforcement organizations are even more information intensive and dependent. They involve not just information on crimes and perpetrators, but also data on community conditions, priorities, and other factors that could shape collaborative approaches to crime prevention and response. Predictive policing, hotspot policing, CompStat, community-oriented policing, and problem-oriented policing all entail new information management and analysis challenges that departments have been investing in over the past decade or more (Brown and Brudney, 2003; Perry et al., 2013).

Data from the most recent (2007) Survey of State and Local Law Enforcement Agencies (the Law Enforcement Management and Administrative Statistics [LEMAS] reported in Reaves, 2010) suggest that many police departments, especially those serving medium-to-large communities, had already turned to IT as an administrative and analytical tool by the onset of the economic downturn. For example, by 2007, more than 80 percent of all departments serving populations of 50,000 or more had used computers for records management, dispatch, crime investigation, crime analysis, and crime mapping (Reaves, 2010).

Among smaller departments, adoption of IT systems was less ubiquitous by 2007. For instance, only 21 percent of the smallest departments (those serving fewer than 2,500 people) used IT for crime analysis, compared with 100 percent of the largest (those serving more than 1 million people) (Reaves, 2010). A similar divergence existed for the use of computer-aided dispatch (23 percent compared with 100 percent). An even greater divergence was observed in the case of hotspot identification (5 percent compared with 92 percent). By contrast, the difference between the smallest and largest departments was much less striking for records management (65 percent compared with 85 percent).

Such differences are consistent with understandings of technology adoption, where such factors as organizational resources affect organizations' ability to acquire and use new technology, and they also logically mesh with the benefits one might expect from IT. The size and complexity of the area that a law enforcement organization protects will presumably shape the value of computerized hotspot identification—which could be a more difficult analytic task for a large, densely populated jurisdiction than for a smaller, less complex one. In the latter case, there may simply be less to gain from using IT to perform the task.

Since the LEMAS survey was conducted, studies have examined several smaller samples of police departments to explore the effect of the fiscal environment on law enforcement organizations and their use of IT.

In late 2008, in partnership with PERF, Lockheed Martin surveyed departments about a broad set of technology issues. During that period at the beginning of the financial crisis, IT ranked high among the projected operational needs of law enforcement over the three- to five-year time frame. IT database integration ranked first, followed by crime analysis and information-led policing (Koper, Taylor, and Kubu, 2009, p. 37). Despite the prevailing economic circumstances at the time, respondents to their survey still planned to pursue new technologies, the majority of which can be classified as IT: "[C]ommonly mentioned plans for acquiring or updating technology involved records management systems, computer-aided dispatch, communications, mobile field devices and capabilities, video devices, crime analysis, and information sharing technology" (Koper, Taylor, and Kubu, 2009, p. 46).

A later survey effort, also led by PERF (2010), explored the nature of the cuts that departments faced and—although not examining IT issues in depth—explored views about technology in that fiscal context. In contrast to the plans to acquire new technologies expressed in the results of Lockheed

Martin and PERF two years before (Koper, Taylor, and Kubu, 2009), leaders expressed a desire to preserve staff over technology—with 80 percent of their respondents indicating that they would not cut sworn officer positions to make it possible to maintain equipment or technology acquisition or operations and maintenance (PERF, 2010, p. 3). Indeed, more than half reported reducing or eliminating new technology programs.

Looking across these surveys and other available data, DOJ issued a report documenting both the broad trends in policing cuts and the issue of technology (DOJ, 2011). In this context, DOJ documented examples of IT acting as a substitute for limited police officers and other personnel, with an increase in telephone reporting of crime (p. 20), use of CCTV and light-based intervention systems to replace officers in some contexts (p. 26), systems to improve resource management and allow fewer cars to respond to calls effectively by better managing vehicle locations (p. 27), and use of social media as a low-cost way of communicating with the public (p. 27). Video conferencing was also highlighted as a form of information and communication technology that reduced the time required for officers to appear at hearings and even substituted for physically transporting inmates to judicial proceedings (pp. 27–28). Survey data also indicated cutbacks both in plans to acquire technology and in training (p. 21). For IT, training reductions are of potential concern, given the need for expertise in using systems to realize their full benefits in efficiency and effectiveness.

DOES USE OF INFORMATION TECHNOLOGY IMPROVE POLICE PRODUCTIVITY?

In 1987, prior to receiving the Nobel Prize in economics, Robert Solow laid down an empirical gauntlet, when, in commenting in a book review on Stephen S. Cohen and John Zysman's *Manufacturing Matters*, he observed, "You can see the computer age everywhere but in the productivity statistics."[2] Solow's observation helped add new momentum to a longstanding debate on the *productivity paradox*, a term documented by Brynjolfsson (1993) in the article "The Productivity Paradox of Information Technology: Review and Assessment." In framing the paradox, the author describes, on the one hand, the extraordinary rise in computing power in the U.S. economy and, on the other hand, the stagnation of productivity, especially in the services sector.

[2] The original source of the quotation is Solow (1987).

In the years following Solow's observation, the academic and policy communities performed many studies seeking to identify the economic effects of IT. Initially, the studies focused on conventional—and typically broad—measures of economy-wide and information-worker productivity (see, for example, Brynjolfsson, 1993; Jorgenson, 2001); however, over time, they turned to more detailed industry-level and firm-level data.[3]

Whereas many of the initial efforts to identify the economic effects of IT came up empty, fueling perceptions of a paradox, increasingly detailed industry- and firm-level analyses eventually identified not just the presence of IT effects in the productivity statistics but a role—or roles—for computers in the economy.

Brynjolfsson (1993) offered four possible reasons for the indiscernibility of a productivity effect in the early studies: (1) mismeasurement of outputs and inputs, (2) lags caused by learning and adjustment, (3) redistribution and dissipation of profits, and (4) mismanagement of information and technology. He noted, "The first two explanations point to shortcomings in research, not practice, as the root of the productivity paradox," whereas the latter two suggest not just the statistical appearance of a productivity paradox, but the underlying reality. On balance, Brynjolfsson concluded, "After reviewing and assessing the research to date, it appears that the shortfall of IT productivity is as much due to deficiencies in our measurement and methodological tool kit as to mismanagement by developers and users of IT." Many of the studies that followed his review and assessment have, more or less effectively, attempted to address these deficiencies.

Broadly speaking, the literature tells a story about the role of IT in the economy, writ large, and in different kinds of institutional settings. Notwithstanding the initial failures to identify productivity effects, the increasingly detailed industry- and firm-level studies suggest that computers can bolster productivity and, in some instances, substitute for other inputs, including certain forms of labor.[4] They also suggest that the nature and

[3] See, for example, Aral, Brynjolfsson, and Van Alstyne, 2012; Bartel, Ichniowski, and Shaw, 2007; Breshnahan, Brynjolfsson, and Hitt, 2002; Brynjolfsson, 1993; Brynjolfsson and Hitt, 1995; Brynjolfsson and Hitt, 1996; Brynjolfsson and Hitt, 2000; Brynjolfsson, Hitt, and Kim, 2011; Chari, Devaraj, and David, 2008; Dewan and Min, 1997; Lehr and Lichtenberg, 1999; Lichtenberg, 1995; Morrison, 1997; Santhaman and Hartono, 2003; Tambe, Hitt, and Brynjolfsson, 2012.

[4] Although less frequently cited than the initial claim of a technology paradox, Louis Uchitelle (2000) reports that Solow eventually reversed his position on the invisibility of the economic contribution of computers, when Solow noted in an interview, "You can now see computers in the productivity statistics." (Uchitelle refers to an interview with Solow that had occurred a week earlier.)

extent of computers' effects will depend crucially on how they are used and by whom. In addition, they imply that a statistical model needs to account for at least some of the differences among uses and users if it is to capture the effects of IT.

A smaller set of literature has specifically examined the productivity effects of IT on police departments (e.g., Chan, 2001). Most often, it has examined the effects of individual products or systems on policing outcomes. For instance, several studies have assessed the productivity effects of mobile computers in police cars (e.g., Ioimo and Aronson, 2004; Nunn and Quinet, 2002; Nunn, 1993; Pilant, 1999) and found little evidence that mobile laptop connectivity enhanced police performance. Danziger and Kraemer (1985) found correlations between detective productivity and use of computers. Much of this literature focuses on productivity improvements in just one department or one section of one department. In addition, relatively weak study designs make the contradictory findings across studies difficult to interpret.[5]

More recently, Garicano and Heaton (2010) examined IT effects on police productivity across agencies and police activities, using techniques that evaluate productivity effects at the economy, industry, and firm levels. Using LEMAS data from 1987 to 2003, they found no simple association between department investments in IT and improvements in clearance rates, crime rates, or other productivity measures. However, when organizational characteristics and management practices are included in the analysis, they did find expected productivity effects. For instance, departments that had more specialization in police functions and those demanding employees with higher skill levels saw significant productivity benefits, such as a 5-percent lower crime rate than comparable departments that had fewer specialized units and lower skill requirements. Similarly, departments that adopted management practices consistent with the use of CompStat had markedly lower crime rates than otherwise comparable departments. This finding suggests a relationship between IT and its use that may be intuitive to practitioners directly involved in deploying and using these systems—that IT has the potential to affect police productivity in complex ways, and the match between its availability and how it is actually used will drive outcomes.

Echoing the findings on IT and the broader economy, what is known about IT and policing also suggests a need for better measurement to inform both individual departments' assessments of their IT investments and judgments about the value of IT in policing writ large (see Bureau of Justice Assistance, undated). Efforts to link IT investments to reductions in crime capture one desired outcome for police forces but ignore other goals—such as improved community relationships with police and reduced fear of crime, which are the focus of some community-policing initiatives.

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Similarly, some administrative data sources in police departments do not capture all the information needed to see the full effects of a new IT system. For example, an IT system might reduce the time required for an officer to carry out functions like report writing or communications, but unless administrative data captures what that time is being used for, the effect may not be detected. If extra time is spent on such readily quantifiable activities as increasing numbers of arrests, the IT system will appear to increase productivity. But if the time goes into interacting with the public or other community intervention activities for which no incidental records are generated, then the system may appear to have no value at all. Furthermore, if IT systems require users to climb a learning curve or if changes in management or organizational practices are needed before benefits will accrue, then the lags and additional investments required must be assessed.[6] As a result, understanding IT as a component of policing requires both identifying the range of ways it can contribute to different police goals and determining effective ways to measure those varied contributions.

[5] Jackson (2014) reviews the literature on measuring outcomes of information sharing, an area distinct from but intimately connected to IT.

[6] These complications affect the assessment of IT in other sectors as well. For example, see Jones et al., 2012, for a discussion of IT use in health care delivery.

CONSIDERING INFORMATION TECHNOLOGY'S POTENTIAL EFFECTS ON POLICE PRODUCTIVITY

Demonstrating that increases in efficiency or effectiveness from IT could be at least a partial answer to recent resource constraints in law enforcement requires rigorous demonstration of IT's benefits—ideally, by measuring a true return on investment for the funds expended to acquire and use the IT systems and tools. As described, however, existing literature is limited in clearly demonstrating productivity gains. This situation is not dissimilar from the broader literature on IT and productivity, so approaching the problem as Brynjolfsson (1993) did—viewing the problem as, first and foremost, a measurement challenge—is useful. The same challenges of effective measurement, learning lags, redistribution of the benefits of IT, and management issues could affect the ability to tease out the effects of these systems on police performance.

Given that the effect of IT depends both on law enforcement agencies having the technology *and* on how they are using it, we believe that a potential explanation for the limited evidence to date for IT's benefits in policing could come from a combination of the challenges Brynjolfsson identified; a first step to addressing them is better mapping out the contributions to policing. Doing so recognizes that police agencies do many different things in pursuit of their public safety mission, and the way IT can contribute to them could differ considerably. We approach this challenge by seeking to break apart those different activities in order to better link IT to what departments are seeking to accomplish.

We do that by developing a logic model that explicitly characterizes our underlying assumptions about the relationships between IT use, policing activities, and mission attainment. The model visually depicts our theory about how various inputs (including IT systems) contribute to producing the outputs and outcomes that police generally strive to achieve. The goal in developing the logic model is to look at a police department's overall daily activities and efforts and to try to distinguish activities that might be affected by IT in different ways.[7]

Our approach to logic modeling draws heavily from the work of Greenfield, Williams, and Eiseman (2006); Greenfield, Willis, and LaTourrette (2012); and Williams et al. (2009).[8] They employ a framework that takes the mission of a program or organization as a foundation and then charts the path from inputs to activities and outputs and, eventually, to outcomes. In effect, the mission statement serves as a guide—or aim point—in developing the program or organization's logic model. We also draw on others' efforts to define measures and metrics for policing and police IT (e.g., Geerken, 2008; Davis, 2012; Moore and Braga, 2003; and Groff and McEwen, 2008).

Absent a universally applicable mission statement for policing programs or organizations, we turned to readily obtainable, real-life examples—a convenience sample—to develop an archetypical statement. Specifically, we looked at the first page of results from an Internet search on *mission statement police department*. On that page, we found links to ten police departments and their associated mission statements, which we then parsed thematically. Commonalities emerged from these ten statements, and we summarized them as follows: "To improve quality of life by protecting life and property; detecting, solving, and reducing crime; reducing fear of crime; and enhancing safety and security in cooperation with citizens and community." The summary statement pulls out key terms from the examples that could directly affect the development of a department's strategy and the conduct of its operations. See p. 10 for a detailed look at how we developed our representative mission statement.

The various activities police departments engage in can be organized or conceptualized in many ways. However, because we wish to differentiate activities supported by different types of IT, we have chosen for this logic model a taxonomy of police functions close to that suggested by Hoey (1998), who distinguished between support services (where IT systems would be used—for instance, for managing personnel data and finances), service delivery (for instance, for surveillance and case management), and strategy. In the latter category, Hoey included crime analyses and other approaches to proactively managing the force.

Our similar conceptualization of police functions refines Hoey's three functions to better distinguish between the types of IT systems used by police, which Nogala (1995) described as falling into five of seven policing technology categories: surveillance and detection, identification, information processing,

[7] In economic parlance, the logic model serves as a schematic representation of a representative department's *production function*, within which IT plays a part or parts.

[8] For additional insight to this approach and examples of other approaches, see also W. K. Kellogg Foundation, 2004; University of Wisconsin-Extension, 2003; Weiss, 1972; McLaughlin and Jordan, 1999; and Wholey, Hatry, and Newcomer, 2010.

communication, and organization and administrative. Thus, our conceptualization considers three broadly defined areas:

- *Support* functions, including communication, coordination, administrative, and oversight functions, such as dispatch, personnel management, surveillance, and in-service training. Specific types of IT investments hypothesized to support these functions include:
  - *Administrative systems*, including records management
  - *Communications systems*, including computer-aided dispatch systems and in-car mobile data terminals
  - *Surveillance systems*, including CCTV and gunshot detection systems.
- *Reactive policing* functions, including responding to citizens' calls for service, responding to emergencies, and conducting investigations. Specific types of related IT investments included systems intended to help law enforcement with *crime investigations*, such as the agency having ownership of an Integrated Automated Fingerprint Identification System terminal.
- *Proactive policing* functions, including intelligence-driven operations, such as hotspot patrols, community-oriented engagement, and extramural integration (collaboration, coordination, and data sharing with other federal and state agencies, businesses, and partner organizations). Specific types of IT investments hypothesized to support these functions include:
  - *Intelligence systems*, including hotspot analysis and crime mapping systems
  - *Community systems*, such as systems for community problem analysis
  - *Extramural systems*, such as gateways to exchange data with other jurisdictions and state, regional, and federal repositories.

These three categories reflect key distinctions between reactive and proactive strategies in current police practice, while keeping separate the common supporting functions that are necessary for general departmental functions and that could therefore contribute to policing activities independent of strategy.

Across these functions, police departments can use IT to collect and analyze information, to manage information, and to deliver information to the people and audiences who need it. For example, for support functions, a police department could use personnel and budget management software, electronic report submissions from mobile data terminals, problem officer detection systems, automated dispatch, case and record management systems, and virtual training. Previous examinations of the use of IT across tasks in these arenas have identified a range of *potential* benefits, including improving the effectiveness of officers in the field, improving data quality in department records, reducing the need for some types of workload, better officer safety from delivery of information on calls or locations en route, and improvements in response times (Groff and McEwen, 2008).

The figure on the following page lays out our policing logic model, using support, reactive, and proactive policing activities as the core policing functions of interest. In the first set of boxes, we list a range of possible policing inputs, categorized as either production or planning inputs, depending on how they are intended to be used. We think of planning inputs as those drawn into decisions about allocating resources to activities. As a practical matter, it may be difficult to draw clear distinctions in either a box or real life. For example, some types of human resources and physical infrastructure are used in day-to-day operations and planning processes, but for simplicity's sake, we have framed all human resources (by type of personnel and their qualifications) and physical infrastructure (including IT) as production inputs. Similarly, information found in data, findings, files, reports, and records can have a seemingly dual function by factoring into both day-to-day operations and planning processes. So, to avoid complexity, we depict information as a planning input and then depict the incorporation of information into day-to-day operations through various feedback channels in later steps of the model.

For each of the three sets of policing activities, we specify a corresponding set of outputs. Note that there is some overlap among them: Both reactive and proactive policing can produce

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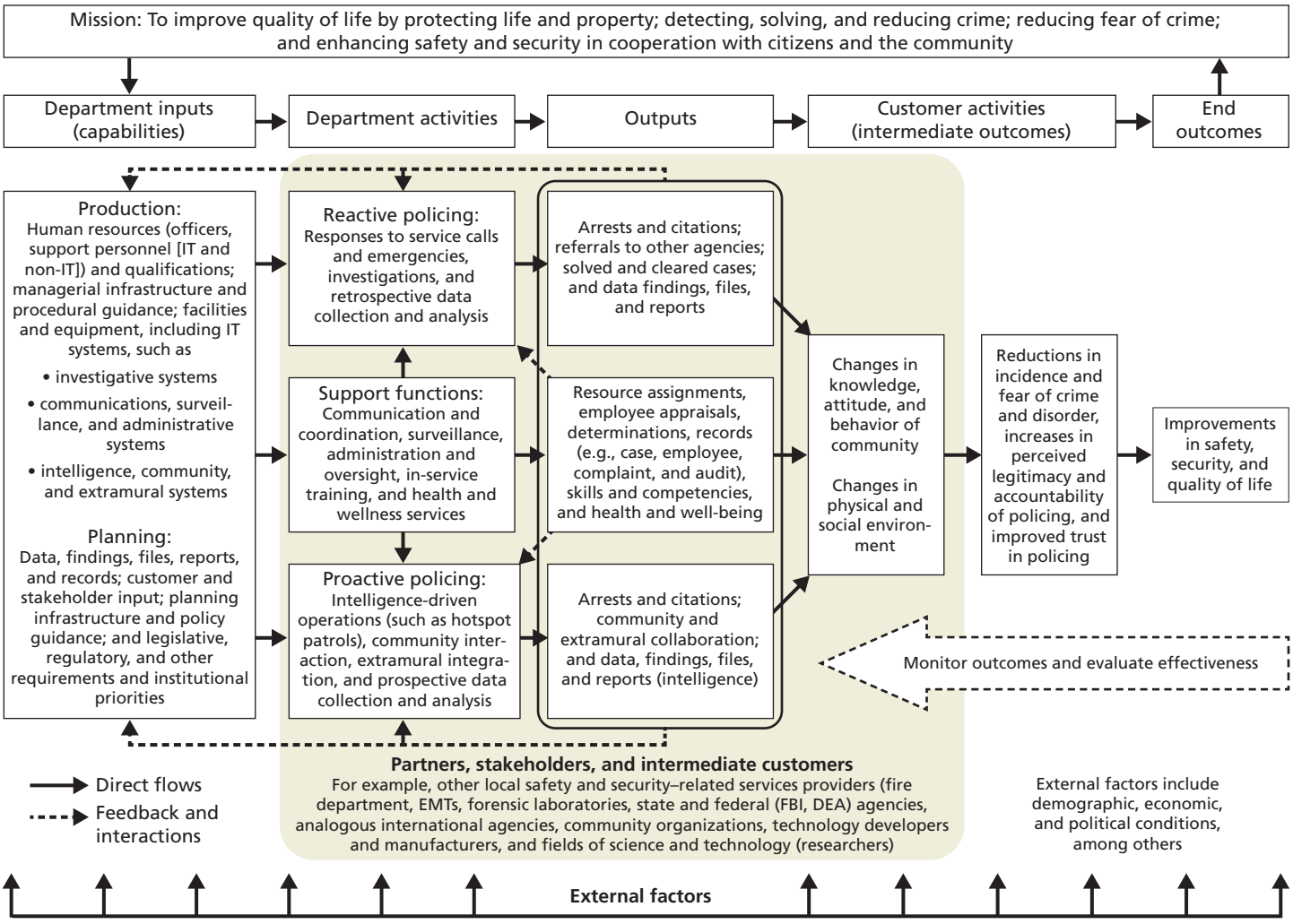
Operations of the Representative Police Department



NOTE: Solid lines indicate direct connections and flows between steps in the process, while dotted lines indicate feedback between the results of efforts (including intermediate steps in the process and efforts monitoring the overall effectiveness and outcomes of law enforcement efforts) and subsequent planning and activities. The green box denotes parts of the process where partners, stakeholders, and intermediate customers interact with the department processes.
EMT = emergency medical technician; FBI = Federal Bureau of Investigation; DEA = Drug Enforcement Administration.

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arrests, citations, data, findings, files, and reports. Moreover, in some instances, only a fine, grammatical line separates an activity from its output. For example, we treat collaboration as an output of community interaction and extramural integration. The utility and benefits of outputs can flow backward through the system through feedback channels and forward through their effects on customer activities.[9] (In the model, *customer* refers to the public that the department seeks to protect.) Supportive outputs can, by definition, contribute to proactive and reactive policing activities; moreover, reactive and proactive outputs, such as those providing information on past crimes and pointing to the potential for future crime, can be reincorporated in reactive and proactive policing activities.

The last two sections of the model depict, albeit in less detail, the customer activities and intermediate outcomes that could ultimately support the department's mission. As we proceed to the right of the model, the department can be expected to have less and less control over how events unfold; nevertheless, we suggest the possibility of monitoring and evaluation, even in this region, as means of strengthening the policing system. Speaking to issues of control, we depict the roles of partners, stakeholders, and intermediate customers and the interventions of additional external factors—such as demographic, economic, and political conditions—in shaping effects.

[9] Note that not every conceivable feedback interaction is included, but rather major feedbacks showing how interactions between different types of activities (and therefore different applications of police IT) could affect others.

DISCUSSION

The motivation in developing the logic model was to break apart the activities that a police department might undertake in order to identify potential effects of IT on department operations. In each of the model's three classes, the effects of IT could be quite different. In the support category, one would expect the effects of many IT interventions (e.g., improved scheduling systems or software) to have largely intermediate effects inside the organization, and the *profits* (to use Brynjolfsson's term) of those changes might be dissipated before there was an opportunity to see an effect in the outputs and outcomes. In any case, the first place to look for such effects would be in the productivity of individuals who work most closely with the systems, rather than in the performance of the officer on the street. However, communications and coordination IT systems—including information-sharing efforts—would have a broader reach and might be expected to affect the outputs and outcomes produced by the officers who use them (Jackson, 2014).

For IT supporting both reactive and proactive policing strategies, looking for potential outcomes should be guided by how IT matches the needs of those activities—and whether the department is actively carrying out those activities. For reactive policing, this is less of a concern because virtually all law enforcement departments devote a significant portion of their time and resources to answering calls for service and responding to the needs of the populations they protect. As a result, we would expect reactive policing outcomes to be affected by IT that had the potential to improve the speed and effectiveness of such activities as responding to calls for service, but not by IT capabilities aimed at strategies that are more proactive in nature (such as IT supporting crime hotspot identification). This same argument can be made in reverse for proactive policing outcomes. We would expect IT tools that are well matched to proactive strategies (such as hotspot tools and IT-based community interaction tools that could inform problem-oriented policing strategies) to be beneficial to officers engaged in those strategies, whereas we would not expect that of IT that is ill suited to proactive strategies (such as computer-aided dispatch designed to increase the efficiency of allocating officers to calls).

As a result, better evaluation of IT in law enforcement agencies is not just about matching IT tools to tasks; it must also consider whether the department or departments being evaluated are actually undertaking particular tasks. In the literature, Garicano and Heaton (2010) made a similar point in their analysis that saw an effect of IT investments on productivity only when a variable seeking to represent departments' use of CompStat was included. We view this issue on a more basic level—that the value of the IT investments a department makes depends on whether it is carrying out the activities those tools are intended to assist. This is most easily illustrated for proactive policing techniques: IT-based community interaction tools might be valuable for a department deeply involved in community policing, but for a department that, either by strategic choice or simply because of resource constraints, only engages in reactive answering of calls for service, such an investment would be a waste of scarce resources. As a result, the logic model provides a means not just to break apart activities by the different potential effects of IT on their outcomes, but also to determine whether benefits would even be expected from particular IT investments, given departmental strategies and officer allocation decisions.

The lessons from such a logic model can be applied to the full range of approaches for evaluating IT in police departments—from better informing the collection of anecdotal evidence (like the success story included in the introduction to this report) to efforts to assess changes in workload with new systems, before and after comparisons when new systems are implemented, and even case and control studies seeking to compare outcomes across departments or department components that have access to different technologies. The potential complementarities between IT (and other) inputs shown in the logic model and the need to capture the match between the IT tools and departments' actual activities are important to reflect in these analysis and modeling efforts to avoid significantly understating the perceived value of IT (that is, by measuring its effect on activities that it should not be expected to benefit). Lack of clear links—and understanding of department IT investments—could lead to overstating the effects of IT if the

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Developing a Representative Police Agency Mission Statement

To develop a representative police agency mission statement, we reviewed a set of nonrandomly selected mission statements. Specifically, we looked at the first page of results from an Internet search on *mission statement police department*. Common themes emerged (see table), leading us to develop the following archetypal mission statement: "To improve quality of life by protecting life and property; detecting, solving, and reducing crime; reducing fear of crime; and enhancing safety in cooperation with community."

Below are the mission statements that we selected to review, by department. All statements were originally accessed on July 10, 2012, and the URLs were rechecked on August 21, 2014. Common themes that we incorporated into the archetypal mission statement are shown in bold.

- Buffalo Police Department: "The primary mission of the Buffalo Police Department is **to improve the quality of life** in the City of Buffalo. This goal will only be accomplished through the cooperative effort of the Police Department and the community. **By working together we can maintain the peace, provide safety and security for our citizens, reduce the fear of crime and solve problems**. To be successful in our mission requires the commitment of the Administration, every employee of this Department and the citizens of our City, all working together to maintain the Buffalo Police tradition as a trusted source of help." (http://www.bpdny.org/Home/About/Mission)
- Houston Police Department: "The mission of the Houston Police Department is **to enhance the quality of life in the City of Houston by working cooperatively with the public and within the framework of the U.S. Constitution to enforce the laws, preserve the peace, reduce fear and provide for a safe environment**." (http://www.houstontx.gov/police/mission.htm)
- Los Angeles Police Department: "It is the mission of the Los Angeles Police Department to **safeguard the lives and property of the people we serve, to reduce the incidence and fear of crime, and to enhance public safety while working with the diverse communities to improve their quality of life**. Our mandate is to do so with honor and integrity, while at all times conducting ourselves with the highest ethical standards to maintain public confidence." (http://www.lapdonline.org/inside_the_lapd/content_basic_view/844)
- Metropolitan Nashville Police Department: "The Mission of the Metropolitan Nashville Police Department is **to provide community-based police products to the public so they can experience a safe and peaceful Nashville**." (http://www.nashville.gov/Police-Department/Administrative-Services.aspx)
- Montgomery County Department of Police: "The Mission of the Montgomery County Department of Police is to **safeguard life and property, preserve the peace, prevent and detect crime, enforce the law, and protect the rights of all citizens**. We are committed to **working in partnership with the community to identify and resolve issues that impact public safety**." (http://www.mymcpnews.com/?s=mission+statement)
- Nassau County Police Department: "To serve the people of Nassau County and **to provide safety and improved quality of life** in our communities through excellence in policing." (http://www.police.co.nassau.ny.us/VisionMission.aspx)
- Sacramento Police Department: "The mission of the Sacramento Police Department is **to work in partnership with the Community to protect life and property, solve neighborhood problems, and enhance the quality of life in our City**." (http://www.sacpd.org/chiefscorner/mission/)
- San Francisco Police Department: "We, the members of the San Francisco Police Department, are committed to excellence in law enforcement and are dedicated to the people, traditions and diversity of our City. In order **to protect life and property, prevent crime and reduce the fear of crime**, we will provide service with understanding, response with compassion, performance with integrity and law enforcement with vision." (http://sf-police.org/index.aspx?page=1616)
- Texas State University Police Department: "The mission of the Texas State University Police Department focuses on excellence, to provide leadership through innovation and creativity in a dynamic, diverse and professional organization. We will strive

to create a safe and secure learning environment, by dedicating ourselves to raising the level of preparedness to meet the needs of today and the challenges of tomorrow. **We pledge to sustain a working partnership with our campus community to improve the quality of life**. We will accomplish our mission by providing proactive service and encouraging community awareness in support of the University's mission." (http://www.police.txstate.edu/About-UPD/Mission-and-Motto.html)

- Wichita Police Department: "The Wichita Police Department's mission is to provide professional and ethical public safety services **in partnership with citizens to identify, prevent, and solve the problems of crime, fear of crime, social disorder and neighborhood decay, thereby improving the quality of life in our community**." (http://www.wichita.gov/Government/Departments/WPD/Pages/About.aspx)

Common Themes in Police Department Mission Statements

	Buffalo, N.Y.	Houston, Tex.	Los Angeles, Calif.	Metropolitan Nashville, Tenn.	Montgomery County, Md.	Nassau County, N.Y.	Sacramento, Calif.	San Francisco, Calif.	Texas State University, Tex.	Wichita, Kan.
Enforce laws		✓			✓					
Preserve peace	✓	✓		✓	✓					
Protect life			✓		✓		✓	✓		
Protect property			✓		✓		✓	✓		
Reduce [prevent] crime			✓		✓			✓		✓
Detect [identify] crime					✓					✓
Solve crime [problems]	✓[a]				✓[b]		✓[c]			✓
Reduce fear [of crime]	✓	✓	✓					✓		✓
Enhance [public] safety [security]	✓	✓	✓	✓		✓			✓	
Reduce social disorder/ neighborhood decay										✓
Improve quality of life		✓	✓			✓				✓
Protect rights	✓	✓			✓					
Work with community	✓	✓	✓	✓			✓		✓	✓

SOURCE: Police department websites (see text).

[a] Solve problems.

[b] Resolve issues.

[c] Solve neighborhood problems.

> The logic model provides a means not just to break apart activities by the different potential effects of IT on their outcomes, but also to determine whether benefits would even be expected from particular IT investments, given departmental strategies and officer allocation decisions.

effects of multiple changes in IT or practice were mistakenly ascribed to only one system or if offsetting effects in different parts of the departments' activities were not captured.

As an exploratory analysis during this study, we attempted to correlate measures of IT use in proactive, reactive, and support applications across agencies with organization-level outcomes—namely, crime rates and offending rates.[10] To do so, we used the best available data on U.S. police departments' IT use and activities, the 2007 LEMAS dataset. Unfortunately, our effort at turning combinations of LEMAS questions into measures for the multiple types of IT, as well as multiple approaches for using IT and the interactions between them, was overly ambitious, given the quality of the available data. As a result, we do not report either the numerical results or a detailed description of the modeling.

The correlation modeling suggested some interesting relationships between IT and both clearance and offense rates for violent and other crime. Some were as would be expected, and were consistent with the view that IT can have productivity benefits. For example, for both types of clearance rates (and, to a lesser extent, with violent crime offense rates), administrative IT was associated with improvements. In further exploratory modeling, these associations were attributable to LEMAS survey responses relating to records management systems that supported in-field reporting capabilities. (Note that in-field reporting capabilities are, in part, a communications IT capability as well.) The findings for administrative and communications systems are consistent with our conceptual model, as well as with comments made to us by police chiefs around the country when we asked them to describe the IT systems that they believed contributed most to their effectiveness.

However, the modeling also produced unexpected results that ran counter to reasonable expectations about the effects of IT. For example, some IT systems were correlated with lower clearance rates and increased crime for some of the modeled relationships. These included intelligence IT (notably, hotspot analysis) and surveillance IT (notably, CCTV and gunshot detection systems). These findings directly contradict widely established findings that hotspot policing is effective at reducing crime (such as the meta-analysis of Braga, Papachristos, and Hureau, 2012). They also contradict multiple studies that have shown at least some evidence that CCTV can reduce crime (Griffiths, 2003; Ratcliffe and Taniguchi, 2008; Skinns, 1998; Office of Justice Programs, 2014; Sivarajasingam, Shepherd, and Matthews, 2003).

One way to reconcile these findings is to run causality effects in reverse—that is, arguing that these technologies were purchased in response to increasing crime or problems clearing crimes rather than being associated with crime increasing after they were implemented. Indeed, Heaton's work showing the effectiveness of increasing police forces on reducing crime rates (2010) demonstrates a positive correlation between crime rates and force sizes. Heaton goes on to show that this is a case of reverse causality, with jurisdictions with higher base levels of crime investing more in police. This is almost certainly the case with respect to hotspot analysis, given the large body of evidence showing that introducing hotspot policing leads to lower crime levels. Whether this is the case with surveillance systems is less clear-cut because the evidence for their effectiveness is not as strong. Further, the evidence for effectiveness is for hotspot *policing*, not just for hotspot analyses without corresponding changes in policing operations to act on the hotspots.

In addition to causality or reverse causality relationships, we also cannot rule out that some of the significant correlations were simply false positives resulting from limitations in the data and the number of categories of IT investments, approaches for using IT, and interactions among them that we assessed.

Though our efforts to carry out a full statistical analysis of police IT use matched with activity types using existing survey data did not succeed, they did yield insights that are relevant to

[10] A similar regression analysis was carried out by Watkins (2005) using earlier LEMAS data.

the design of future efforts to assess the effects of IT systems on law enforcement performance.

First, conceptually, it is important to collect data not just on department acquisition of IT systems, but also on how the systems are used and the activities that the use is intended to support. The 2007 LEMAS data lacked sufficient detail to allow us to do such an analysis across a broad population of domestic police agencies, but future research efforts could collect sufficiently detailed information if the need to do so is included in their research design. Furthermore, because LEMAS is a periodic survey, those lessons are relevant to help improve how future data collections can help answer these research questions.

Second, in considering potential productivity improvement from IT use, analysts need ways to measure relative levels of effort devoted to different police functions. Put another way, in considering IT investments as a force multiplier, benefits will be driven by the amount of force that is there to multiply. For example, we would expect an IT investment designed to facilitate community policing (for example, social media systems to augment or replace other modes of community interaction) to have the greatest value for a department that was devoting significant effort to community-policing activities. A department that was not doing community policing—or that had a community-policing unit in name only—might buy the same system and would get little or no benefit from it. Our team sought to build measures for different elements of reactive and proactive policing, so distinguishing such situations from available data proved difficult.

Third, in addition to asking what IT investments and procedures changes were made, it is also necessary to ask when the investments were made. Because of the learning requirements and other effects seen in other sectors' use of IT, timelines matter. The potential for delays—which we struggled with in seeking to use existing data on IT acquisition and outcome measures, such as crime rates—means that simple correlation modeling can confuse, and may not appropriately detect, the effects of technology investments.

Given current and likely future fiscal challenges, how to achieve public safety goals at less cost will almost certainly be a continuing concern. With the potential to act as a force multiplier or to perform some functions that would otherwise consume sworn officer or nonsworn civilian time and effort, IT could be an ingredient to help address that concern. However, as was the case for IT in industry, strong evidence for that relationship is elusive. More clearly linking evaluation to how the technology can affect organizational outputs and outcomes—using tools like the logic model described here—could provide a stronger foundation for identifying and measuring those effects.

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About This Report

With declining revenues over the past five years, cities and states in the United States have sought to limit the growth, and in many cases reduce the budgets, of their police forces. This budget tightening has presented police chiefs and city administrators with challenging questions about how to deliver public safety more efficiently. In many jurisdictions, chiefs have adopted new technologies intended to reduce manpower costs as one strategy for meeting this challenge. To examine the cost-effectiveness of some of these strategies, RAND researchers developed a model describing how information technology and policing activities work together to produce key policing outcomes. They then conducted some exploratory analyses of this model and described what would be needed to test relationships between information technology investments and outcomes formally.

The study described in this report went through several iterations over the course of its completion, and a variety of RAND colleagues contributed to it. The authors would like to acknowledge the contributions of colleagues Kata Mihaly, Aaron Kofner, Rob Davis, Kevin Feeney, and Ed Balkovich, who were involved in the project at various points. RAND colleague Paul Heaton and an anonymous National Institute of Justice reviewer provided valuable input to an earlier version of the document that was instrumental in focusing the work and defining appropriate analytic bounds for the study.

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The research reported here was conducted in the RAND Safety and Justice Program, which addresses all aspects of public safety and the criminal justice system, including violence, policing, corrections, courts and criminal law, substance abuse, occupational safety, and public integrity. Program research is supported by government agencies, foundations, and the private sector.

This program is part of RAND Justice, Infrastructure, and Environment, a division of the RAND Corporation dedicated to improving policy and decisionmaking in a wide range of policy domains, including civil and criminal justice, infrastructure protection and homeland security, transportation and energy policy, and environmental and natural resource policy.

Questions or comments about this report should be sent to the project leader, Brian Jackson (Brian_Jackson@rand.org). For more information about the Safety and Justice Program, see http://www.rand.org/safety-justice or contact the director at sj@rand.org.

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