Providing Unbiased and Objective Technical Assistance

Enabling Criminal Justice Information Exchange

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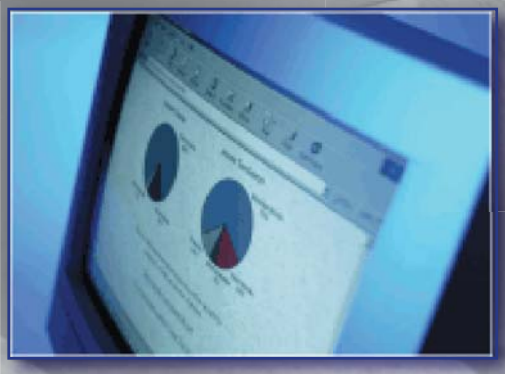
Center for Criminal Justice Technology

COMPREHENSIVE REGIONAL INFORMATION SYSTEM PROJECT
VOLUME 1

Metrics for the Evaluation of Regional Law Enforcement Information-Sharing Systems



NOBLIS TECHNICAL REPORT
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Center for Criminal Justice Technology

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Noblis Technical Report

Comprehensive Regional Information-Sharing Project, Volume 1

Metrics for the Evaluation of Law Enforcement Information-Sharing Systems

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EXECUTIVE SUMMARY

Metrics are a set of measures that may be used to assess the success or failure of a system or program.

- A *system* is a tool, in this case, the software and hardware associated with an information-sharing system and the additional support (such as system administrators) needed to operate the components. In assessing systems, metrics are frequently used to track measurable performance quantities, such as system response time, reliability, and use.
- A *program* encompasses the system, users, policies for applying the system, and operations to which the system is applied. In assessing a program, metrics can be used to track measurable quantities related to operations, such as time, labor, and cost savings realized from implementing a new program.

Difficulties arise when trying to use metrics to assess system or program features that produce qualitative results presenting the challenge of measuring results that may not be quantifiable. Additional difficulties arise when attempting to measure results that may be attributed, in part, to factors external to the system or program being evaluated.

As part of the Comprehensive Regional Information Sharing Project (CRISP), this study was performed by Noblis' Center for Criminal Justice Technology, in partnership with the National Institute of Justice (NIJ). The study examined the use of metrics as a tool to assess the effectiveness of a law enforcement information-sharing system (ISS) and its impact on operations. The challenges associated with using metrics are very prevalent when assessing an ISS—particularly with regard to lapses in time between specific use of the system and the noticeable impact on operations. Additionally, since an ISS may be one of many resources used that has an impact on operations, its role may not be measurable or directly attributed to a case closure, for example.

This metrics study required a phased effort. First, research was conducted on the state of metrics collection in law enforcement, with an emphasis on metrics related to ISS programs. This provided some insight into lessons learned on the use of metrics and identified basic elements needed for an ISS metrics program.
Next, metrics evaluation lessons-learned were gathered from information-sharing programs and interviews with law enforcement agencies as part of the larger CRISP effort; programs contacted included the Comprehensive Regional Information Management Exchange System (CRIMES), Florida Department of Law Enforcement (FDLE) InSite, the Factual Analysis Criminal Threat Solution (FACTS), Citizen Law Enforcement Analysis and Reporting (CLEAR)/ Illinois CLEAR (I-CLEAR), the Florida Integrated Network for Data Exchange and Retrieval (FINDER), and the Automated Regional Justice Information System (ARJIS). The primary effort—which is the focus of the study—was to devise a detailed, automated approach for developing a metrics collection and analysis program. Finally, issues and impacts associated with the approach devised were examined to guide its appropriate application.

This document addresses the importance of having a formal plan in place for metrics collection so that appropriate metrics are collected without burdening users with the collection process. The plan described in this document—based upon a mapping between ISS objectives and potential metrics—includes the following steps:

- Step 1: Define ISS program objectives
- Step 2: Determine which types of metrics to collect
- Step 3: Determine feasibility of the metrics
- Step 4: Map ISS program objectives and metrics
- Step 5: Collect metrics
- Step 6: Analyze metrics collected

Key recommendations for a metrics collection program that resulted from this study are summarized below:

Recommendation 1. Institute a formal plan for metrics collection so that useful and appropriate metrics are collected without burdening users with the collection process.

Recommendation 2. Consider the benefits of a preliminary behavioral study on how best to obtain quality input from users.

Recommendation 3. Recognize the significant value of qualitative information as metric data.

Recommendation 4. Use a combination of metrics to assess each objective, as opposed to considering the metrics as distinct from one another.

Recommendation 5. Leverage the relationship between law enforcement agencies and the broader criminal justice system.

Recommendation 6. Acknowledge that some metrics will provide an indication of the usefulness of the ISS rather than identifying definitive relationships between ISS use and meeting of ISS objectives.

Recommendation 7. Recognize that planning for and implementing a metrics collection program is a long-term process but taking specific actions early on may facilitate the effort.

Recommendation 8. Use ISS metrics as a design tool to plan for, evaluate, or improve other law enforcement programs.

Recommendation 9. Consider expanding this research to examine ISS and non-ISS programs beyond the criminal justice system that rely on measures of effectiveness and seek to produce primarily qualitative results.

Acknowledgments

Noblis would like to acknowledge the following Advisory Group, which was formed to help determine the state of metrics collection and use for evaluating the effectiveness of law enforcement information-sharing systems. The Advisory Group reviewed this document and provided recommendations that have been incorporated into the document:

- Jim Austin with the Naval Criminal Investigative Service (NCIS) and the Law Enforcement Information Exchange (LInX)
- Dr. Ron Eaglin, Dr. K. Michael Reynolds, and Jim McClure with the Florida Integrated Network for Data Exchange and Retrieval (FINDER)
- Tommy Sexton, former Director of the National Law Enforcement and Corrections Technology Center (NLECTC) for the Southeast Region, now with the National Institute of Justice (NIJ)
- Bob Mosley, an independent consultant affiliated with the Metropolitan Washington Council of Governments (MWCOG) and its regional Pawn System.

The authors also appreciate the contributions of the following individuals for their review of draft versions of this document and for their support during the overall CRISP effort:

- Mr. Hyuk Byun, Program Executive, National Institute of Justice
- Mr. William Ford, Program Manager, National Institute of Justice
- Ms. Michele Moses, Technical Program Analyst (contractor), National Institute of Justice
- Mr. Phil Ramer, Senior Research Associate, Institute for Intergovernmental Research
- The Members of the Global Intelligence Working Group

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Difficulties arise when trying to use metrics to assess system or program features that produce qualitative results because of the challenge of measuring results that may not be quantifiable. Additional difficulties arise when attempting to measure results that may be attributed, in part, to factors external to the system or program being evaluated.

This study examined the use of metrics as a tool to assess the effectiveness of a law enforcement information-sharing system (ISS) and its impact on operations. The challenges associated with the use of metrics are very prevalent when assessing an ISS, particularly lapses in time between specific use of the system and a noticeable impact on operations. Additionally, the ISS may be one of many resources used that has an impact on operations. For example, an investigator may use an ISS to generate leads in a case, but the case may not close for a number of months. During this period, the investigator may also derive information from other sources—such as following up on leads called in by the community—to facilitate case closure. Once the case is closed, the investigator may not recall or have the time to report on all of the sources used to close the case. Therefore, the role of the ISS may not be measurable or directly attributed to the case closure.

1.1 Definition of Terms

Some terms used throughout the document are defined below. By presenting standardized definitions, the intended meaning of the term is interpreted consistently in each document.

- **Information exchange/exchange information**—Giving *and* receiving of information
- **Information sharing/share information**—Giving *and/or* receiving of information
- **Information-Sharing Program**—Effort encompassing the ISS, users, policies for applying the system, and operations to which the system is applied
- **Information-Sharing System**—A collection of software and hardware components used to perform information-sharing functions [Additional support (such as system administrators) needed to operate the components are also included as part of the ISS.]
- **Region**—Area consisting of agencies with which a user may coordinate activities; may extend over city, county, or state boundaries; a multi-jurisdictional area
- **Regional law enforcement information-sharing system**—Electronic system containing information originating from local law enforcement agency records management systems that is shared among law enforcement agencies within a region

1.2 Background

As part of the Comprehensive Regional Information Sharing Project (CRISP), this study was performed by Noblis' Center for Criminal Justice Technology, in partnership with the National Institute of Justice (NIJ). The purpose of the overall CRISP program is to identify best practices in how information is being delivered within regional law enforcement ISSs. This metrics study is one component of the CRISP effort. Additional work products developed under the CRISP effort include (1) documenting the functional and technical systems for selected ISS programs, (2) developing a mapping tool that graphically shows the locations of ISSs nationwide and provides technical and functional information about them, (3) developing a concept of operations reflecting best practices gathered from the

interviews, and (4) developing a handbook consisting of preliminary functional and operational requirements for law enforcement information-sharing.

Background literature research and discussions with individuals of the Advisory Group and those who participated in the CRISP program revealed that metrics applied to assess an ISS program generally fall into one of two categories: a case study/one-time survey or general guidance on types of metrics that may be indicative of ISS utility.

In addition to system performance data, the case-study approach may include various quantitative questions about system use, perceived impact of the program, and changes in workflow, supplemented by success stories. A case study or survey of ISS users and other stakeholders can lead to a detailed snapshot assessment of a program. However, the complexity and investment of time required to conduct the study do not allow for occasional follow-up of the program.

The general guidance approach is useful for examining types of metrics, common program objectives, and the pros and cons associated with collecting the metrics and using them to determine whether objectives have been met. However, the general guidance approach provides little information on how to collect the metrics electronically to allow periodic assessment of a program's effectiveness.

This study expands upon the case study and general guidance approaches to provide a metrics methodology—by automating the case study/general guidance approaches—that program managers can employ to assess an ISS program.

1.3 Metrics Study Objectives and Scope

There are two primary objectives of this study:

- Define a methodology for identifying appropriate metrics to assess—monitor the benefits and performance of—an ISS
- Determine feasible applications and limitations of metrics as applied to an ISS

The metrics collection methodology that is the focus of this study seeks to evaluate the ISS program with respect to the following critical areas as they pertain to agency personnel and public safety:

- Impact on mission
- Impact on collaboration
- Quality of the investment in the ISS program

Impact on mission can be evaluated by examining who uses the ISS and how they use it. Potential users include agency personnel from local, regional, tribal, national, and international jurisdictions. The results of the evaluation may be used to enhance the program or support a decision to either continue or discontinue the program.

Impact on collaboration can be evaluated by examining whether the ISS program provides the user population the information it wants and needs, thus promoting more effective teamwork both internally and regionally. The evaluation results may also be used to promote increased interest in the ISS among the user population and to facilitate more effective information exchange via the ISS.

Law enforcement investments in an ISS may be evaluated by examining the purpose, efficiency, return on investment, and cost-versus-benefit of the ISS program. The results of an evaluation may be used to develop new programs, enhance existing programs, or allocate resources in support of information exchange.

This study focuses on the use of information already available via an ISS and does not address metrics related to the process of entering information into an ISS or a records management system (such as filing forms and reports). However, limited recommendations are offered for modifying the information input process to improve the quality of the metrics collected from the ISS.

1.4 Methodology for the Metrics Study

This metrics study required a phased effort. First, the state of metrics collection in law enforcement was determined, with an emphasis on metrics related to ISS programs. This provided some insight into lessons learned on the use of metrics and identified basic elements needed for an ISS metrics program. This insight was then used to develop a detailed automated approach for a metrics collection and analysis program. Then, issues and impacts associated with the devised methodology were examined to guide its appropriate application.

To determine the state of metrics collection in law enforcement, a literature review was conducted. In addition, an advisory group comprised of individuals with ISS experience was established to solicit initial ideas and concepts and to perform a peer review of the study document.

The advisory group consisted of individuals affiliated with the Law enforcement Information Exchange (LInX), the Florida Integrated Network for Data Exchange and Retrieval (FINDER), the NIJ, and the Metropolitan Washington Council of Governments (MWCOG), which included the regional Pawn System and the emerging National Capital Region Law Enforcement Information-Sharing System.

Findings from the literature review and the advisory group were supplemented by information gained from detailed ISS interviews that supported the larger CRISP effort. ISS programs and law enforcement agencies interviewed as part of the CRISP effort included the Comprehensive Regional Information Management Exchange System (CRIMES), in the Hampton Roads area of Virginia; the Factual Analysis Criminal Threat Solution (FACTS) system based in Tallahassee, Florida; the Citizen Law Enforcement Analysis and Reporting (CLEAR) system in Chicago, Illinois; InSite at the Florida Department of Law Enforcement (FDLE); the FINDER system based in Orlando, Florida; and the Automated Regional Justice Information System (ARJIS) in San Diego, California. Stakeholders who were interviewed and associated with these programs included agency managers, ISS managers and governance, end users, and ISS technical support staff. The findings of this literature review are summarized in Section 2.

Developing an approach for an ISS metrics collection and analysis program is very complex. Therefore, a step-by-step methodology was developed in this study. The methodology includes determining which metrics to collect, how to collect the corresponding data for those metrics, and how to analyze the results. One key requirement of the methodology is that any metrics collection program should place little or no burden on ISS users. Thus, the emphasis is on automated metrics collection that requires no direct user input, supplemented by infrequent and minimal direct user input.

It is critical to determine the issues and impacts associated with an ISS metrics collection program in order to mitigate circumstances that may hinder the value and reliability of the metrics program. Agency preparations prior to program implementation are suggested, including the possibility of adding staff resources to implement and monitor the program, as well as to analyze the metrics data.

1.5 Document Organization

Following the Introduction, the remainder of this document is organized into four main sections. Section 2 discusses the state of metrics collection for law enforcement programs. Section 3 presents the results of this study by providing a detailed methodology for a metrics collection and analysis program for an ISS. Section 4 discusses some of the issues associated with a metrics program and potential impacts on agency operation. Section 5 contains recommendations for agencies considering an ISS metrics program. A list of references and a list of acronyms follow in the Appendices.

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2 State of Metrics Collection for Law Enforcement

Law enforcement agencies currently collect some metrics to track the success of their operations. Many of these metrics— such as crime rate, murder rate, number of violent crimes, number of property crimes, and employment data—are reported to the National Incident-Based Reporting System (NIBRS) [10], Federal Bureau of Investigation (FBI) Uniform Crime Reports (UCR) [3], Census Bureau [12], and other databases. While these metrics are typically measurable, they have not been clearly correlated with specific law enforcement programs or initiatives. Anecdotal evidence and success stories provide some indication of the potential correlations.

A literature review, CRISP interviews, and a national law enforcement survey led to a number of concrete, detailed evaluations of law enforcement and information-sharing programs. The findings from this effort are presented below.

2.1 Literature Review

Three of the documents reviewed presented very good methodologies for evaluating information-sharing systems or programs that are designed to provide qualitative benefits. All three methodologies were based on one-time, extensive surveys. Components of these methodologies are reflected in the methodology presented in Section 3 of this document. Additional documents of interest can be found in the Appendix A, References.

In *An Assessment of an Information Sharing Technology (ARJIS): Examining its Potential Contribution to Improved Performance Through the Eyes of Street Level Officers* [14], Dr. Martin Zaworski uses three constructs for measuring the success of ARJIS: task technology fit theory, individual performance measures, and information-sharing. The study examined ARJIS users, users who did not have access to an

ARJIS-type ISS were used as a control group.

- **Task Technology Fit Theory** encompasses data, systems, and performance. The data aspect measures the detail, locate-ability, and compatibility of data in the ISS; data consistency/inconsistency is also mentioned. The system aspect measures ease of use and reliability. The performance aspect measures how well the ISS helps officers perform their jobs.
- **Individual Performance Measures** involves *investigations*, *arrests*, and *clearances*. Additional measures of individual performance include effectiveness, individual productivity, in-custody links, training, and user satisfaction.
- **Information Sharing** is the most difficult construct to define. The author examined "the extent to which street-level officers perceive information sharing as a benefit in their daily jobs."

For this study, these three constructs helped to determine which types of metrics are needed for an ISS and how to best categorize the metrics.

In *The Use of Metrics in Electronic Records Management (ERM) Systems* [5], the Industry Advisory Council (IAC) defines 11 categories of metrics for evaluating an electronic records management (ERM) system:

- Access to services
- Accuracy (proper declaration and classification of records; appropriate number of classifications)
- Capacity (number and size of records stored; how much of the ERM is being used to manage the records of the organization)
- Efficiency
- Participation (ERM usage by system owners who "declare, classify, and manage documents")
- Productivity (workflow; related to performing business tasks; utilization of resources; rate of service for those using system versus those not using the system)
- Search and retrieval process
- System
- User satisfaction
- Utilization
- Legal (ERM supporting legal and regulatory requirements)

The study was conducted on behalf of the Office of Management and Budget (OMB) and the National Archives and Records Administration (NARA). Study participants consisted of OMB, NARA, IAC member companies, and other government agencies. A case-study approach was taken, identifying metrics being used for ERM systems.

In the third study, the Government Accountability Office (GAO) conducted a study of 12 years of local law enforcement data on Community-Oriented Policing Services (COPS) programs; the results of this study are documented in *COPS Grants Were a Modest Contributor to Declines in Crime in the 1990s* [4]. Metrics such as crime rates and number of new officers hired—along with policing strategies—were compared against spending on COPS programs to determine the cost benefit and whether there was a decline in crime as a result of the COPS programs. The GAO accounted for factors external to the COPS program, such as "local economic conditions and changes in population composition, and changes in state-level policies and practices that could be correlated with crime, such as incarceration and sentencing policy."

The Bureau of Justice Assistance (BJA)—with the Department of Justice's Office of Justice Programs—has a website [1] on Program Evaluation, with information systems being one type of program addressed. Three types of measures are presented: process, outcome, and usability. Many of the metrics associated with these measures are included in Section 3 of this document.

The Justice Research and Statistics Association (JRSA) website includes a paper entitled *Assessing the Effectiveness of Criminal Justice Programs—Assessment and Evaluation Handbooks No. 1 and No. 2* [6]. The two-part paper presents a systematic approach to periodic evaluation of criminal justice programs. Four main criteria for assessing program effectiveness are suggested and are used to develop guidelines for a program effectiveness model: goals and objectives, links between program activities and objectives, performance measures, and acceptable performance.

2.2 CRISP Interviews

As noted previously, the ISS programs included in the CRISP interviews were CRIMES, InSite, FACTS, CLEAR, FINDER, and ARJIS. The extensive CRISP interviews gathered information on system objectives, development, functionality, information exchanged, success stories, success factors and recommendations, impact on operations, governance and management, funding and costs, participating agencies, effectiveness, technical architecture and communications, and operational characteristics.

The extent to which metrics are used to evaluate these programs varied. Below is a summary of the evaluation efforts that are under way for each program included in the interviews. The reader is referred to the CRISP products listed in Section 1.1 for additional CRISP-related information on these programs.

2.2.1 CRIMES—Comprehensive Regional Information Management Exchange System

CRIMES is a regional law enforcement ISS based in Hampton Roads, Virginia. Currently, it has no formal, defined process or procedure in place for collecting success stories and metrics associated with CRIMES. End users naturally focus on moving forward with their investigations rather than voluntarily taking time to document demonstrable benefits and effectiveness derived from having access to the system. As with many other regional information-sharing projects, there are several individuals who champion the system within individual agencies and throughout the region. These individuals have established contacts with users; through those contacts, they request and strongly encourage the user community to provide success stories. Recognizing the need for a formal process, the CRIMES Executive Board recently established an Evaluation Committee to identify how to establish metrics, measure success, and determine return on investment.

The lack of system metrics or other definitive means to clearly show the benefit of using CRIMES provides an impetus for developing a public relations function and the collection of success stories; this function was particularly important since participating agencies do not mandate the use of CRIMES. CRIMES stakeholders have also identified a public relations function as a vital resource. In addition to promoting the benefits of the system through the collection and dissemination of success stories, a public relations function can clarify

misconceptions about the system—for both internal and external stakeholders—that would otherwise go unaddressed and could negatively impact continued effective use of the system. It is anticipated that when a public relations function is in place, success stories resulting from the use of CRIMES will be disseminated to the general public, as well as within the law enforcement community.

The interviewees cited community support, communication with employee representatives, and steady funding as critical elements for the success of the ISS.

2.2.2 InSite—Intelligence Site System

InSite is a Florida statewide intelligence ISS based in Tallahassee, Florida, that is currently deployed and managed by the FDLE. There are not a large number of InSite success stories that are well-documented, mostly due to the nature of the intelligence information. The information comes from a large variety of sources, and the information may not be specific enough to establish readily identifiable relationships. Consequently, the value of the information lies in fully analyzing it over time and continually trying to link it to new information that is entered into the system. The successful mitigation of potential threats or future crimes is the payoff for maintaining an intelligence system.

According to FDLE, to be truly effective and allow informed decisions to be made, an intelligence system must have information entered frequently by its users and have that information analyzed in a timely fashion. The FDLE does collect certain key metrics to analyze the performance and effectiveness of the InSite system. These metrics include the number of threats (entered through the domestic security module), the number of registered users accessing the system, and the number of Tips, Tasks, and Cases that are created by the users. These metrics are a measure of how the system is being used, by whom, and how often.

2.2.3 FACTS—Factual Analysis Criminal Threat Solution

FACTS is another law enforcement ISS based in Tallahassee, Florida. The core application for the FACTS system currently deployed and managed by the FDLE is called Distributed FACTS (dFACTS). Metrics demonstrating the effectiveness of the FACTS system have also proven to be difficult to collect as there is no defined process for doing so. While transaction logs are maintained for auditing purposes, the logs cannot be used directly in qualitatively assessing the effectiveness of the system for law enforcement purposes. Investigators often work with minimal information; multiple queries of the FACTS system may be required to generate a solid lead. Merely quantifying the number of queries (or individual transactions) can be a misleading measure of the effectiveness of the system. As with all ISSs, the FACTS system needs to be used in order to be an effective tool, and the more complete the information used in the query request, the more likely the results will provide investigative leads.

Success stories are often a valuable way to capture the best practices that users experience in obtaining information from the system. FDLE management considers these success stories a measure and a propellant of the system's effectiveness. These accounts become the source of training aids for instructing new and veteran users. At FDLE, there are two very strong user advocates that remain in constant communication with users by email and phone, as well as through outreach training/conferences that are periodically organized in the users' region. These advocates encourage users to capture success stories. Users typically email their success stories to one of these user advocates, who enters the accounts into the system. This allows others to benefit from reading about unique ways of using the system and to share in the success that reinforces positive images of the system, thereby promoting the system. FACTS has a success-story page that describes the methodology of how the cases were closed and how the queries were done.

2.2.4 CLEAR—Citizen and Law Enforcement Analysis and Reporting System

CLEAR is a combination of a records management system (RMS) and ISS containing mostly law enforcement information. Time savings with CLEAR have been observed simply because personnel can retrieve reports electronically rather than taking time to physically drive to the Chicago Police Department (CPD) and obtain hard copies for investigations. CPD noted that the records division was reduced in staff and whole departments were closed as a result of the automation. The use of grant money required accountabil-

ity that was typically addressed by measuring full-time equivalent (FTE) personnel savings.

Another feature of the system that saves times includes a photo lineup capability. Creating the line-up is easy, fast, and gets very good results. In addition, the near–real-time availability of the photo lineup enables detectives to obtain better and faster information from witnesses producing more leads while the case is only hours old, which makes those leads more valuable.

Similarly, arrest data is updated every four hours and gets to detectives days earlier than before the system was in place. Though use—in general—is not mandated, system use in Cook County and other agencies outside of CPD has increased from 0 to 16,000 registered users in just over three years. The capabilities provided by CLEAR enabled CPD to implement a Deployment Operations Center—targeting specific areas of observed criminal activity—that has proven effective.

2.2.5 FINDER—Florida Integrated Network for Data Exchange & Retrieval

FINDER, based in Orlando, Florida, is a system for sharing law enforcement information that was developed by the Florida Law Enforcement Data Sharing Consortium. Metrics collection is well underway for FINDER, with short- and long-term plans being developed to collect additional and more meaningful metrics. The metric categories are user evaluations, system activity, and system outcome. Currently, there is a button on the user screen that users can select to enter a narrative of a success story. Additional indicators of FINDER success are improvements in the following processes: determination of victim's identity, determination of suspect's identity, arrests, property recovery, and vehicle recovery.

Enhancements are being considered to capture characteristics (tags) regarding the effects a search or hit had (e.g., lead, arrest, name, agency, case #, arrest made, property recovered). Another desirable feature would be to search characteristics of the collected metrics, such as searching data by an agency, a date range, or another attribute, as well as a means to automate the process of categorizing success stories so that they may be more easily evaluated.

The FINDER team suggested four critical metrics:

- The total number of queries by registered user, noting that it is a positive indicator if this measure is increasing
- The number of links (secondary searches) to another agency's data, indicating potential collaboration was suggested
- The number of secondary searches—number of times a report from another agency is clicked on in a report—to provide indication of collaboration
- Data reflecting stolen property recovered from pawn shops

2.2.6 ARJIS—Automated Regional Justice Information System

The ARJIS system in San Diego, California, began as a joint effort of 10 founding agencies in the San Diego area that formed a Joint Powers Agency in 1981. This effort spurred the growth of data sharing in the region over the intervening years; during this time, ARJIS added functionality and agency members and also incorporated new technology into the system. Today, ARJIS supports two counties in Southern California—San Diego and Imperial—with 71 member agencies and approximately 11,000 users.

Currently, there is no formal metrics collection program for ARJIS. It is strongly believed that if the system is being used or relied upon extensively, it is a success. One indirect measure of ARJIS success is that information from ARJIS is used to define and direct programs and initiatives, such as traffic management. There are monthly user group meetings to share aspects of ARJIS use and program status.
The reader is also referred to the Zaworski paper [13] for additional information about ARJIS system effectiveness.

2.3 National Survey of Law Enforcement Information-Sharing

A national law enforcement survey was prepared and conducted by Noblis, in conjunction with the Police Executive Research Forum. More than 200 agencies responded to the survey regarding regional information-sharing among law enforcement. Agencies surveyed reflected a mix of ISS participants and non-

participants and represent a range of geographic areas and agency sizes. Agencies responded to questions regarding general agency characteristics, methods that agencies currently use to share information, factors surrounding an agency's decision to participate in a regional ISS, information-sharing needs, desired capabilities of an ISS program, and lessons learned from agencies currently participating in an ISS program.

Approximately 56 percent of agencies that responded to the survey currently participate in some sort of regional law enforcement ISS. Of those, approximately 60 percent collect or track measures to evaluate the benefit of the system. In the survey, these agencies were asked a general question regarding their agencies' collection or tracking of certain measures to evaluate the benefit of a regional law enforcement ISS. Specifically, agencies were asked about a few key metrics that attempt to span many of the metrics presented in Section 3 of this document. The following responses (percentages approximate) were provided among the agencies that currently collect or track measures:

- 41 percent collect or track crime statistics and trends.
- 28 percent collect or track system reliability measures.
- 26 percent collect or track measures related to the frequency with which information is shared internal to their agency.
- 22 percent collect or track measures related to the frequency with which information is shared with other agencies or jurisdictions.
- 19 percent collect or track measures related to allocation of resource time.
- 17 percent collect or track success stories.
- 15 percent collect or track measures related to time to solve crimes and conduct other law enforcement duties.
- 15 percent collect or track measures related to improved community outreach, such as volume of leads from the community.
- 12 percent use link analysis transactions to link search keywords to investigations or crimes solved.

While the majority of the surveyed agencies participating in some sort of regional law enforcement ISS do collect or track measures, the numbers above imply that metrics collection is not commonplace. Guidance is clearly needed on how best to collect metrics, what types of metrics to collect, and the principle behind metrics collection.

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3 Approach to Developing an ISS Metrics Collection and Analysis Program

This section presents a methodology for identifying, collecting, and analyzing ISS metrics. Six steps have been identified for any metrics collection and analysis approach:

Step 1: Define ISS program objectives

Step 2: Determine which types of metrics to collect

Step 3: Determine feasibility of the metrics

Step 4: Map ISS program objectives and metrics

Step 5: Collect metrics

Step 6: Analyze metrics collected

Each of these steps is described in detail below.

3.1 Step 1: Define ISS Program Objectives

The first step in establishing a metrics collection program is to determine the objectives of the ISS program; these objectives directly impact the types of metrics that need to be collected and the collection process. The following are stakeholders in this step:

- Managers and governance staff (agency managers, ISS managers, and governance)
- End users
- ISS technical support staff

While the fundamental objectives of an ISS program may be the same for all stakeholders, different stakeholders may have specific objectives they want to meet. Potential program objectives, shown in no particular order of importance, are further described below for each type of stakeholder.

The objectives listed in Sections 3.1.1 through 3.3.3, while thorough, are not intended to be exhaustive. ISS program objectives will vary and can be made more detailed depending on the specific aspect of the program being assessed. The program and the objectives may be assessed with respect to agency or regional initiatives, the ISS stakeholders, and the various types of end users. Agency or regional initiatives may include such areas as community-oriented policing, environmental crime, gang prevention, auto-theft prevention, drunk driving, intelligence, domestic violence, and cyber-crime [3].

3.1.1 Management and Governance Objectives

Management and governance objectives include the objectives of both the ISS management and governance and agency management and administrative support stakeholders. These objectives support the missions of the ISS program and the individual agencies participating in the system. Explicit management and governance objectives are as follows:

- Improve accountability
- Support the Computer Statistics Process (CompStat)
- Manage financial resources
- Manage people resources—time savings; productivity; staff redeployment
- Identify and assess trends—track results
- Increase public trust—transparency of data/citizen access to local data (e.g.,. crime in neighborhood); sharing with public
- Improve officer safety
- Enhance collaboration by facilitating sharing information intra-agency and inter-agency regarding best practices, success stories, and training
- Facilitate the end-user objectives and technical support objectives listed below

The above objectives also impact end users and technical support stakeholders, either directly or indirectly.]

3.1.2 End-User Objectives

End users include all stakeholders who use the ISS. However, for the purposes of defining end-user objectives, the focus is on command staff, patrol officers, detectives and investigators, crime analysts, and intelligence analysts, as well as others who may directly use the ISS in their day-to-day operations. Potential program objectives include the following:

- **Improve officer and investigator safety** by being able to obtain person identification, ad-

dress history, photo, associates, rap sheet, and other information quickly before approaching a person or location

- **Save time** and use time more effectively when submitting, retrieving, or exchanging information; may indicate options for staff redeployment
- **Increase officer visibility and availability** by providing the means for patrol officers to submit reports and do information searches from the mobile data computer (MDC) while in the field, as opposed to in the station away from the public
- **Increase productivity** by allowing resources to work smarter and more efficiently
- **Increase and leverage suspect leads** from the law enforcement community and from citizens in the community (field interviews and tips)
- **Improve quality and availability of suspect/person-of-interest data** by being able to obtain person identification, photo, rap sheet, other historical information, addresses, and associates and by ensuring expected quantity from participants
- **Improve capture of cross-jurisdictional offenders**
- **Shorten time to arrest suspects**
- **Provide access to broader set of court orders**
- **Enhance prosecution used in court to bolster cases**
- **Improve success of intelligence mission** by coordinating intelligence operations, including de-confliction, and improving access to intelligence
- **Increase case closure rates** by reducing the time to closure and by improving the quality of information needed to obtain a conviction and close a case
- **Improve crime prevention** by providing law enforcement with information to allow them to be proactive instead of reactive
- **Improve crime detection** by cross-referencing multiple records to identify crime—or potential crime—electronically [For example, use parole records and pawn records to identify that a parolee under house arrest is out illegally and pawning (possibly stolen) merchandise.]
- **Enhance collaboration** by improving communications and information access within an agency or region and improving communication and information access across agencies and jurisdictions
- **Enhance crime mapping and link association** with critical ISS tools.

3.1.3 Technical Support Objectives

Technical-support stakeholders ensure that the ISS is available as needed for all stakeholders. Their objectives are primarily technical in nature. Assessing the objectives requires significant direct input regarding hardware and software and indirect input regarding use and user satisfaction.

- **Provide reliable electronic access** to disparate information by providing timely access to the ISS as needed and with acceptable response times for queries
- **Provide electronic access to reliable information** by ensuring information is accurately submitted, accurately retrieved, and accurately attributed to the proper sources
- **Provide security for the ISS**, including access control and physical security
- **Provide a user-friendly method for users to submit and retrieve information**, including providing sufficient hardware and software for the user population
- **Provide system users access to timely technical support when needed**
- **Provide training for system users**, including online training materials and face-to-face sessions

Note that **Improve Officer Safety** and **Improve Public Safety** are two overriding objectives for all stakeholders. **Improve Officer Safety** is directly addressed among the Management and Governance objectives, as there are combinations of metrics that may be used to support this objective. For example, the optimal ways to assign officers on the street and investigators to cases in order keep the officers safe

may be gleaned from the metrics. **Improve Officer Safety** is also directly addressed among the end-user objectives, as there are specific law-enforcement ISS tools or searches that end users may perform to support this objective. **Improve Public Safety** is implicit in the objectives for all stakeholders and is not listed as a separate item.

3.2 Step 2: Determine Which Types of Metrics to Collect

There are two primary aspects of the ISS program that may be assessed using metrics: ISS system performance and ISS impact on day-to-day operations. For each aspect, there are numerous metrics that can be collected to assess an ISS. It is helpful to first categorize these metrics, which in turn will help in Step 4 to establish a link between the metrics and objectives. The work of Zaworski and the IAC guided the categorization of the system performance and day-to-day operations metrics.

The list of metrics presented in this section is extensive, and not all metrics will be collected by all programs or agencies. The list is intended to provide various concrete options for measuring objectives, providing a basis of discussion for the types of metrics to be collected. Depending on the ISS program, some or all of the metrics presented below may be included in the metrics collection. Some of the metrics that need to be collected will be new to the law enforcement program, which will require additional effort and possible changes to existing ISS applications in order to capture the metrics. Some metrics may also be captured without the user's knowledge, while some metrics may require direct user input, as will be discussed in Section 3.5. Section 3.5 also addresses the need for control groups or baseline values for accurate metric interpretation.

3.2.1 Metrics for Assessing System Performance

Metrics related to ISS system performance are typically quantitative and reflect existing system operations, functionality, and capabilities. When evaluating system performance metrics, one should take into consideration that ISS host-system performance may be impaired by individual agency system performance. System features and characteristics that are critical to meeting ISS objectives are used to categorize the various metrics. Objectives are not repeated here, but they will be mapped to the metrics identified in Section 3.4. There are four main metric categories for assessing system performance:

- Access to services
- Capacity
- Search and retrieval
- Information security

Specific metrics are provided for each metric category.

3.2.1.1 Access to Services

- Time to access services (by service type)
- System response time (by request or query type)
- System reliability of primary system: availability, security, processing integrity, and confidentiality
- System reliability of back-up system (if back-up exists)
- Number of registered end users per desktop computer or laptop
- Percent of time registered user gains access when needed
  - Percent of time valid user gains access
  - Percent of time valid user is denied
  - Number of log-ins that are actually re–log-ins due to system timeouts and other technical constraints
- Percent of time that reports are accessible to valid users (by report or query type; by user type)
- Distribution of system access methods (by user type)—groupings are not mutually exclusive:
  - Percent of registered users accessing via Internet
  - Percent of registered users accessing via intranet
  - Percent of registered users accessing via other method
- Distribution of access tools (by user type)—groupings are not mutually exclusive:

  - Percent of registered users accessing via office desktop computer or laptop
  - Percent of registered users accessing via MDC or personal data assistant (PDA)
  - Percent of registered users accessing via another tool

3.2.1.2 Capacity (not all ISSs will use licenses)

- Number of licenses available or concurrent users allowed (by user type)
- Number of licenses in use or typical number of concurrent users (by user type)
- Number of additional licenses or concurrent users needed (by user type)
- Maximum number of concurrent users the system can support and still meet specified response time and other performance requirements

3.2.1.3 Search and Retrieval (may be a problem if the number and types of tools or search options are too limited)

- Summary of collaboration tools availability (possible ratings: Y if available; N if not available; D if not available, but desired by users)
- Distribution of collaboration tools—percent of registered users using each, or any, collaboration tool (by user type)
  - Email, message board, point-of-contact pointers, etc.
- Distribution of collaboration tools—frequency of use for each tool (by user type)
  - Email, message board, point-of-contact pointers, etc.
- Summary of links to other resources or other databases (possible ratings: Y if available; N if not available; D if not available, but desired by users)
- Summary of the types of query fields available (possible ratings: Y if available; N if not available; D if not available, but desired by users)
  - Name, date of birth, boats, weapons, etc.

3.2.1.4 Information Security

- Percent of invalid login attempts
- Percent of time invalid user gains access to system (if detectable)
- Percent of time invalid user is denied access to the system
- Summary of access controls (possible ratings: Y if present; N if not present)
  - Password protection, distinct password for each user, role-based access to information
- Reliability of security software

3.2.2 Metrics for Assessing Day-to-Day Operations

Metrics related to the impact of the ISS program on day-to-day operations are typically qualitative and may help assess how the ISS is being used. These metrics are needed to assess the effectiveness of the ISS and to determine in what ways the ISS helps to prevent and solve crime. Some of these qualitative measures may be converted to quantitative metrics. The list began with abstract types of observations that should be measured, then more quantitative, concrete measures were identified to represent the abstract observations. A combination of metrics may be needed to measure one abstract observation. System and program features and characteristics that are critical to meeting ISS objectives are used to categorize the various metrics. Objectives are not repeated here but will be mapped to the objectives in Step 4. The main metric categories for assessing day-to-day operations are listed below:

- Link association
- Data quality
- Performance (occurrences)
- Performance (time savings)
- Efficiency
- Participation
- Productivity
- Usefulness (by user type, by agency)
- User satisfaction (by user type)
- Utilization

Specific metrics are provided for each metric category.

3.2.2.1 Link Association

- Number of times a registered user accesses a record from another jurisdiction

–Tag who/what jurisdiction submitted each record (by record type; by user type)

–Tag who/what jurisdiction accessed each record (by record type; by user type)

- Number of link associations that are from disparate agencies (e.g., Agency A has a stolen car, and the ISS links it to a person in Agency B, and links it to property stolen in Agency C)

  – Tag and map the jurisdiction in which an individual is arrested versus the jurisdiction in which the individual resides

  – Tag and map the jurisdiction naming a suspect/offender/associate in a narrative or incident report versus the jurisdiction in which the individual resides

- Number of link associations that are from different records (e.g., pawn record has name of individual pawning jewelry, the ISS links it to the individual's arrest/conviction record, which shows individual should be under house arrest)

3.2.2.2 Data Quality

- Detail and completeness of reports (records)
  - Percent of required report fields that are completed (by record type; by agency)
  - Percent of optional report fields that are completed (by record type; by agency)
- Compatibility—frequency with which registered users are able to access/open records (by record type; by agency); possibly dependent on software tools available at each agency
- Accuracy
  - Reliability of the information source (by agency; by record type)
- Currency
  - Percent of agencies using an established mechanism to delete records based on some criteria, such as date (by agency; by record type)
  - Frequency with which records are updated (by agency; by record type)
  - Incident reports, field reports, citations, warrants, mug shots, etc.
  - "Actionable" information—time between information retrieval and some law enforcement action (e.g., arrest, traffic stop, issue warrant) based upon the retrieval
  - Timeliness—time between report completion and report submission to the ISS (based on agency input or on filing date and time entered on the report)
- Consistency
- Locate-ability
- Legal requirements met or exceeded (by agency and for the ISS as a whole)
- Relevance to (various agency) missions
- Improved report quality (e.g., clarity, classified correctly, legible; accurate)

3.2.2.3 Performance (Occurrences)

- Percent or number of times where ISS information assisted with each of the following law enforcement actions [Note: must solicit users for this information]
  - Apprehensions (take individual into custody; may or may not include an arrest)
  - Warrants
  - Arrests
  - Clearances (cases solved; may result in arrest or other resolution)
  - Convictions (court finds person guilty of a crime)
  - Cases closures (cases resulting in conviction or permanent resolution)
  - Accessing mug shots
  - Generating a line-up
  - Investigations
- Identify a lead
- Identify a point of contact
- Identify supporting records/documentation
- Obtain supporting records/documentation (See Section 3.2.2.7)
  - Leads to additional cases
  - Property recovered

3.2.2.4 Performance (Time Savings)

- Time or percent change in time to achieve the following [Note: some times may be higher if closing a case that would not normally have been closed without the ISS]:
  - Apprehensions (take individual into custody; may or may not include an arrest)
  - Warrants
  - Arrests
  - Clearances (cases solved; may result in arrests or other resolutions)
  - Convictions (court finds person guilty of a crime)
  - Case closures (cases resulting in conviction or permanent resolution)
  - Mug shots
  - Generation of a line-up
  - Investigations—investigate a case and gather information
- Identify a lead
- Identify a point of contact
- Identify supporting records/documentation
- Obtain supporting records/documentation (See Section 3.2.2.7)
  - Leads to additional cases
  - Established patterns of behavior/crime
  - Recovered property

3.2.2.5 Efficiency

- Cost per user (by user type)—measure used by some vendors
- Cost per query (by user type)—measure used by some vendors
- Impact on short-term and long-term trends by crime type
  - Crime rates
- Violent crimes
- Property crimes
- Other crimes and violations
  - Case-closure rates
  - Value of recovered property

3.2.2.6 Participation

- Number of agencies actually participating in the ISS (could also be geographic size of coverage)
- Number of agencies eligible to participate
- Number of agencies wanting to participate
- Total number of agencies in the ISS region (may be the same as the number of agencies eligible to participate)
- Distribution of the records submitted (by user type; submitted by agency)—percentage of record types submitted attributed to each of the following:
  - Incident reports
  - Field reports
  - Citations
  - Warrants
  - Mug shots
  - Other
- Percentage of available records appropriately included in the ISS
  - Number of records available in the ISS
  - Number of records eligible to be included in the ISS

3.2.2.7 Productivity

- Effort to generate a success (by user type; for use with pop-up survey question)
  - Number of nodes visited versus whether or not a session was successful
  - ISS tools used versus whether or not a session was successful
  - Records queried versus whether or not a session was successful
- Effort an officer/investigator expends per week to obtain documents from other jurisdiction(s)
  - Number of trips to other jurisdiction(s) and time required
  - Number of calls to other jurisdiction(s) and time required
- Allocation of resource time (distribution)—track to reassign resources if additional time is made available as a result of the ISS

  - Amount or percent of scheduled time users spend performing different job functions (by user type)
- In office or on road—searching for information
- In office—administrative duties
- On the street—interfacing with the community and dealing with crime
- Number of tips received from the community (by type of tip) [Note: Although ISS access is not available to the community, tips could be entered by law enforcement or extracted from other community-accessible tool]
- Number of tips searched (by user type and by tip type)

3.2.2.8 Usefulness (by user type, by agency)

- Number of visits to a record (by record type)
- Distribution of records searched and retrieved (by user type; by agency) [Note: Expect certain user types to have need for certain types of information. If searching unexpected types of information, users may possibly be finding use for non-traditional information sources.] Percentage of record types searched or retrieved attributed to each of the following:
  - Incident reports
  - Field reports
  - Citations
  - Warrants
  - Mug shots
  - Other
- Ability to track recidivism
  - Number of times a given name appears at Time Period 1 versus number of times the same name appears at Time Period 2 or subsequent period
- Value of data from a (local) stand-alone system versus from a regional system (survey question)
  - Percent of searches done using the (local) stand-alone system
  - Percent of searches on the ISS

3.2.2.9 User Satisfaction (by user type)

- Ease of use—user satisfaction rate
- Learning curve—time from first use until time when ISS is used regularly with good facility
- Number of calls to help desk
- Response time for call to help desk
- Time to problem resolution
- Number of hours of training
- Number of hours of re-training
- Training content—user satisfaction rate

3.2.2.1 0 Utilization

- Mandated use
  - Number of users mandated to use the ISS
  - Percent of mandated users using the system (by user type; by search type)
- Voluntary use
  - Number of registered users voluntarily using the ISS
  - Percent of voluntary registered users using the system (by user type; by search type)
- Number of queries per day, month, or year (by user type; by record type)
- Number of logins to the ISS over a defined time period, such as a day (by user type)

3.3 Step 3: Determine Feasibility of the Metrics

Metrics feasibility is determined by whether or not a metric is collectable and whether or not the metric reflects in a meaningful and reliable fashion the objective being assessed. It is more feasible to collect some metrics than others. Metrics that can be captured electronically or without noticeable impact to the system or end users—such as number of queries per day—are relatively easy to capture. However, some metrics may require solicitation of end users for information or require significant data analysis before a value for the metric can be determined. For example, a more difficult metric to collect is the extent to which the ISS was used to help obtain a warrant. The end user has to provide this information, most often some time after the warrant was obtained—or not obtained—and some time after the ISS was used in the warrant process.

Determining relevancy of the metric to the objective is necessary to avoid spending scarce time and resources collecting information that may be useless or misleading for assessing objectives. Excessive collection of information unnecessarily burdens the system and makes it very difficult to extract important information, even if done electronically. Someone must sort through reported metrics and decide what to use and what not to use. Since the primary objective of law enforcement personnel is first and foremost to perform their jobs, spending too much time completing surveys distracts from this objective. Collecting unnecessary information from end users and other stakeholders is distracting, time-consuming, and often counter-productive. Some metrics may be considered impractical—and therefore infeasible—if their collection places a burden on the users.

There may also be technology limitations to metrics collection. It may be that the software capabilities and algorithms needed to collect and compile the metrics do not exist. A clear metrics collection plan—including ISS objectives and a mapping between the objectives and the metrics—is strongly recommended to ensure that only the necessary metrics are collected and that the metrics collected can be analyzed properly.

3.4 Step 4: Map ISS Program Objectives and Metrics

The purpose of mapping metrics to ISS program objectives is to ensure that the proper metrics are being collected and can support the stated objectives. Table 3-1 maps the objectives presented in Section 3.1 to the metrics presented in Section 3.2. All objectives noted are addressed; however, metrics other than those indicated may also be applicable. Also, some metrics may appear for multiple objectives. For convenience, the table includes references back to the previous sections for the stakeholder categories. Corresponding objectives can be found in the referenced sections. References back to the metric categories are also provided in the table, with corresponding specific metrics found in the referenced sections.

3.5 Step 5: Collect Metrics

Developing a metrics collection methodology requires consideration of fundamental statistical procedures, including the following:

- Define the population
- Establish a basis for metrics comparisons
- Identify metric collection mechanisms
- Identify metric collection frequency
- Verify the accuracy of the metric information

Regardless of how metrics are collected, a decision must be made regarding the time(s) of collection. It may be desirable to collect metrics in the early stages of an ISS implementation to see how the program is progressing and to provide an initial impression. Program managers may compare the early-stage metrics against their program goals for the implementation phase, such as adding new users and gaining a steady increase in collaboration. The early stage metrics will most likely not indicate if the ISS objectives are being met but may indicate if progress toward meeting those objectives is being made. Metrics collection may also occur once the ISS program reaches steady-state. At steady-state, the majority of users should be using the ISS, allowing for additional interested users to join as appropriate. In addition, at steady-state, all features should be available to all users, providing the opportunity for the ISS to be utilized to its full potential. The steady-state metrics should indicate whether or not objectives are being met.

3.5.1 Define the Population

Defining the population of users and other stakeholders is important for determining who should be included in the metrics collection and for understanding the scope of the collection process. The population should encompass enough individuals so that objectives may be fairly assessed, but it should not encompass more individuals than necessary. A population encompassing too wide a scope will result in a more cumbersome and costly collection process with unnecessary information to be analyzed. In addition, different metrics may be collected for the various populations and sub-populations, depending upon their related objectives. Only the metrics needed for each sub-population should be collected, as opposed to collecting all metrics for all users.

The overall population from which metrics should be collected is the group of stakeholders managers and governance (agency managers, ISS managers and governance), end users, and ISS technical support. Each group of stakeholders may be broken out

Table 3-1 Mapping Between Objectives and Metrics

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Methods
Management and Governance — (Section 3.1.1)		
Improve accountability	Performance (time savings)— Section 3.2.2.4	All
	Participation— Section 3.2.2.6	All
	Productivity— Section 3.2.2.7	All
Support Computer Statistics (CompStat) Process	Performance (occurrences)— Section 3.2.2.3	All
	Performance (time savings)— Section 3.2.2.4	All
	Usefulness— Section 3.2.2.8	All
Manage financial resources	Efficiency— Section 3.2.2.5	• Cost per user (by user type)—measure used by some vendors • Cost per query (by user type)—measure used by some vendors
Manage people resources	Performance (time savings)— Section 3.2.2.4	All
	Efficiency— Section 3.2.2.5	All
	Participation— Section 3.2.2.6	All
	Productivity— Section 3.2.2.7	All
Identify and assess trends	Performance (occurrences)— Section 3.2.2.3	All—tracked over time
	Performance (time savings)— Section 3.2.2.4	All—tracked over time
	Efficiency— Section 3.2.2.5	All—tracked over time
	Participation— Section 3.2.2.6	All

Table 3-1 Mapping Between Objectives and Metrics (continued)

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Methods
Identify and assess trends (concluded)	Usefulness—Section 3.2.2.7	All
Increase public trust	Productivity—Section 3.2.2.7	Number of tips received from the community
Improved officer safety	All	All
Enhanced collaboration	All	All
End Users—(Section 3.1.2)		
Improve officer safety	Performance (occurrences)—Section 3.2.2.3	Percent or number of times ISS with ● Apprehensions ● Warrants ● Cases closed ● Accessing mug shots ● Arrests ● Generating a line-up ● Convictions ● Investigations ● Clearances ● Leads to additional cases
Save time and use time more effectively	Performance (time savings)—Section 3.2.2.4	All
Increase officer visibility and availability	Productivity—Section 3.2.2.7	Workflow
Increase productivity	Productivity—Section 3.2.2.7	All
Increase and leverage suspect leads	Performance (occurrences)—Section 3.2.2.3	Percent or number of times ISS with ● Apprehensions ● Investigations ● Accessing mug shots ● Leads to additional cases ● Generating a line-up
Improve quality and availability of suspect/person of interest data	Data quality—Section 3.2.2.2	All
	Performance (occurrences)—Section 3.2.2.3	Percent or number of times ISS with ● Accessing mug shots ● Investigations ● Generating a line-up ● Leads to additional cases
Improve capture of cross-jurisdictional offenders	Search and retrieval—Section 3.2.1.3	All

Table 3-1 Mapping Between Objectives and Metrics (continued)

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Methods
Improve capture of cross-jurisdictional offenders (concluded)	Link association—Section 3.2.2.1	All
	Performance (occurrences)—Section 3.2.2.3	All
	Participation—Section 3.2.2.6	All
Shorten time to arrest suspects	Performance (time savings)—Section 3.2.2.4	Time or percent change in time to achieve the following: ● Apprehensions ● Cases closure ● Arrests ● Convictions ● Clearances ● Warrants ● Accessing mug shots ● Generating a line-up ● Investigations–investigate a case and gather information ● Leads to additional cases ● Establish patterns of behavior/crime ● Recover property
Provide access to broader set of court orders	Search and retrieval—Section 3.2.1.3	All
Enhance prosecution used in court to bolster cases	Data quality—Section 3.2.2.2	All
Improve success of intelligence mission/case closures	Performance (occurrences and time savings)—Sections 3.2.2.3 and 3.2.2.4	Percent or number of times ISS assisted with the following: Time or percent change in time to achieve the following: ● Investigations ● Leads to additional cases
Increase case closures	Performance (occurrences)—Section 3.2.2.3	Percent of number of times ISS assisted with: ● Case closures ● Accessing mug shots ● Generating a line-up ● Investigations ● Leads to additional cases

Table 3-1 Mapping Between Objectives and Metrics (continued)

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Methods
Improve crime prevention	Performance (occurrences and time savings)—Sections 3.2.2.3 and 3.2.2.4	Percent or number of times ISS assisted with the following; Time or percent of change in time to achieve the following ● Apprehensions ● Warrants ● Cases closed ● Accessing mug shots ● Arrests ● Generating a line-up ● Convictions ● Investigations ● Clearances ● Leads to additional cases
	Efficiency—Section 3.2.2.5	● Crime rates by crime type—violent crimes; property crimes; other crimes and violations
	Productivity—Section 3.2.2.7	● Workflow ● Tips received from the community
Improve crime detection	Link association—Section 3.2.2.1	All
	Data quality—Section 3.2.2.2	● Locate-ability ● Reliability of info source ● Compatibility ● Currency ● Accuracy
	Efficiency—Section 3.2.2.5	Crime rates
Enhance collaboration	Link association—Section 3.2.2.1	All
	Search and retrieval—Section 3.2.2.1	All
	Performance (occurrences and time savings)—Sections 3.2.2.3 and 3.2.2.4	All
	Participation—Section 3.2.2.6	● Number of agencies actually participating (could also be geographic size of coverage) ● Number of agencies eligible to participate ● Number of agencies wanting to participate
	Usefulness—Section 3.2.2.8	All
Enhance crime mapping and link association	Search and retrieval—Section 3.2.1.3	All
	Link association—Section 3.2.2.1	All

Table 3-1 Mapping Between Objectives and Metrics (concluded)

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Methods
Technical Support—(Section 3.1.3)		
Provide reliable electronic access	Access to services—Section 3.2.1.1	• System response time • Percent of time registered user gains access when needed • System reliability
	Capacity—Section 3.2.1.2	All
	Utilization—Section 3.2.2.10	All
Provide security for the ISS	Access to services	All
	Information Security—Section 3.2.1.4	All
Provide electronic access to reliable information	Information security—Section 3.2.1.4	All
	Data quality—Section 3.2.2.2	• Reliability of info source • Legal requirements met or exceeded
Provide a user friendly method for users to submit and retrieve information	Search and retrieval—Section 3.2.1.3	All
	User satisfaction—Section 3.2.2.9	All
Provide system users access to timely technical support when needed	User satisfaction—Section 3.2.2.9	• Number of calls to help desk • Response time to call to help desk • Time to problem resolution
Provide training for system users	User satisfaction—Section 3.2.2.9	• Number of hours of training and re-training • Training content—user satisfaction rate

into various sub-populations as defined by program or agency affiliation, ISS role, and law enforcement role (e.g., civilians, command staff, patrol officers, investigators and detectives, crime analysts, and intelligence analysts). It is assumed that the collected metrics will be periodically compiled into reports for further analysis and shared. Knowing the audience for these metric reports, how the reports will be used, and whether the reports will be made available for internal law enforcement agencies and/or the public will also guide the sub-populations selected for collection and reporting.

It is envisioned that agencies that both contribute to and use the ISS would be the primary population from which to collect metrics. There may be cases where some agencies only submit data but do not actually use the ISS for information-searching. There may also be some cases where agencies only use the ISS without submitting data. Many information-sharing programs require agencies to submit at least a minimal amount of data in order to use the system. Furthermore, agencies that submit data typically are also users of the implementation. The purpose for this technique is to compare the effectiveness of the ISS program to previous law enforcement methods. The baseline should

reflect steady-state law enforcement operations as they exist prior to ISS implementation and should be compared to steady-state metrics for law enforcement operations after ISS implementation.

Establishing a baseline requires law enforcement to determine the values of current metrics prior to implementing an ISS program. This may be done via extensive surveys, including interviews with stakeholders and electronic capture of some measures. The specific types of metrics included in the baseline should be the types of metrics to be tracked in the program. Once the ISS is operational, the values of the baseline metrics should be compared to the values of the metrics under the ISS program. The baseline may be used as a point of comparison for some period of time. However, comparison of metric values from one year to the next will indicate the impact of the program on operations over a period of time. In some situations, a baseline will not be available, such as where certain metrics are not historically tracked or where metrics are associated with capabilities not available prior to the ISS. Other techniques for comparison, such as those discussed below, will need to be applied when the baseline is not available.

A second technique is to use a control group that does not use an ISS. One or more control groups may be established. Each control group will have different attributes, such as objectives and their priorities, program size, location (city, suburban, rural, etc.), size and geographic distribution of population served, the need to interface with other jurisdictions, and so forth. An ISS program would compare its metrics to those of a control group's with very similar attributes. The same metrics must be compared for each ISS group, and the control group and the metrics must be defined in the same manner. Metrics must also be normalized so that the metrics may be compared one-to-one. The purpose of using a control group is to examine differences in metric values and attribute the differences—positive or negative—as a result of the ISS program. An alternative control group technique is to use other operational ISS programs, possibly already at steady-state, as a basis for comparison. These steady-state programs should have similar attributes and metrics that make them appropriate candidates for comparison.

Another technique is to pre-set target levels for each metric. This technique enables the decision maker to know immediately the extent to which the program objectives, measured by the metrics, are being met as planned. Additionally, the process of pre-setting target levels helps to determine if the metric is really necessary, if the metric can be interpreted in a meaningful way, and how it will be used. Decision makers set the target levels, with significant input from stakeholders. Having an established baseline will make it easier to define program objectives and targets. Establishing pre-defined target values for ISS metrics to be collected requires stakeholders to first assess their current operations and program performance (prior to an ISS implementation), set program objectives, and plan the types and magnitudes of changes they would like to achieve.

One additional and more generalized technique may be applied, but it should be applied with caution. ISS metrics may be compared to national metrics (e.g., local decline in crime rate versus national decline in crime rate). This technique shares the same general principle as the control-group technique. However, care must be taken when using this technique since national metrics may not scale to local regions, depending upon the similarity of the local and national attributes.

3.5.3 Identify Metric Collection Mechanisms

The collection mechanism is the method for collecting the metric data. One or more collection mechanisms may be used for capturing metrics. Sensitivity is necessary when selecting a mechanism so that ISS users do not feel that the system is tracking their actions and professional performance. There are two distinct groups of collection mechanisms—continuous and periodic.

3.5.3.1 Continuous Collection Mechanism

The only valid method for continuous metrics collection is electronic. Algorithms are used to tag transactions and to convert the tagged transactions into meaningful metrics. Electronic collection is transparent to the ISS user.

Continuous automated capture and analysis of data without direct user/stakeholder input allows for continuous metrics collection. The information derived is primarily quantitative. This fundamental mechanism should be used for frequent and long-term assessment

of objectives, where appropriate. A wide range of metrics on all registered users may also be captured using this mechanism.

3.5.3.2 Periodic Collection Mechanisms

There are various periodic collection mechanisms that are beneficial—some formal and others ad hoc—that may be used to supplement and clarify metrics that are continuously collected electronically. There are currently many law enforcement reports prepared, such as the monthly manager's report, section manager's reports, and squad report. In lieu of a separate collection mechanism, one option is to include a very limited number of targeted questions and responses in existing performance reports, as relevant, rather than creating another report. A few supplemental collection mechanisms are listed below:

- **Periodic, (brief) electronic survey** of ISS users (including agencies), with users directly responding to a set of questions. The information captured may be a combination of quantitative and qualitative metrics and provide periodic snapshots of the effectiveness of the ISS. The survey should be brief, straightforward, and infrequent, so as not to distract from day-to-day operations. The user may be directly asked to assess the impact the ISS has had on certain operations, based on a range of multiple-choice responses. The user may also be asked to supply narratives describing success (or failure) stories as a result of the ISS. All users or a representative cross-section of users may be surveyed using this mechanism. [Note: Regular, pop-up type surveys have not been successful with the ISS programs participating in the CRISP interviews.]
- **Periodic extensive survey/interview** of users (including agencies) and stakeholders, focusing primarily on qualitative feedback. This survey and interview process—or case study—is often lengthy and provides a detailed snapshot of the ISS impact on operations. It may be conducted in person or administered electronically, or a combination of the two approaches may be used. Personal success stories may also be collected as a part of this process. Input from any ISS program advocates should be included. A representative cross-section of users may be surveyed using this mechanism since a survey of all users would likely be time- and cost-prohibitive. Administration of an extensive electronic survey would be external to the ISS, with the survey being submitted and results compiled using a tool or other resources separate from the ISS.
- **Ad-hoc feedback**. This type of mechanism may include feedback at user group meetings and focus group meetings. It may also occur as an informal exchange between a user and technical support personnel or a user and an ISS manager. Comments about the ISS should be logged as often as possible. These comments may provide content for future surveys or guidance on metrics that need to be collected or analyzed more closely. Collection of program and system data—such as planned, projected costs, and resource allocation—also falls in the ad-hoc category.
- Periodic automated capture can be used to capture infrequently changing data from the system.

Metrics evaluation for an ISS relies on user input to supplement the metrics collected electronically. Therefore, the collection mechanism must take into consideration how to encourage users to voluntarily provide input on their ISS use (e.g., success stories, likes and dislikes about the system). The FINDER program suggests that before metrics collection begins, a behavioral study is needed to determine how to get users to want to submit information, how to encourage reporting of successes, and what motivates users to submit feedback. One option for motivation includes educating users—as part of the training programs—on the value and importance of supplying information about the system. Other potential options for study include incentives, certificates, posting of successes for all to see with attribution to the agency/group supplying the input, and the display of graphics to depict key metrics). Care must be taken to use motivation techniques that do not encourage embellishment of success stories so that the input remains credible.

It should be noted that Governance Board approval may be required prior to the collection of any ISS information to ensure adherence to any memorandum of understanding (MOU).

3.5.4 Identify Metric Collection Frequency

The frequency of metrics collections should be guided by the complexity of the collection mechanism and the purpose for assessing objectives. The electronic, automated capture of data without direct user/stakeholder input mechanism is intended to be a constant collection of data, stored in a pre-determined report format. ISS operation may be continually monitored using this mechanism. Metrics may be collected for every registered user for every session, from log-on through log-off. The brief electronic survey of ISS users—with users directly responding to a set of questions—is intended to be infrequent for a given user, but the survey process may be applied frequently (e.g., daily) in order to survey a variety of users over a period of time. In this way, it may be possible to survey all users over time. A pop-up survey may appear to the user after some criteria has been met (e.g., 100 system log-ins by the user). The pop-up may appear when the user logs on or logs off the ISS. Alternatively, a link may exist for the user to select and voluntarily complete a survey. Given its complexity, the extensive survey or interview of users and stakeholders is intended to be infrequent. An extensive survey may be needed, supplementing the electronic metrics collection, to justify program enhancement, replacement, or termination.

3.5.5 Verify the Accuracy of the Metric Information

Metrics are meaningless if the information upon which they are based is inaccurate. It is essential to define objectives, establish baselines, and set targets to reduce the chance that data errors will go undetected; this can be accomplished by providing a basis upon which to scrutinize the collected data. There are a number of indicators of data inaccuracies:

- There are unexplained fluctuations in the data.
- The data is garbled or has noticeable errors.
- Reports or records are incomplete.
- Data is missing.
- Data for a given agency is inconsistent with historical or comparable agency data and cannot be explained by the presence of the ISS.
- The volume of reporting, by agency, is too high or too low.
- Feedback from users or user advocates is inconsistent with information collected.

If inaccuracies are found, the metrics collection process will need to be corrected. Software tools and algorithms for collecting, sorting, and analyzing data are just a few of the potential sources of the errors. For example, terminology may vary across agencies. The software used for accepting queries and generating responses must be able to adapt to this variation in order to properly match queries and responses. Users and agencies must also play a role by making sure that the data they submit is complete, accurate, and properly formatted.

The ISS training process should impress upon stakeholders and users the importance and value of complete and accurate survey/metrics-related data, as well as case data. To the extent possible, these individuals should have a good understanding of how they benefit if they support metrics collection.

Table 3-2—Metrics Collection Strategy Summary expands on the summary presented in Section 3.4 to address some of the considerations presented above. The headings in Table 3-1—stakeholders objectives, metric category, and specific metrics—are repeated in Table 3-2. Table 3-2 also includes information about the collection population, the mechanism and frequency of collection, the basis for comparison, and the user input required. Collection population specifies from what source the metrics should be collected; for example, sometimes ISS records or technical logs are the sources for the data. The collection mechanism specifies whether the metric should be collected electronically, via a brief survey, or by an extensive survey. Collection frequency suggests how often the metrics should be collected. The basis of comparison indicates which comparisons methods presented in Section 3.5.3 are appropriate. The User Input Required column indicates a “yes” if the end-user stakeholder group must directly supply information. If direct input from the end users is not required, the responsible stakeholder is listed. In most cases, no specific schedule have been provided (e.g., every 6 months) since scheduling will be specific to the ISS program of interest. However, the table does indicate whether the frequency is continuous or periodic. Where multiple options are listed, the options are intended to be used in conjunction with one another. Where “All” is entered, then all options for that column apply.

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Metrics	Collection Population	Collection Mechanism and Frequency	Basis for Comparisons	User Input Required
Management and Governance —(Section 3.1.1)						
Improve accountability	Performance (time savings)—Section 3.2.2.4	All	All	- Continuous automated capture - Periodic extensive survey	All	Yes
	Participation—Section 3.2.2.6	All	- ISS records - Agency records	Periodic extensive survey (and new agencies join the ISS)	Initial and target levels	Management and governance input
	Productivity—Section 3.2.27	All	All	- Continuous automated capture - Periodic extensive survey	All	Yes
Support Computer Statistics (CompStat) Process	Performance (occurrences)—Section 3.2.2.3	All	All	- Continuous automated capture - Periodic extensive survey	All	Yes
	Performance (time savings)—Section 3.2.2.4	All	All	- Continuous automated capture - Periodic extensive survey	All	Yes
	Usefulness—Section 3.2.2.8	All	All	- Continuous automated capture - Periodic (brief) survey for value of data input	- Target levels for all metrics - Add baselines for value of data input	Yes for value of data input

Table 3-2 Metrics Collection Strategy Summary

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Metrics	Collection Population	Collection Mechanism and Frequency	Basis for Comparisons	User Input Required
Manage financial and people resources	Performance (time savings)—Section 3.2.2.4	- Cost per user (by user type) - Cost per query (by user type)	All users, supplemented by ISS and agency management records	- Periodic automated capture of usage statistics - Ad-hoc collection of system costs	Target levels	Management and governance input
	Efficiency—Section 3.2.2.5	All	All	- Continuous automated capture - Periodic extensive survey	All	Yes
	Participation—Section 3.2.2.6	All	- ISS records - Agency records	Periodic extensive survey (and new agencies join the ISS)	Initial and target levels needed	Management and governance input
	Productivity—Section 3.2.27	All	All	- Continuous automated capture - Periodic extensive survey	All	Yes
Identify and assess trends	Performance (occurrences)—Section 3.2.2.3	All—tracked over time	All	- Periodic extensive survey of agencies	All	Yes
	Performance (time savings)—Section 3.2.2.4	All—tracked over time	All	- Continuous automated capture - Periodic extensive survey	All	Yes

Table 3-2 Metrics Collection Strategy Summary (continued)

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Metrics	Collection Population	Collection Mechanism and Frequency	Basis for Comparisons	User Input Required
	Efficiency—Section 3.2.2.5	All—tracked over time	- ISS records - Agency records	Periodic extensive survey (and new agencies join the ISS)	Initial and target levels needed	Management and governance input
	Participation—Section 3.2.2.6	All	All users, supplemented by ISS and agency management records	- Periodic external survey of crime metrics - Periodic automated capture of usage statistics - Ad-hoc collection of system costs	- All for crime metrics - Target levels for cost metrics	Management and governance input
	Usefulness—Section 3.2.2.8	All		- Continuous automated capture - Periodic (brief) survey for value of data input	- Target levels for all metrics - Add baselines for value of data input	Yes for value of data input
Increase public trust	Productivity—Section 3.2.27	- Number of tips received from the community - Number of tips searched - Allocation of time (proportion of officer time spent in community)	ISS and agency records	- Continuous automated capture - Ad-hoc collection of resource allocation	All	Management input

Table 3-2 Metrics Collection Strategy Summary (continued)

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Metrics	Collection Population	Collection Mechanism and Frequency	Basis for Comparisons	User Input Required
Improved officer safety	All	All	See End Users section below			
Enhanced collaboration	All	All	See End Users section below			
End Users—(Section 3.1.2)						
Improve officer safety	Performance (occurrences)—Section 3.2.2.3	Percent or number of times ISS assisted with - Apprehensions - Cases closed - Arrests - Convictions - Clearances - Warrants - Accessing mug shots - Generate a line-up - Investigations - Leads to additional cases	Officers; investigators/ detectives; crime and intelligence analysts	All	All	All end users
Save time and use time more effectives	Performance (time savings)—Section 3.2.2.4	All	All	All	All	All end users
Increase officer visibility and availability	Productivity—Section 3.2.2.7	Allocation of resource time	Officers; investigators/detectives; command staff; community members	Ad-hoc information from management, officers, and community	All	Officers and management
Increase productivity	Productivity—Section 3.2.27	All	All	All	All	All end users

Table 3-2 Metrics Collection Strategy Summary (continued)

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Metrics	Collection Population	Collection Mechanism and Frequency	Basis for Comparisons	User Input Required
Increase and leverage suspect leads	Performance (occurrences)—Section 3.2.2.3	Percent or number of times ISS assisted with - Apprehensions - Accessing mug shots - Generate a line-up - Investigations - Leads to additional cases	Officers; investigators/ detectives; crime and intelligence analysts	All	All	All end users
Improve quality and availability of suspect/person of interest data	Data quality—Section 3.2.2.2	All	Officers; investigators/ detectives; crime and intelligence analysts; technical support	All	All	All end users
	Performance (occurrences)—Section 3.2.2.3	Percent or number of time ISS assisted with - Accessing mug shots - Generate a line-up - Investigations - Leads to additional cases	Officers; investigators/ detectives; crime and intelligence analysts	All	All	All end users

Table 3-2 Metrics Collection Strategy Summary (continued)

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Metrics	Collection Population	Collection Mechanism and Frequency	Basis for Comparisons	User Input Required
Improve capture of cross-jurisdictional offenders	Search and retrieval—Section 3.2.1.3	All	All	- Continuous electronic capture for usage - Ad-hoc survey of ISS requirements	Targets	- All end users for usage data - Technical support and management
	Link association—Section 3.2.2.1	All	All	- Continous automated capture - Ad-hoc end user input	Target levels	End users as needed
	Performance (occurrences)—Section 3.2.2.3	Percent or number of times ISS assisted with - Apprehensions - Cases closed - Arrests - Convictions - Clearances - Warrants - Accessing mug shots - Generate a line-up - Investigations - Leads to additional cases	Officers; investigators/detectives; crime and intelligence analysts	All	All	All end users
	Participation—Section 3.2.2.6	All—tracked over time	- ISS records - Agency records	Periodic extensive survey (and new agencies join the ISS)	Initial and target levels needed	Management and governance input

Table 3-2 Metrics Collection Strategy Summary (continued)

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Metrics	Collection Population	Collection Mechanism and Frequency	Basis for Comparisons	User Input Required
Shorten time to arrest suspects	Performance (time savings)—Section 3.2.2.4	Time or percent change in time to achive the following - Apprehensions - Cases closure - Arrests - Clearances - Warrants - Mug shots - Generate a line-up - Investigations - investigate a case and gather information - Leads to additional cases - Establish patterns of behavior/crime	All	All	All	All end users
Provide access to broader set of court orders	Search and retrieval—Section 3.2.1.3	All	Officers; investigators/ detectives; crime and intelligence analysts	All	All	All end users
Enhance prosecution used in court to bolster cases	Data quality—Section 3.2.2.2	All	Officers; investigators/ detectives; crime and intelligence analysts	All	All	All end users

Table 3-2 Metrics Collection Strategy Summary (continued)

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Metrics	Collection Population	Collection Mechanism and Frequency	Basis for Comparisons	User Input Required
Improve success of intelligence mission/case closures	Performance (occurrances)—Sections 3.2.2.3 and 3.2.2.4	Percent or number of times ISS assisted with the following; Time or percent change in time to achieve the following - Investigations - Leads to additional cases	Officers; investigators/detectives; crime and intelligence analysts	All	All	All end users
Increase case closures	Performance (occurrences)—Section 3.2.2.3	Percent or number of times ISS assisted with - Case closures	Officers; investigators/detectives; crime and intelligence analysts	All	All	All end users
Improve crime prevention	Performance (occurrences)—Sections 3.2.2.3 and 3.2.2.4	Percent or number of times ISS assisted with the following; Time or percent change in time to achieve the following - Apprehensions - Cases closed - Arrests - Investigations - Leads to additional cases - Establish patterns of behavior/crime	All	All	All	All end users

Table 3-2 Metrics Collection Strategy Summary (continued)

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Metrics	Collection Population	Collection Mechanism and Frequency	Basis for Comparisons	User Input Required
	Efficiency—Section 3.2.2.5	Crimes rates by crime type—violent crimes; property crimes; other crimes and violations	All	All	All	All end users
	Productivity—Section 3.2.2.7	- Tips received from the community	Officers; investigators/ detectives; crime and intelligence analysts	All	All	All end users
Improve crime detection	Link association—Section 3.2.2.1	All	All	- Continuous automated capture - Ad-hoc end user input	Target levels	End users as needed
	Data quality—Section 3.2.2.2	- Locate-ability - Compatability - Accuracy - Reliability of info source - Currency				
	Efficiency—Section 3.2.2.5	Crime rates	ISS and agency management data	Periodic external survey of crime metrics	All	Management and governance input
Ehance collaboration	LInk association—Section 3.2.2.1	All	All	- Continuous automated capture - Ad-hoc end user input	Target levels	End users as needed

Table 3-2 Metrics Collection Strategy Summary (continued)

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Metrics	Collection Population	Collection Mechanism and Frequency	Basis for Comparisons	User Input Required
	Search and retrieval—Section 3.2.1.3	All	All	All	All	All end users
	Performance (occurrences and times)—Sections 3.2.2.3 and 3.2.2.4	All	Officers; investigators/ detectives; crime and intelligence analysts	All	All	All end users
	Participation—Section 3.2.2.6	- Number of agencies actually participating (could also be geographic size and coverage) - Number of agencies eligible to participate - Number of agencies wanting to participate	Technical suport; ISS management and governance	All	All	All end users
	Usefulness—Section 3.2.2.8	All	All	All	All	All end users
Enhance crime mapping and link association	Search and retrieval—Section 3.2.1.3	Summary of links to other resources or other databases	ISS requirements	Ad-hoc	Targets	Technical support and management

Table 3-2 Metrics Collection Strategy Summary (continued)

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Metrics	Collection Population	Collection Mechanism and Frequency	Basis for Comparisons	User Input Required
Technical Support—(Section 3.1.3)						
Provide reliable electronic access	Access to services—Section 3.2.1.1	- Time to access services - System response time - System reliability - Percent of time user gains access when needed - Distribution of system access methods - Distribution of access tools	Technical support logs	- Continuous automated capture - Ad-hoc for distribution of access methods and tools - Possible ad-hoc input from users	Target levels if no prior electronic means for sharing information	- Technical support and input - Possible end user input
	Capacity—Section 3.2.1.2	All	Technical logs	Ad-hoc survey of ISS license and vendor agreements (and when changes occur)	Target levels	No—just technical support input
	Utilization—Section 3.2.2.10	All	ISS policies and technical logs	- Continuous automated capture - Ad-hoc survey of ISS policies	Target levels	Management, governance, and technical support input
Provide security for the ISS	Access to services—Section 3.2.1.1	- System reliability - Percent of time user gains access when needed	All	Continuous automated capture	Target levels	Technical support

Table 3-2 Metrics Collection Strategy Summary (continued)

Stakeholder Objective	Metric Category Applicable to Assessing Objective	Specific Metrics	Collection Population	Collection Mechanism and Frequency	Basis for Comparisons	User Input Required
	Information security—Section 3.2.1.4	All	Technical support logs	Continuous automated capture	Target levels	Technical support
Provide electronic access to reliable information	Information security—Section 3.2.1.4	All	Technical support logs	Continuous automated capture	Target levels	Technical support
	Data quality—Section 3.2.2.2	All	All	All mechanisms ongoing, supplemented by random data quality checks	All	All stakeholders provide input
Provide a user friendly method for users to submit and retrieve information	Search and retrieval—Section 3.2.1.3	All	Technical support	- Continuous automated capture - Ad-hoc survey of ISS requirements	Target levels	Technical support
Provide system users access to timely technical support when needed	User satisfaction—Section 3.2.2.9	- Number of calls to help desk - Response time to call to help desk - Time to problem resolution	Technical support call center logs	- Continuous automated capture - Periodic (brief) electronic survey - Ad-hoc input	Target levels	- Technical - End user input as needed
Provide training for system users	User satisfaction—Section 3.2.2.9	- Number of hours of training and re-training - Training content—user satisfaction rate	All	- Periodic (brief) electronic survey - Ad-hoc input	All	User input

Table 3-2 Metrics Collection Strategy Summary (concluded)

3.6 Step 6: Analyze Metrics Collected

There is the potential for vast amounts of data to be generated in ISS metrics collection. Statistical techniques—such as factor analysis and multi-colinearity analysis—may be applied to determine variability and relationships between factors affecting the values of the metrics. Statistical techniques will also need to be applied to manage the data and to determine which of the many independent variables should be used to predict the values of the dependent variables. It will be beneficial to consider cross-sections of the ISS population to tailor results to specific ISS objectives. A few possible cross sections are listed below:

- Metric type
- Registered user name
- User group (agency, type of stakeholder, or law enforcement role)
- Query type
- Dates
- Type of crime or problem

Additional cross-sections may help to determine the trail of leads or other information facilitated by the ISS:

- Name of suspect, criminal, or person of interest
- Disposition of cases

As previously mentioned, metrics data may be quantitative or qualitative. If the data is quantitative, descriptive statistics can be used to summarize the raw metrics data collected. The most common descriptive statistics are the mean, variance, median, and other percentiles of the collected data sets. For each quantitative metric, a set of descriptive statistics may be calculated across all users or for various cross-sections of the population (such as investigators). Statistical inference techniques must be applied in order to make probability statements about the extent that objectives are being met and the associated level of confidence in those probability statements. As with descriptive statistics, this technique applies to quantitative data. Inference techniques are also used to estimate any statistical correlation between metrics and objectives. If there is data from a baseline or control group, hypothesis testing may be used to determine whether there is a difference between the value of the baseline/control group metric (or related objective) and the value of the same ISS metric. If target levels have been set, one may test whether or not the target is being met. Additionally, a probability distribution may be fit or frequencies generated for a data set of a given metric, indicating the possible range of values for the metric and the likelihood of those values.

For qualitative data, there are a few options for analysis. One option is to translate the information into a quantitative format using a ranking or scoring method. This is often done when developing a survey to solicit responses to subjective questions. Survey participants may be asked to rank a system feature on a scale of 1 to 5, for example, as opposed to simply being asked which system features they like.

Another option is to categorize the responses and then apply quantitative analysis techniques by considering the number of responses falling into each category. Again, the entire population or cross-sections of the population could be analyzed. This categorization may be done up front. For example, with FINDER, there are plans for users to select category(s) for the success stories they submit. Alternatively, intelligent software may be used to categorize narrative information, based on keywords.

Another consideration when analyzing metrics data is the impact of outside factors on law enforcement operations. Outside factors include operational changes that may indirectly affect metrics (e.g., policy changes, resource redeployment, and implementation of new law enforcement programs). The analysis of metrics should factor in these changes and consider which metrics or programs they are intended to impact. Other factors include changes in population (size, age, and geographic location), crime trends before the ISS, economy, and socio-economic changes. The goal is to avoid overestimating or underestimating the value of the ISS and to recognize when other factors are responsible. Such an approach will result in better planning by proper attribution of benefits to the variety of law enforcement programs used by an agency. The reader is referred to a standard text or website on statistics [16, 17] for additional background on the techniques presented in this section.

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4 Issues and Impacts

Metrics collection is a massive and challenging endeavor. Throughout this document, many areas have been identified that require consideration before a metrics collection program can be established; the most significant considerations are discussed below. Some considerations regarding implementation of an ISS and its impact on policies and resources are listed first. That discussion is followed by consideration of additional technology that may enhance the operation of an ISS metrics collection program.

4.1 Impact on Policy and Resources

Functional requirements will need to be formally developed because many of the proposed metrics are not readily available and supporting data is not typically collected for law enforcement operations. In addition, the techniques for automatic electronic capture of many of the metrics must be specified. Many of these requirements will be applicable to various ISSs and should be shared among those ISSs. Significant work will be required to define functional capabilities and to develop supporting software. The functional capabilities should define (1) the specific transactions that must be tagged and tracked, (2) the algorithms needed to generate metric values based upon these transactions, and (3) the algorithms needed to analyze the metrics. Coordination between users, system planners, and software developers will be critical. While functional requirements also impact technology, it is necessary to incorporate the requirements for metrics collection first during ISS policy and planning.

The decision to make participation in the ISS voluntary or mandatory will need to be made and will affect ISS policy. An ISS will not be used more than minimally required unless it is deemed beneficial to the users. Therefore, voluntary-versus-mandatory participation in the ISS may affect the quality of the metrics. For example, high rates of usage and participation may be very meaningful if use is voluntary but possibly meaningless if use is mandatory. An ISS with voluntary participation that has low usage rates may provide a strong indication that the ISS is not viewed as useful. At the same time, voluntary participation and high usage rates may indicate that the ISS is viewed as useful. When usage and participation rates for a mandatory ISS are significantly higher than expected, it may also indicate that the ISS is viewed as useful. It is also possible that mandatory usage may encourage otherwise reluctant users to try the system and learn how to use it effectively.

A comparison group should be developed or selected before the ISS is implemented. Planning for the comparison group should be part of the planning for the metrics collection program. The law enforcement environment is very dynamic. Therefore, it is not possible to hold external ISS factors constant in order to determine whether the ISS contributes to meeting its objectives. The use of a comparison group attempts to account for the impact of some of these external factors. Metrics must be interpreted very carefully and supplemented by success stories from the user population in order to determine the success—or failure—of the ISS.

Additional resources will probably be needed if a metrics collection program is implemented. Software developers will be needed to program the functional capabilities required to tag transactions in order to collect the metrics. Technical support will be needed to ensure proper collection of metrics and to monitor the collection process. Statistical analysts will be needed to define the metrics, to map metrics to objectives, and to compile, analyze, and interpret the metrics. Additional analysts may be needed to help sort through the increase in information that users will obtain with an ISS and to determine the relevance of the information found via the ISS. ISS advocates have proved beneficial—based on feedback from the FACTS, LInX, and FINDER programs—by communicating with users about how the systems are being used, success stories, and recommended improvements. Costs associated with the additional resources, as well as cost of the metrics collection program, should be included when planning for the ISS.

There are several other considerations regarding the overall ISS program that may impact the metrics collection process. For instance, ISS management and governance have a significant influence on the comfort level users have towards the ISS. In addition, total cost of ownership should be determined—and planned for—early in the ISS planning process so that the program is sustainable even after initial funding has been exhausted. These two factors will affect operation of the ISS program, operation of the metrics collection

program, and ultimately the user's ability to effectively use the system and the user's desire to provide meaningful input on system use.

4.2 Impact on Technology

It may be beneficial to have a secure database for ISS programs that are willing to share their metrics collection methodology and functional requirements, metrics data, and conclusions regarding the extent to which ISS objectives are being met. This information would provide guidance to agencies considering an ISS or considering a metrics collection program. The information would also serve as a source of comparison data for ISS programs. Interested programs would need to coordinate this effort and set policies for its use.

The use of a decision tool to guide ISS planners through the process of developing a metrics collection program may be beneficial. The tool would have two roles: to help planners define a metrics collection program and to analyze and interpret the metrics collected. The tool could guide program definition by soliciting ISS objectives from the planner and then generating a map between the objectives and feasible metrics. The planner would input baselines, target levels, or other comparison values for each metric. The metric values would be extracted from the ISS and analyzed statistically by the tool, with results presented in a summary report.

5 Recommendations

Developing the type of metrics collection program described in this document is a long-term effort. Several recommendations may simplify the process.

Recommendation 1: Institute a formal plan for metrics collection so that useful and appropriate metrics are collected without burdening users with the collection process. The specific details of a metrics collection plan will vary by ISS program, requiring some tailoring of the methodology presented in this document. Having a metrics collection plan in place before the collection process begins will factor into overall planning for ISS resources, policy, and technology requirements. The plan should address each of the steps discussed in Section 3:

Step 1: Define ISS program objectives

Step 2: Determine which types of metrics to collect

Step 3: Determine feasibility of the metrics

Step 4: Map ISS program objectives and metrics

Step 5: Collect metrics

Step 6: Analyze metrics collected

Recommendation 2: Consider the benefits of a preliminary behavioral study on how best to obtain quality input from users. Lapses in time between specific use of the system and the noticeable impact on operations—coupled with the fact that the ISS may be one of many resources used that have an impact on operations—heightens the importance of direct user input for a comprehensive assessment of objectives. The results of such a behavioral study could be shared among various law enforcement programs considering an ISS. Lessons learned from the study could also be used to design an effective collection mechanism for the metrics.

Recommendation 3: Recognize the significant value of qualitative information as metric data. Qualitative information, such as narratives, provides critical metric data. Techniques to characterize this information and make it quantifiable are strongly recommended.

Recommendation 4: Use a combination of metrics to assess each objective, as opposed to considering the metrics as distinct from one another. For example, the amount of time a user spends on the system is not a direct indicator of system usefulness. Spending a long time on the system may indicate usefulness or it may indicate the users' inability to navigate the ISS and quickly find information. Spending a short time on the system may indicate that the ISS is easy to navigate, the information is easy to locate, or the user became frustrated and gave up before the desired information was found. The amount of time a user spends on the system should be combined with such metrics as types of searches the user conducts, links from one search to another, and direct user feedback, as available. This combination of metrics will help determine how the system is being used.

Recommendation 5: Leverage the relationship between law enforcement agencies and the broader criminal justice system. Tracking the flow of ISS information throughout the criminal justice system will help determine how the ISS information is being used and the extent to which the ISS is meeting its objectives. This recommendation requires exchange of information among law enforcement agencies and other criminal justice agencies, such as the Courts, Corrections, and possibly federal agencies (such as Homeland Security and the FBI).

Recommendation 6: Acknowledge that some metrics will provide an indication of the usefulness of the ISS rather than identifying definitive relationships between ISS use and meeting of ISS objectives. Given that stakeholders have little time to use a system that is not meeting a need, regular usage of the ISS by the stakeholders may be sufficient proof that the ISS is meeting its objectives, particularly for systems where participation is voluntary. Before embarking on a metrics collection program, consider the type of information that the metrics will provide and whether or not that information will be sufficient. Sharing success stories and other anecdotes may be critical to obtaining user buy-in but may not be sufficient to justify budget requests. Budget requests will require definitive and concrete measures showing direct links (statistical correlations) between the ISS and law enforcement objectives.

Recommendation 7: Recognize that planning for and implementing a metrics collection program is a long-term process but taking specific actions early

on may facilitate the effort. For example, recording data in universally defined formats, such as Global Justice Extensible Mark-up Language (GJXML) for data interchange [13], makes participation in an ISS possible. GJXML is used when exchanging data between two systems or programs. While the fields within two databases may be different, it is possible to exchange data meaningfully if each maps their own database elements to the GJXML elements. Universally formatted data will facilitate transaction tagging needed for generating metrics. Furthermore, as can be seen from the list of metrics in Section 3, some metrics may be captured with minimal effort, particularly some of the system performance, participation, efficiency, and utilization quantitative metrics. These metrics may be coupled with basic user satisfaction input, such as success stories and the extent to which the ISS meets the user's objectives. The result would be a preliminary indication of ISS success and guidelines for a more expansive metrics collection program.

Recommendation 8: Use ISS metrics as a design tool to plan for, evaluate, or improve other law enforcement programs. This document focuses on using metrics to evaluate an ISS. However, baselines are continuously updated, targets are established, and assessment of objectives with concrete data is ongoing; this allows managers to better determine what types of initiatives need to be started, continued, or discontinued. If new initiatives are piloted, some of the ISS metrics may be used as a basis of comparison for the pilot performance. For example, if PDAs are piloted for patrol officers, ISS performance and user satisfaction metrics may be compared to PDA metrics regarding information-sharing.

Recommendation 9: Consider expanding this research to examine ISS and non-ISS programs beyond the criminal justice system that rely on measures of effectiveness and seek to produce primarily qualitative results. Various public- and private-sector programs use metrics to measure and track their progress towards meeting qualitative and quantitative objectives. Lessons learned from some of these programs may provide insight on how to develop and operate a law enforcement ISS metrics program.

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Appendix B: Acronyms

ARJIS	Automated Regional Justice Information System
BJA	Bureau of Justice Assistance
CLEAR	Citizen Law Enforcement Analysis and Reporting
COPS	Community Oriented Policing Service
CPD	Chicago Police Department
CRIMES	Comprehensive Regional Information Management Exchange System
CRISP	Comprehensive Regional Information Sharing Project
dFACTS	Distributed Factual Analysis Criminal Threat Solution
ERM	Electronic Records Management
FACTS	Factual Analysis Criminal Threat Solution
FBI	Federal Bureau of Investigation
FDLE	Florida Department of Law Enforcement
FINDER	Florida Integrated Network for Data Exchange and Retrieval
FTE	Full-time equivalent
GAO	Government Accountability Office
GJXML	Global Justice Extensible Mark-up Language
IAC	Industry Advisory Council
InSite	Intelligent Site System (FDLE)
I-CLEAR	Illinois Citizen and Law Enforcement analysis and Reporting
ISS	Information-sharing system
JRSA	Justice Research and Statistics Association
JXDM	Justice XML Data Model
LInX	Law Enforcement Information Exchange
MDC	Mobile Data Computer
MOU	Memorandum of Understanding
MWCOG	Metropolitan Washington Council of Governments
NCIS	Naval Criminal Investigative Service
NIBRS	National Incident-Based Reporting System
NARA	National Archives and Records Administration
NIJ	National Institute of Justice
NLECTC	National Law Enforcement and Corrections Technology Center
OMB	Office of Management and Budget
PDA	Personal Data Assistant
RMS	Records Management System
UCR	Uniform Crime Reports

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