

■ ■ The Integrated Data System Approach: A Vehicle to More Effective and Efficient Data-Driven Solutions in Government ■ ■

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Introduction

America's Crisis in Public Trust

Public confidence and trust in government's administration of public services in the United States is at an all-time low. Only 20 percent of Americans describe government programs as well run and say that they trust the federal government most of the time (Pew Research Center, 2017a). This crisis in confidence comes at a time when the U.S. population is larger and more diverse than ever (U.S. Census Bureau, 2017), and while the U.S. is shouldering a post-recession national debt of over \$19 trillion. There is tremendous pressure on our government human service agencies to address complex social problems with less. So why are our government agencies perceived as so ineffective by the public?

Major policy analysts have identified outmoded and dysfunctional features of the American public problem-solving process that are not suited to addressing the complexity of our contemporary national problems (Kettl, 2002, 2009, 2012; Lindblom & Cohen, 1979). Government effectiveness is often thwarted by top-down, one-way, hierarchical leadership; compartmentalized bureaucracies with rigid boundaries; and no disciplined knowledge development-to-practice cycle that utilizes existing administrative data in an ongoing process to understand and solve problems. These barriers thwart effective, efficient, and ethical governance and undermine public trust in government's ability to solve pressing problems.

Approaches to Public Administration Reform

Ineffective public administration management structures have led to a proliferation of responses. Most recently, the Office of Management and Budget (OMB) and the United States Congress have called for the cross-sector use of government collected administrative data to inform social problem-solving processes that lead to evidence-based policy. This resulted in the passage of H.R. 1831 in March of 2016, establishing the Commission on Evidence-Based Policy. The goal of the Commission is to identify and encourage innovative approaches that show how existing administrative data can be integrated and made available to facilitate "program evaluation, continuous improvement, policy-relevant research, and cost-benefit analyses," and to identify concrete "infrastructures" to support these objectives while maintaining high "data security" (Evidence-based Policymaking Commission Act, 2016).

This most recent effort to transform American public administration reflects the core tenets of three key reform movements: (1) Performance Management (PM); (2) Evidence-Based Policy (EBP); and (3) Continuous Quality Improvement (CQI). Performance Management emanates from the public administration sector and it primarily seeks to bolster government

accountability. PM requires goal setting toward the attainment of important, visible outcomes, strategic planning to identify the steps necessary to achieve those goals, and measurement of progress toward these ends (Moynihan, 2008). Based on the performance information generated, public administrators are held accountable for the agencies they oversee and their agencies' ability to meet goals for public service through sanctions or rewards. The main focus of Evidence-Based Policy, which comes from the university research sector, is the incorporation of high-quality research into the policy-making process. This movement relies upon an accumulated body of rigorous scientific knowledge to inform the adoption of certain policies based on their demonstrated record of success. It also calls for independent program evaluations to ensure that policies are producing the expected results. Finally, Continuous Quality Improvement has emerged from the private business sector. This movement began as a response from critics of assembly-line production and regimented factory management and seeks to refocus business on the merits of more dynamic and innovative processes to create and build better products. Additionally, it emphasizes the necessity of creating a culture that encourages employees to make active contributions to improving those processes from their unique perspectives. Continuously improving upon an organization's process will eventually produce a higher quality product, which is the ultimate goal of this movement. This requires attention to incremental improvements derived through a trial-and-error process.

Despite the useful core concepts upon which these movements are based, each has faced a unique set of challenges when applied to government and has remained in and of itself insufficient to reform American public administration. Performance Management has suffered, first and foremost, from its emphasis on performance outcomes and the corresponding sanctions and rewards associated with those outcomes. Because of this strict accountability focus, many public administrators have come to view the movement as a means of forced compliance reporting or a mechanism for public shaming (Waite, 2010). In addition, the accountability-driven nature of PM has also led to data manipulation and gaming in this high-stakes environment, a side effect that ultimately undermines the entire improvement process by distorting the data through which outcomes are assessed (Heinrich, 2002). While accountability is undeniably important, especially in government, a single-minded focus on high-stakes accountability can distort a well-intended PM system. In contrast, Evidence-Based Policy maintains a dominant focus on research studies as the primary vehicle to effective public policies. While government is responsible to a diverse set of stakeholders and must engage in the policymaking process amid complex political sensitivities and competing interests, EBP demands that only high-quality science be considered in making important program and policy decisions—a demand that is unrealistic within the context of public administration (Jennings & Hall, 2012). Furthermore, there is often a presumption that all high-quality research is beneficial to policymakers when, in fact, much of the research generated is highly contextualized, precluding any generalizations or broad applications across contexts. Often, research that is directly relevant to the specific needs of policymakers and

public administrators simply *does not exist*. Finally, adapting Continuous Quality Improvement from the private business sector to the public service sector has proven challenging due to a number of salient differences between these two realms. In comparison to private enterprise, the public sector lacks a defined customer, is not unified across departmental agencies, is beholden to a variety of stakeholders, tends to lack a singular strategic vision, and is often tasked with too many performance targets (Vinni, 2007). This movement requires an emphasis on processes over outcomes, an emphasis which is fundamentally incompatible with the public sector need for government scrutiny, accountability, and a focus on policy and program outcomes (Swiss, 1992). Thus, while Performance Management, Evidence-Based Policy, and Continuous Quality Improvement have singularly struggled to revolutionize the organizational management of public administration, all three of these movements have merit and their core tenets should be considered as we seek innovative approaches to improve public administration.

Integrated Data Systems: A New Approach

Fortunately, there is a robust national movement that seeks to intentionally integrate these concepts in a way that has been demonstrated to improve government administered human services. This approach is currently being utilized at the state and local level to address vexing social problems (Fantuzzo & Culhane, 2015; Heidbreder, 2016; Jennings & Hall, 2012). This movement is called the Integrated Data Systems (IDS) approach. The IDS approach synthesizes the critical tenets of these reform movements to produce a more responsive system of organizational management in government (See Figure 1). State and local IDS sites around the country have demonstrated that this approach can produce ongoing effective and efficient improvements in public administration while building public trust and protecting personal data.

Recognizing the potential of IDS to produce cross-sector actionable intelligence for government leaders and the complexity they represent, the John D. and Catherine T. MacArthur Foundation provided funding to the University of Pennsylvania to establish a network of IDS sites for the purpose of studying their best practices. University of Pennsylvania researchers identified high-functioning state and local sites with strong track records of using integrated cross-sector administrative data to address complex social problems in their jurisdictions. This network is called Actionable Intelligence for Social Policy (AISP). At present, it includes state sites (Florida, Hawaii, Indiana, Michigan, New Jersey, South Carolina, and Washington), and county/city sites [Allegheny County (Pittsburgh), Cook County (Chicago), Cuyahoga County (Cleveland), Los Angeles County, Mecklenburg County (Charlotte, NC), Milwaukee, New York City, Philadelphia, and Tri-County Silicon Valley, CA]. These Network sites represent over 25% of the U.S. population

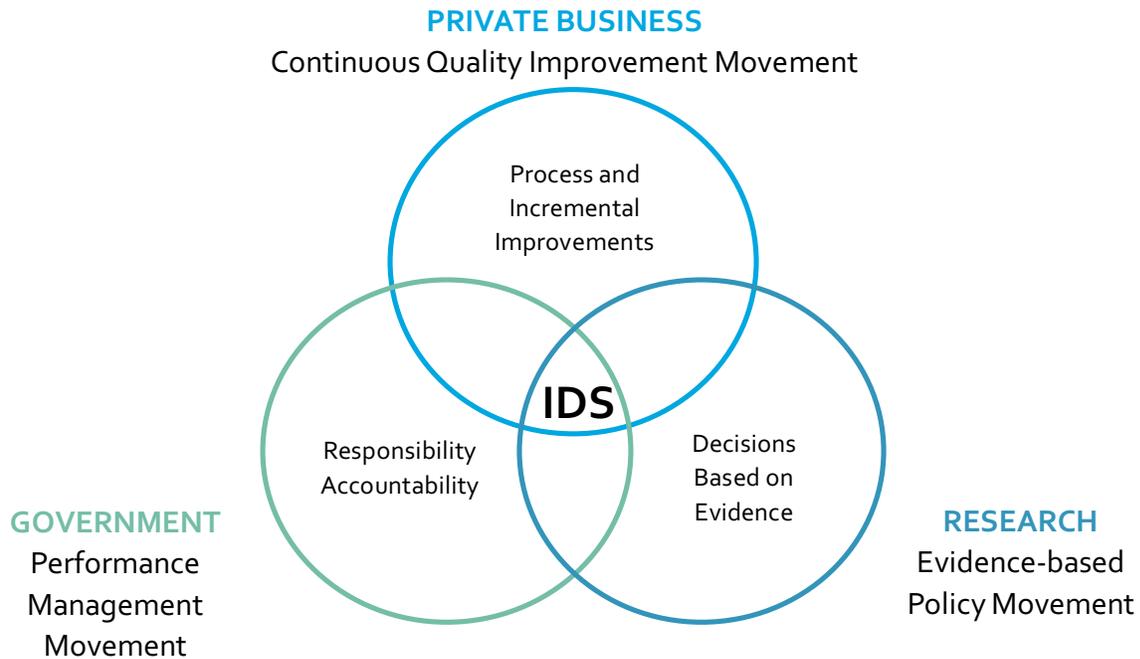


Figure 1. IDS approach at the intersection of PM, EBP, and CQI.

and are producing, in a sustainable real-time manner, actionable intelligence to advance social problem solving in their government agencies.

The IDS approach introduced in this paper is derived from the careful study of the best practices of these fully functioning AISP IDS Network sites. The purpose of this paper is threefold: First, it will present the conceptual framework for the IDS approach. This section will describe how the IDS approach’s conceptual framework incorporates heuristic concepts from the major reform movements discussed above. Second, it will detail how these core features of the IDS approach are used to build a sustainable infrastructure to support a fully functioning IDS for state and local government. Finally, the paper will illustrate how the IDS approach can be used as an effective and efficient vehicle to data-driven solutions through a close look at a single inquiry cycle and an overview of the larger systematic and iterative social problem-solving process within government.

Conceptual Framework of the Integrated Data System Approach

The Integrated Data Systems (*IDS*) approach combines core tenets drawn from the Performance Management, Evidence-Based Policy, and Continuous Quality Improvement movements to offer a conceptual framework that has been demonstrated to provide an effective vehicle for change in state and local government. These core tenets are:

1. The creation of an established but flexible **system of inquiry** built upon a theory of change that is logical, testable, and linked to an ultimate outcome of public service;
2. The collection and analysis of **relevant, high-quality data**; and
3. The **integration of people and data** across agencies, led by a committed executive leadership team and based on bidirectional dialogue using a common language of inquiry.

The IDS approach distills unique fundamentals of each movement to form an improved version of organizational management for American public administration.

Core Tenet One: A System of Inquiry

Foundational to the IDS approach is the creation of an established system of inquiry to solve social problems. At its core, this system involves an ongoing process of organizational inquiry resulting in actionable intelligence that informs decision making relevant to a social problem. Actionable intelligence is not data; it is the useful knowledge or meaning-making generated when data and findings are reviewed and discussed by stakeholders close to the social problem of interest. This system is analogous to the engine of a car. The system is the process by which organizational inquiry is converted into the actionable intelligence providing force to move the problem-solving process forward towards practical and sustainable solutions.

First and foremost, the system of inquiry within an IDS approach must be connected to a logical, testable organizational theory of change where government actions are tied to public outcomes. For example, a theory of change might state that improving the availability of permanent supportive housing should lead to a reduction in homelessness. Bonstingl (1992) argued that “transforming organizations cannot occur without knowledge and without theory. Unless change is related to a theoretical framework, one does not know what to change” (7). Before creating an established process for organizational management, a system of beliefs connecting action to outcomes must exist. This system can be based on scientific evidence, generally held beliefs, professional experience, or theory. To produce a cohesive working logic

model, the resources, proposed actions, ultimate outcomes, and causal mechanisms of the organization's work must be disentangled, clearly defined, and operationalized.

After this working theory of change has been established, the system must test that logic in an ongoing, iterative process. The theory of change must be explicitly tested to ensure that the logic model provides an accurate representation of reality. The theory of change must also be malleable and incorporate revisions as new information becomes available. The Continuous Quality Improvement literature stresses that this organizational learning is "an ongoing, never-ending process" rather than a one-time effort or project (Bonstingl, 1992, p. 15). It requires organizational trial and error, a willingness and patience to describe and evaluate outcomes, and adjust resources, inputs, and actions as needed. In this way, what does not work becomes just as important as what does work. Even the most innovative ideas do not work at first, and the most promising practices often need to be tweaked to work within a specific context. Thus, ongoing testing of the theory of change through trial and error is essential to the system.

The need for trial and error within the system must operate in tension, however, with the need for accountability to public expectations. While Continuous Quality Improvement focuses on improving business processes, Performance Management stresses the importance of accountability to public outcomes. Because government uses taxpayer dollars to solve pressing social problems, it must be publicly accountable for the outcomes it produces. It is essential that accountability remain low stakes as well as centered on transparency and public communication rather than on reward and punishment. In essence, the process-oriented organizational learning promoted by Continuous Quality Improvement must be combined with the outcomes-oriented public accountability promoted by Performance Management.

Additionally, these outcome targets, which act as a source of accountability, must remain true to what the current logic model indicates is achievable. While it may be more politically and conceptually palatable to set an outcome target of "100%" for an important public service objective, it does not provide a useful benchmark to understand and improve the organizational theory of change. According to Bonstingl, "Statements that lack the methods are worthless...Goals that lie outside the upper limits of the existing process cannot be achieved by that process" (p. 7). Outcome targets that are too lofty to be achieved by the inquiry process represent an idealistic attempt to solve complex, entrenched social problems at an unworkable pace and further erode the public trust because failure is inevitable. Rather, public administrators should work toward incremental improvements in social problem solving, striving for realistic outcome targets that reflect the true capacities of the current system. Focusing on these "small wins" rather than dwelling on the process' failure to immediately achieve overarching goals keeps the system moving forward while allowing it to engage in the lengthier trial-and-error process. Continuous Quality Improvement endorses the idea that organizational learning cannot occur

when any course of action that does not meet its intended aim is immediately abandoned and labeled a failure. These “failures” must be analyzed and understood within the overall theory of change and then utilized as the basis for future change. An IDS approach embraces this tenet of CQI as part of a system of inquiry built to test and refine a logical, testable theory of change. This system is flexible, incorporates and eliminates information based on relevancy to the working theory of change, strives for continuous improvements, values both successes and challenges as opportunities for organizational learning, and is transparent and accountable to the public.

Core Tenet Two: Relevant, High-Quality Data

The second essential tenet of the IDS approach to public administration is data. ***Data are the raw elements*** that are used throughout the IDS problem-solving process to ultimately produce actionable intelligence. These data comprise the *gas* that the vehicle’s engine must process and convert into energy to move the vehicle forward.

The IDS approach distills two important concepts about data from the organizational movements previously discussed. Data must be relevant to the social problem being solved and must be of sufficient quality. *Data relevancy* “refers to the usefulness of the information for the intended audience’s anticipated purposes,” and *data quality* refers to “whether disseminated information is accurate, reliable, and unbiased” (Office of Management and Budget 2002, p. 1).

Because the bulk of administrative data currently collected serves the purpose of generating compliance reports, not all the data are relevant to the social problems being addressed. Much of the data is extraneous or redundant and is, therefore, unnecessarily burdensome and costly to collect and process. Similarly, administrative data do not necessarily include all the information necessary to address a social problem. Despite the preponderance of compliance data, many data elements relevant to the system’s logical inquiry process are missing. Without all the necessary data elements, the system cannot accurately test its organizational logic model. In short, the data, or the fuel for the vehicle, must be of the right blend—with unnecessary elements eliminated and missing elements inserted—in order to be processed effectively by the engine.

Both Performance Management and Continuous Quality Improvement recognize that an organization must decide what data to collect based on organizational objectives and causal connections (i.e., outcomes of the logic model and how they relate to inputs) (Behn, 2014). As Rothbard (2015) argues, “Relevance is the degree to which data accurately address the objective of the project or analysis...To be relevant, it is necessary to know which inputs (staffing, service type, volume, etc.) are associated with which outputs” (p. 85). Individual departments must assess data practices in terms of the organization-wide logic model and modify data collection to

eliminate or incorporate the appropriate data elements. Data relevance is thus constantly evolving within the system as the logic model evolves.

In addition to being relevant, the data must also meet a given threshold of quality to be useful in the social problem-solving process. Errors can be introduced into administrative data due to problems of measurement, collection, transference of records, and/or analysis. Data that are of high quality accurately “represent the real-world construct to which they refer” (Rothbard, 2015, p. 82–83). If data relevancy is analogous to the correct blend of gas necessary to fuel an engine, data quality is analogous to the purity of that gas. Unrefined fuel replete with impurities is less effective at powering the vehicle, and in fact can damage the engine. If data are invalid or unreliable across time, systematically missing, or in some other way biased, the system will not be able to effectively process and convert them into usable information. By ignoring data quality and processing error-riddled data, the system may produce faulty information and, subsequently, incorrect decisions related to the social problem being addressed.

Thus, it is essential, within an integrated data systems approach, to first define “data quality” and to then establish strategies by which this quality may be built into the processes of measurement, collection, record transfer, and analysis. Rothbard writes, “The process of defining the way data quality is conceptualized and operationalized in an agency and the practice of writing down the methods being employed to ensure this task be successfully implemented is a first step in enhancing data quality” (p. 83). The system must first assess the current level of data quality relative to an established standard. The data must be scoured for measurement error, redundancy, missingness, coding errors, and inconsistencies (Boruch, 2012). Strategies to address these issues should be developed and implemented, and ongoing data audits, data management procedures, and standardization of data collection and analytic practices should be established.

The need for high-quality scientific data comes primarily from the Evidence-Based Policy movement. EBP recognizes the need for policymakers to adhere to scientific standards of data quality, research design, and statistical methods (Jennings & Hall, 2012). While EBP encourages policymakers to use existing research in evaluating programs and policies, the IDS approach acknowledges the need for public administrators to employ scientific standards of data quality and appropriate research methodology for *their own* purposes. Rather than relying on third-party researchers to produce valid and reliable findings that may only be tangentially related to the policy or program of interest, public administrators can authorize quality research that is directly applicable to their specific inquiry needs. Though contention exists within the scientific community about what “counts” as quality data, standards for administrative data quality and the methods used for government research should, at minimum, be working toward the same degree of scientific rigor utilized by the academic community. Thus, high-quality data are essential to a functional system of organizational management within an IDS approach. Relevant and quality

information provides a basis for evaluating the performance of the system as a whole and monitoring change within that system as it progresses toward the ultimate aims of its theory of change.

Core Tenet Three: Integration of People and Data

The final tenet essential to the IDS approach to public administration relates to the ***integration of people and data*** within the system. While the system and the data are certainly necessary components of a functional IDS, they are insufficient to produce effective solutions to complex social problems. The system itself does not make decisions. The data themselves are not intelligence. It is the community of people involved in the social problem-solving process engaging in bidirectional dialogue that converts data into actionable intelligence, uses actionable intelligence to propel decision making, analyzes and reflects on the success of their choices, and refines and revises operations accordingly. The integrated efforts of the people within the system represent the *drivers* of the car. These drivers share the responsibility of traveling effectively and safely on the road of IDS inquiry. They must work collaboratively to decide upon a destination and a route for getting to that destination, while abiding by the rules of the road.

The IDS approach extracts three key elements related to integration from Performance Management, Evidence-Based Policy, and Continuous Quality Improvement. All of these movements recognize the importance of fully committed executive leaders, horizontal communication across departmental silos and vertical communication within organizational hierarchies, and an organizational culture that promotes data literacy and usage. As attempts to implement these movements in public administrative contexts has evidenced, the people within an organization remain the most crucial and most difficult component in spurring organizational change. First and foremost, the integration of the participants involved in the social problem-solving process must begin with executive leaders' commitment to the concept and practices of the IDS approach. Organizational leaders must understand and accept the core tenets of this approach and the strategies and mechanisms by which these tenets are operationalized. Without full buy-in by executive leaders to the approach itself and to the complex and demanding work it will entail, the organization cannot successfully implement systematic change. Organizational goals, operational norms, and staff culture emanate from organizational leadership. As proponents of CQI have discovered, the full potential of CQI cannot be actualized "without the strongest possible leadership from the top of the organization" (Bonstingl, 1992, p. 20). A quality improvement approach demands much from its workers and requires executive leadership to exhibit visible, unwavering commitment to the core tenets of that approach. Similarly, critics of PM have attributed challenges with its implementation to the perceived apathy or ambivalence of executive leadership. As Moynihan (2013) notes, "One of the clearest findings about performance management is that such systems are more likely to succeed when agency leaders

are perceived as committed to the performance system” (p. 29). Executive leadership’s understanding of the IDS approach is thus vital, and leadership must devote organizational resources and efforts to operationalize the approach, and visibly demonstrate their commitment to the approach to workers across the organization.

Secondly, barriers to organizational communication, both across and within organizational divisions, must also be eliminated to ensure productive dialogue among key contributors. Interdepartmental dialogue or horizontal communication is essential to bring together all relevant people across agencies. Agency employees must develop institutionalized methods of communication and relevant data sharing across departments. Just as the manufacturing, marketing, and sales departments within a private business must communicate and share information to operate successfully, so must distinct departments and agencies within public administration have ongoing dialogue and open transmission of relevant information. Take, for instance, a city school district that wants to understand more about students who are chronically absent. This agency would not only benefit from the educational information that it collects and analyzes but from information related to students’ physical health, incidents of residential instability among those students, information related to transportation access, and so on. Inter-agency communication and information sharing would facilitate the school district’s ability to answer this question and provide a more comprehensive picture of the students of interest.

Despite the utility of this cross-agency communication, the traditional bureaucratic silos present within public administration systems often preclude inter-departmental communications despite the complex nature of most social problems and the multidimensional understanding required to comprehensively serve human beings. While these connections across bureaucratic silos are atypical and often difficult to establish, an integrated data systems approach requires that these channels of communications are created and fostered. CQI endorses the idea that departments within a business organization are distinctive parts of an integrated whole (Bonstingl, 1992). Proponents of PM have also noted that this organizational reform requires regular interagency meetings to facilitate data sharing, dialogue, and critical reflection regarding the effectiveness of decisions made (Moynihan, 2008). Thus linking employees across organizational divisions is crucial to forming a comprehensive whole.

In addition to this horizontal communication, intradepartmental communication and open transactions among employees at different levels of an organizational hierarchy must be established to ensure integration. This vertical integration values the perspectives of all people and encourages bidirectional exchanges within a department or agency regardless of title or seniority. The goal of vertical integration is to build a culture of collaboration among all employees that is marked by ongoing exchanges to improve organizational processes. Within organizations

that have rigid hierarchical structures, like the bureaucracies of most public administration organizations, the existing barriers to open dialogue can be immense. These organizational structures typically favor unhealthy “information pathologies” where information flows from the top of the hierarchical structure down to the bottom but does not move as easily from the bottom to the top (Kettl, 2009). Those at the bottom of the hierarchy, usually those closest to the social problem being addressed by the agency, lack the necessary authority of voice to participate in important organizational decisions. Moynihan (2008) argues that “traditional bureaucracies are too hierarchical, removing decision-making power from those with a close knowledge of management problems, and processes” (p. 34). Both Continuous Quality Improvement and Performance Management emphasize the importance of vertical, intradepartmental communication in successful organizational management. Because CQI requires all employees to participate in the quality improvement process, uninhibited exchanges among employees at all levels are essential. Vinni (2007) notes that CQI “is a philosophy of change based on open communication and employee involvement in the organization and control of work. The main thrust of these changes is towards collaborative teamwork” (p. 109). Waitt (2011) also recognizes the necessity of two-way organizational communication for the success of PM reforms, noting that “leaders executing a performance management program need to listen as much, or even more, than explaining what is being done” (p. 3). Removing systematic impediments to vertical integration is essential to organizational health and to promoting bidirectional exchanges across hierarchical levels.

The final aspect required to achieve successful integration of people within public administration involves an organizational emphasis on *data literacy* and *data-use*. Horizontal and vertical integration of employees is facilitated by the creation of a common language of inquiry. Because an IDS approach requires an ongoing process whereby the organizational theory of change is tested through the analysis of relevant, quality data, it requires that employees have a basic understanding of data and data analytics. While successful usage of the data requires personnel with “particular expertise in data management, evaluation design, and fundamental statistical understanding” (Rothbard, 2015, p. 79-80), it also requires that all employees have a minimal level of literacy surrounding the inquiry process and the data that inform that process in order to actively participate in the organizational dialogue. This common language becomes the medium through which horizontal and vertical transactions can take place within a collaborative work environment. Proponents of CQI and detractors of PM recognize the need for a common understanding of the organization’s core process and the data that inform that process. CQI requires that all employees engage in organizational inquiry and thus meet a minimal threshold of literacy in regard to data and data usage (Bonstingl, 1992). As Moynihan (2008) argues, “the simple supply of performance data does not create its own demand for use, and the most critical challenge facing agencies is to find ways to encourage managers to examine performance information and use their collective knowledge to improve how they run agencies” (p. 19).

Approaches to organizational management in public administration cannot simply mandate that employees collect and report data as a means to ensure that government actually *utilizes* the data to drive the organizational decision-making process. The approach must focus on building the capacity of employees to understand organizational data and to appreciate the power of that data to inform organizational operations. It is only through building awareness of how data are used within a system and by demonstrating the value of data to all employees that organizations can move toward a data culture and employees can become fluent in the language of data and more fully participate in the data-driven, problem-solving process.

The IDS approach outlined above draws from three major reform movements in government, the scientific community, and the private business sector. The system involves a core process of organizational inquiry that is supported by data and translated into actionable intelligence by an integrated group of participants. Actionable intelligence allows public administrators to make better decisions on behalf of the citizenry they serve and drive the vehicle of social problem solving forward. By committing to such a demanding and multi-faceted approach to public problem solving, administrators can be confident that the decisions they make are based on the best possible capacities of their organization and its employees. While these best possible capacities may not always produce the “correct” decisions or decisions that yield immediate and staggering positive results, the public can ask no more of its government than to work to the upper limits of its capacity.

But how is an IDS created and used? While this section has outlined the conceptual rudiments of the IDS approach, the following section describes the building blocks of that approach and highlights best practices derived from the study of IDS currently in operation around the country.

Building the Infrastructure for a Fully Functional IDS

To actualize the conceptual framework described in the previous section, state and local governments must develop a robust IDS infrastructure to support real-time, sustainable use. The purpose of this section is to indicate how the core tenets of the approach described above are concretely translated into a fully functioning and operational IDS that can be effectively used to solve salient social problems. This section will introduce the reader to what a fully functioning IDS looks like and the common operational components that make up the IDS infrastructure, which are drawn from AISP’s national study of well-developed IDS in the AISP Network supported by the John D. and Catherine T. MacArthur Foundation (see Table 1). This study revealed four major components of the IDS infrastructure that are necessary to produce a fully functioning IDS. These components are: (1) governance, (2) legal issues and data security, (3) data management and analytics, and (4) political and economic sustainability. Subsequent support from the Laura and

John Arnold Foundation enabled AISP to establish panels of national experts to further elucidate IDS best practices across these foundational components.

What is a Fully Functioning IDS?

To be a fully functioning IDS **you must have:**

Full government leadership support to build and use an IDS approach to social problem solving in government.	Governance
A governance process in place to develop and manage all the basic functions of IDS operations; this involves overseeing the people, regulations, policies, & procedures of the IDS.	
A community of relevant stakeholders that agrees that building and using an IDS is the right thing to do.	
Written ethical and legal agreements in place that authorize the use of the IDS on a routine basis.	Legal Issues & Data Security
Adequate technology and trained personnel to integrate cross-sector administrative data at an individual level efficiently for all IDS inquiry projects while keeping individual records private and secure.	
Trained data managers and data analysts who have access to relevant data elements across sectors that are of sufficient quality to use appropriate statistical methods to conduct high-priority IDS inquiry projects that generate the actionable intelligence to affect the mission of the IDS.	Data Management & Analytics
Research and policy experts who can translate the findings from IDS inquiry projects into useful actionable intelligence to enhance policy and practice.	
Effective means to communicate the value of what has been learned from IDS inquiry to relevant stakeholders by showing them how IDS use has resulted in increased understanding of an important social problem and how it has enabled government to improve policies and services while keeping personal data private and secure—thus demonstrating fidelity to the IDS mission, vision, and values.	Political & Economic Sustainability
Political and economic support to sustain IDS inquiry on all relevant high-priority projects across time.	

Table 1. A fully functioning IDS.

These infrastructure components are hierarchical in nature and represented by a stratified pyramid (see Figure 2) where each component or layer depends on the foundation created by the layers below it to ultimately produce actionable intelligence for social problem solving. An IDS is not considered fully functioning and ready for routine use until all these layers are operational. At the base of the pyramid is the most fundamental aspect of a fully functioning IDS: governance. The governance structure of the IDS approach incorporates several core tenets from both integration and system, unifying people within and across hierarchies under the authority of executive leaders to create the mission, values, and protocols of the system itself. This represents the collective drivers actually coming together to begin to build the vehicle. Next, legal issues are addressed through negotiating appropriate legal agreements and regulations to provide a legal pathway for IDS use. It is at this point in the building process, that data security measures are also implemented to ensure that the IDS has the capacity to comply with privacy laws. While not explicitly tied to the core tenets themselves, these legal and security issues are invaluable as they aide the theoretical vehicle in traveling safely to its destination and function as “rules of the road.”

Once permissible legal use and data security measures are in place, the governing body can attend to data management and analytic protocols which ensure that administrative data are integrated in a rigorous manner. Additionally, this component guarantees that all inquiry projects will use high-quality, relevant data which will be analyzed appropriately with the most advanced statistical methods available. This component relates to both the system and data core tenets; it represents the engine of inquiry that allows the vehicle to move using high-quality, relevant data as fuel. The final step to producing actionable intelligence on a routine basis is establishing the political and economic sustainability of the IDS. This involves fostering ongoing use by securing long-term support for IDS operations across administrations and budget processes. This final component incorporates aspects of the integration tenet, as various categories of stakeholders must work together to demonstrate the effectiveness of the system and generate the political will to foster future use. This step creates a context that supports continued use of the vehicle and allows the drivers to continue to plan “trips” despite political shifts or changing economic constraints. Only when all the layers of the pyramid are in place, are we ready to use an IDS effectively and efficiently to generate actionable intelligence to drive social problem solving.

Infrastructure Component One: Governance

Governance essentially represents the collective, *integrated* drivers who work together to establish the *system of inquiry*. People within and across government silos, brought together through the will of executive leadership, establish the infrastructure of the inquiry process that will drive government decision making. This inquiry process will be based on the iterative testing of existing theories of change using administrative data. Governance both initiates and oversees this inquiry process. Governance thus establishes the ethical and practical foundation for IDS use.

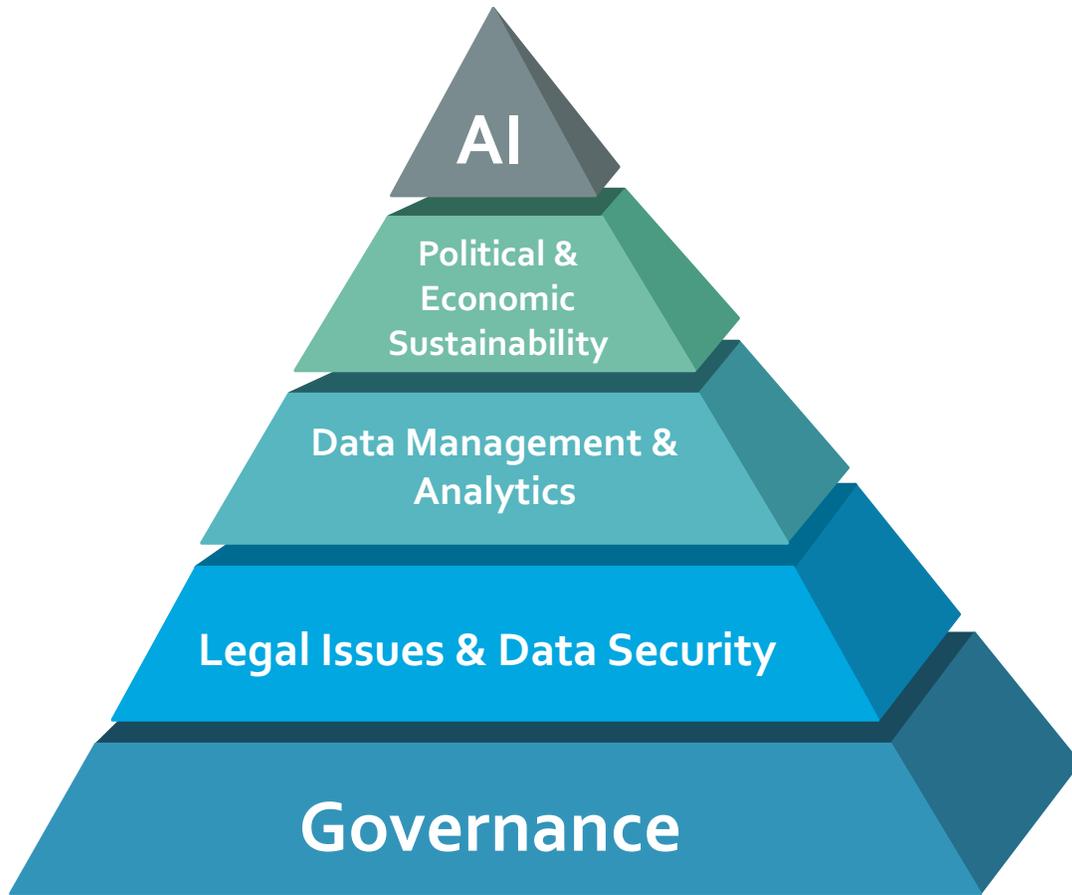


Figure 2. Core components of the infrastructure of the IDS approach.

It ensures that the IDS is used to solve problems and improve services, resulting in social benefits that outweigh any risks associated with using private information. To achieve this end, the governance process must have an established governing body, which consists of key stakeholders, typically appointed to develop and oversee the operations of the IDS. In a climate of substantial public mistrust of government, it is the responsibility of the governing body to ensure that the IDS operates ethically and legally according to the well-established ethical principles of human subjects research and existing laws.

First and foremost, a governance process cannot exist without the support and commitment of executive leadership. It is the responsibility of a jurisdiction's executive leaders to meet the needs of the citizens they are authorized to serve. Thus, all IDS effort to improve the effectiveness or efficiency of public services falls under purview of the executive leadership. It is the top government leadership that must first decide to pursue the IDS approach and sanction the creation of an IDS governing body. The executive leadership must ensure that the governing

body is given the time and resources to thoughtfully construct a solid IDS infrastructure and oversee its operations.

With full support from executive leadership, an IDS governing body can be assembled. Only an inclusive governing body, with voices represented from all key stakeholder groups, can ensure that the dignity of participants is respected and all stakeholders have an active voice in decision making. There are four overall categories of stakeholders, each with specific knowledge to contribute to the IDS governance process: government executive leadership, frontline service providers, researchers, and the public (i.e., both direct beneficiaries of services and the public at large) (see Figure 3). As stated previously, the executive leaders and their designees (i.e. mayors or governors and the heads of their various departments) have a critical role to play by providing the political and financial support to build and use the IDS. Service providers contribute information regarding the data collection process, the services currently provided, and the lives of the clients they work with. Service providers may also be able to articulate questions that, if answered, will improve the quality of their service provision. Researchers use their expertise to ground proposed inquiries in the existing evidence base and ensure rigorous methods are employed for both data integration and analysis. Finally, the public, often represented by client advocates or good government groups, provides oversight. They ensure that client data are always treated with respect and that inquiries are in the best interests of the public. Not every

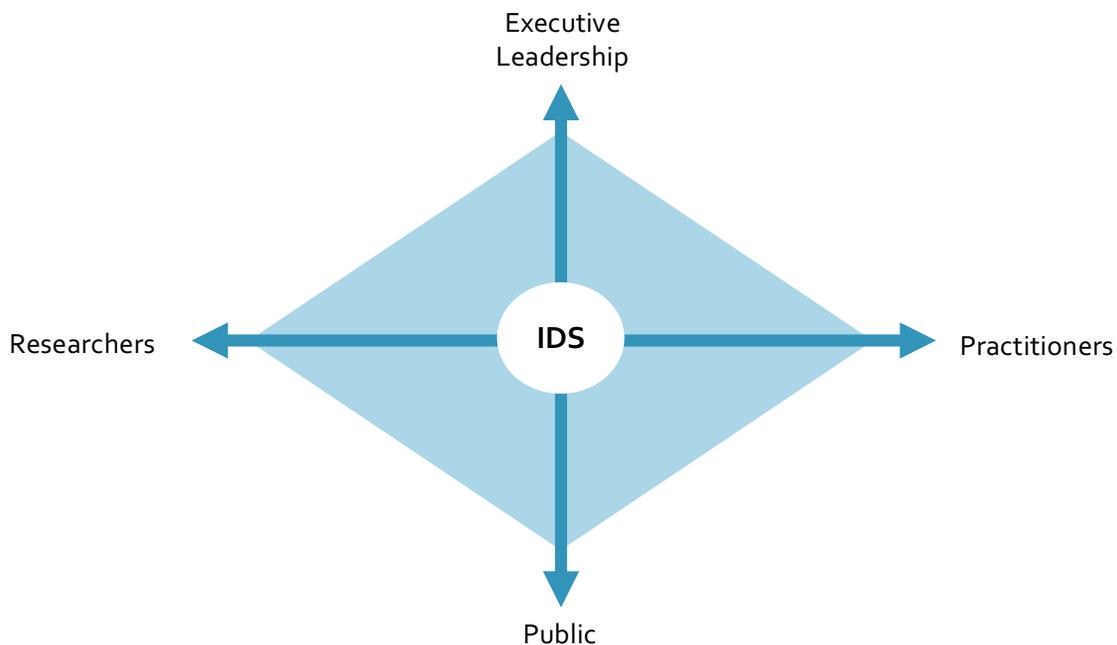


Figure 3. Key contributors to the IDS approach.

stakeholder will have expertise in every aspect of the IDS work, but that does not make any voice less important to the process. Each stakeholder group represents a distinctive contribution and a unique perspective. This creates a normal dynamic tension between differing perspectives that needs to be negotiated through their collaboration. This represents both horizontal and vertical integration, where there are no barriers to communication across stakeholder groups and there are no barriers to communication across hierarchical levels. Only in an environment of mutual respect and collaboration can the IDS governing body ensure the transparency required to build public trust and ensure the priorities of one group do not overshadow the priorities of another. Often, the governing body will also identify staff with the technical expertise to carry out the day to day activities of the IDS. These individuals will both carry out the will of the governing body and have important knowledge to contribute to the decision-making process, as the individuals most familiar with the data.

Once the governing body has been assembled to sufficiently represent all of the key stakeholders (people), it can begin to construct the policies and protocols that will guide the IDS work. This begins with the broad vision, mission, and values of the IDS, then narrows to specifics of IDS operations. Together the vision, mission, and values statements ensure the IDS' beneficence toward the public. More than just text for a website, these statements are a public commitment that the IDS will act in service of both clients and the taxpayers. These statements serve to promote transparency and help reassure a skeptical public that personal information will be protected and treated with the highest respect. The vision statement is a simple declaration that describes in plain language the end goal of the IDS and long-term expected benefits of IDS operations. It makes evident to all how the IDS will ultimately benefit the clients being served by participating agencies, the citizens of the community, the policymakers that will use the generated actionable intelligence in their decision making, and other communities that will use the knowledge generated by the IDS. The mission statement explains what the IDS is and how its vision for the future will be achieved; it articulates the IDS' chief purpose as improving the effectiveness and efficiency of the social problem-solving process. Values statements articulate the ethical principles that will inform the policies and procedures to be developed. For example, values might include transparency, inclusivity, or a commitment to protecting privacy. Together these clear and honest statements, achieved through consensus of all stakeholders, are an assertive step toward dispelling myths and fears about government use of personal data.

By assembling an inclusive governing body and articulating clear guiding statements, the IDS has created an inquiry process that respects persons' privacy and confidentiality while maximizing benefit to citizens. This represents the actualization of the values of autonomy and beneficence, values that have been surfaced as essential to the ethics of human subjects research (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). But autonomy and beneficence are not sufficient to ensure justice, the third

value of ethical research. Justice happens when the work of integrating and analyzing personal information is done in a way that is fair and equitable in its distribution of both risk and benefit. Thus, the governing body must go beyond inaugural vision, mission, and value statements and articulate protocols of IDS use. Which data will be integrated? How? When? By whom? How will it be secured? Who will be able to access it and for what purposes? Some of these decisions will only need to be made once, during the formative stage of the IDS. Others will be routine aspects of the governing body's work. For example, data safeguards and research priorities will need to be regularly reassessed and proposed projects will need review, approval, and oversight. To assist governing bodies' consideration of the full range of their responsibilities, AISP has developed a list of basic IDS functions that was derived from its study of AISP network sites. Table 2 lists the basic functions of an IDS and the associated questions that must be addressed in order to build and use an IDS successfully.

All of these agreements are ultimately formalized in a Memorandum of Understanding (MOU) signed by all participating organizations. The MOU serves as the *constitution* for the IDS, a written instrument embodying its protocol, rules, and regulations. Every aspect of governance discussed so far—the governing body participants, the vision, the mission, the values, the protocols for operation, and legal permission for use—is captured in the MOU, and therefore its importance cannot be overstated. It formalizes the unification of the *people* behind the IDS and their shared commitment to the work. The next section will address the MOU and other legal issues in more detail, as well as the data security measures necessary to ensure the IDS has the technical capacity to uphold privacy laws. Together with the governance structures discussed above, these two components are essential for restoring public trust and must be established before inquiries using administrative data can proceed.

Basic Functions of an IDS		
	Functions	Related Questions
Building an IDS	Secure top government leadership support for IDS	Do you have the support of top government executives?
	Assemble governing body	What governance model will be selected and who will be involved?
	Develop IDS mission, vision, and values statements	How will the IDS improve government decision-making?
	Craft protocols for basic IDS functions	Who will integrate the data and carry out other daily functions?
	Finalize ethical & legal agreements (MOUs & DULs)	Are your IDS operations ethical and lawful?
	Bolster data security through computer technology	What safeguards are in place to protect personal data?
	Build adequate data management capacity	Are you assessing data quality & ensuring quality data integration?
	Ensure quality data analytic capacity	Do your data analytic plans and analysts meet scientific standards?
Using an IDS	Set priorities for inquiry projects	Have you set priorities for the use of your IDS?
	Approve proposed inquiry projects	What process will approve & commission projects?
	Monitor project execution to completion	How will the governing body monitor the progress of inquiry projects?
	Translate project's actionable intelligence into actions	How will the IDS translate findings into proposed policy actions?
	Identify economic implications of proposed actions	How will you consider the cost implications of inquiry projects?
	Communicate with IDS stakeholders and the public	How will the benefits of your IDS be communicated to the public?

Table 2. Basic functions of an IDS.

Infrastructure Component Two: Legal Issues and Data Security

The second essential component of IDS is legal issues and data security. Legal issues and data security do not directly represent any of the core tenets from the previous section but are, nonetheless, essential for IDS use. They can be thought of as the rules of the road and safety regulations. This component ensures that the vehicle can travel without breaching any laws and with minimum potential risk to both passengers and other vehicles. Legal issues and data security measures build on the foundation established by IDS governance to make clear to the public how

IDS will use the personal information found in government administrative records to improve public services while protecting the confidentiality of individuals. These data are originally collected by government agencies through the routine provision of programs and services and the agencies hold and use this information in the context of existing laws. Understanding those laws and the related legal issues associated with their use is essential to the governance process, as is knowledge of technical and computer science innovations designed to minimize risk of data breaches or unauthorized disclosures.

Legal issues. Fundamentally, the purpose of law in a society is to govern and guide actions and relations among and between persons, organizations, and governments to protect the valued liberties and rights of members of that society from unreasonable intrusions by persons, organizations, or governments. The law at its best provides freedom within form. It regulates transactions to protect liberties, and can best be equated to traffic signals in a big city, which use red and green lights to permit many individuals to move about the city freely with minimal harm. The red lights protect citizens from the impulses of other drivers, and the green lights permit citizens to get to their destinations while also regarding the rights of other drivers. A driver's license signifies that the individual knows the law and is willing and capable of abiding by it. Therefore, to a naïve, uninformed person the legal component of IDS should be equally simple—just identify the laws that govern the use of the personal data collected by the government and give the government a license to integrate and use these data in accordance with the existing laws to regulate IDS use. This sounds like a simple, linear, and rational process—and it should be. However, this does not reflect the reality of the complex and often irrational world of 21st century America which pose challenges to IDS use.

Two prevailing forces beset lawyers and generate legal challenges to IDS use. They include (1) the unprecedented crisis of public mistrust surrounding government's use of personal data and (2) the also unprecedented, though complex, opportunities to use IDS to make substantial improvements in government services. The substantial lack of public trust creates a predisposition to very cautious legal practices by counsel in government agencies. Fears of litigation, longstanding cultural trends, norms and policies within government agencies against sharing, as well as overly conservative interpretations of federal, state, and local laws all point to a "no" red light, legal response (Petrila et al., 2017, p. 6). Unfortunately, this climate of "many reasons to say no" is a breeding ground for myths, misinterpretations, and half-truths about the risks associated with IDS use and how these risks compare to the benefits. To complicate matters further, the effectiveness and utility of an IDS is enhanced when there are more data partners and community stakeholders involved. From a legal perspective, this makes the formulation of comprehensive legal agreements (such as an MOU) very complex and time consuming. This requires an experienced general counsel that understands the intricacies of the relatively new and burgeoning world of Big Data. All of this may be burdensome to consider for the typically

overburdened legal counsel in government service. This burden further challenges and thwarts effective IDS use and increases the likelihood of a “no” or red light response.

As discussed in the previous section, the MOU is the most important of the legal documents that will be developed by the governing body in partnership with legal counsel from the participating agencies. Acting as wise counsel, the IDS lawyer must ensure that the MOU is grounded in both the letter and spirit of the relevant laws governing data use. The lawyer’s role is to surface existing federal, state, and local laws governing use of administrative data and identify provisions for permissible use. The Federal Privacy Act of 1974, 5 U.S.C. § 552a (2000) is the federal omnibus “code of fair information practices” that regulates the collection, maintenance, use, and dissemination of personal information. Additionally, two major extensions of the Privacy Act specifically address the protection of individual health and education records—the Health Insurance Portability and Accountability Act of 1996 (HIPAA) and the Family Educational Rights and Privacy Act of 1974 (FERPA). All federal statutes prohibit agencies from releasing personally identifiable records without prior written consent of the client. However, these laws acknowledge the rights and responsibilities of the agencies that collect the private information to provide services and use these data to learn how they can improve the quality of the services they provide (Hotz, Goerge, Balzekas, & Margolin, 1998). They explicate exceptions for permissible uses of personal data that include research, evaluation, and the improvement of government services. According to HIPAA, for example, research is considered an allowable “public interest benefit activity” if a set of conditions are clearly articulated in written legal data use agreements (45 C.F.R. § 164.501). FERPA has a study and evaluation exception which allows for the sharing of educational records to improve educational programs (20 U.S.C. § 1232g(b)(1)(D); Privacy Technical Assistance Center, 2017).

To aid the governing body and its legal counsel in the development of a legally grounded MOU, the AISP Expert Panel on Legal Issues has developed several checklists and templates which may be of use (Petrila et al., 2017, p. 6). The first is a road map for how an MOU is developed (see Figure 4). The responsibility of the governing body is to take the first steps: identify data sources, identify participating programs, and identify data categories and fields. Once the governing body is clear on the major databases they need related to high priority IDS inquiry projects, legal counsel can assist the governing body in identifying applicable laws and addressing any challenges that may arise as a result of those regulations. Once the issues have been resolved to the satisfaction of all parties, the MOU can be drafted to formalize the relationships among IDS participants. An annotated MOU template was also developed by the expert panel and can be found in their report (Petrila et al., 2017, Appendix B). This template can facilitate the development of MOUs since it reflects best practices of lawyers with experience in negotiating IDS data-sharing and use agreements.

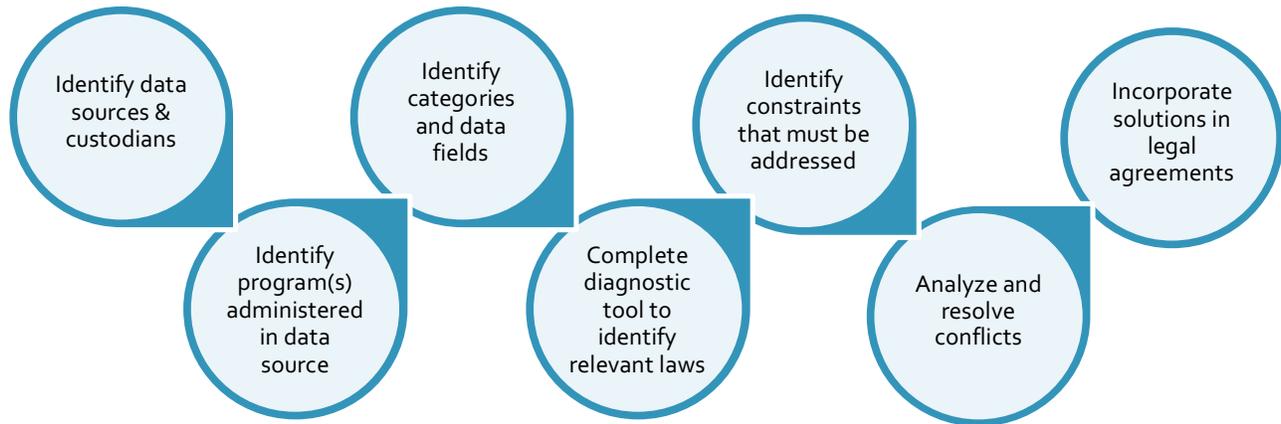


Figure 4. Process of addressing legal issues in the development of a MOU for IDS use.

While the MOU authorizes agencies to release their data to a central organization for integration, a second major type of legal agreement is needed to govern the access to integrated, de-identified datasets to authorized researchers (i.e., the data analytic team) to actually answer questions of interest. These data analysts could either be from within the government with expertise or research partners external to the government. This agreement is called a data use license (DUL) (or a data use agreement in HIPAA language). DULs are project specific and govern permissible uses of data by researchers, practices for storing and securing the de-identified data, data ownership, and the destruction or deletion of data upon research completion. Here too, the role of legal counsel and the legal agreements they generate is to dictate the rules of the road, but not stop traffic entirely. DULs put in place the appropriate safeguards to ensure that research with linked administrative data can take place to benefit the public at large, with minimal risk to any individual. An annotated DUL template can also be found in Petrila et al. (2017: Appendix C). Together these two legal agreements, the MOU and the DUL, embody the resolution of the complex legal issues that can arise for IDS.

And while both the MOU and DUL speak to data security procedures, a written plan for data security is not sufficient to repair a deep public mistrust. To feel confident that their personal information is being appropriately handled, the public must see that the most advanced technology available is being used to avert both accidental data breaches and malicious attacks.

Data Security. As stated above, we live in an era of low public trust in government. This is particularly true regarding American’s confidence in government’s ability to protect *their* personal data. According to a recent Pew report on *Americans and Cybersecurity*, only 12 percent of

respondents said they were “very confident” government agencies can keep their records secure, and half reported that they do not trust the government to protect their data (Pew Research Center, 2017b). This is why the foundational tiers of the IDS infrastructure are so focused on generating transparent IDS operations that follow clear ethical and legal standards to keep administrative data at the individual level secure. In addition to IDS governance, legal agreements, procedural safeguards, and comprehensive staff training, technological innovations are also critical to making use of administrative data more secure.

Achieving high levels of data security through using the best of computer science is an essential component of the IDS approach. Increasing interest in using Big Data (Lane, 2016), has stimulated innovative approaches and procedural safeguards to greatly reduce the risk of unauthorized access to personal data. Within the AISP Network, data managers are considering all of these recent advancements to minimize the risk of breaches of individual-level data from an IDS or risks of re-identification of de-identified data sets used in IDS inquiry projects. The Expert Panel on IDS Technology and Data Security solutions recommended several existing advanced applications of computer science to proactively protect data from unauthorized users and minimize misuse by authorized users (Patterson et al., 2017).

First, the panel recommends the use of cryptography to safeguard against unauthorized access to private information. Cryptography is the science of computerized encoding (encryption) and decoding (decryption) of information to protect privacy. All private identifiable individual information is masked with complex mathematical constructs where only the authorized IDS data administrator holds the key to the encryption. All IDS data should be encrypted in transit and at rest, rendering it useless without the required key, which is stored separately. Increasingly advanced encryption methods are being used with identified data being stored and de-identified data being transferred electronically for research uses. The National Institute of Standards and Technology (2014) maintains quality control over accepted and well-tested encryption practices that are currently available for use.

The second recommendation also addresses unauthorized access. Advanced computer programming exists that enables IDS data administrators to detect external intrusion attempts and unauthorized internal users. These programs are useful, not only because they increase the likelihood that the individual attempting to access data will be identified and caught, but because they can help IDS data administrators to identify potential vulnerabilities that hackers may be trying to exploit. As these potential weaknesses are identified, they can be quickly remedied, thus enhancing IDS operators’ ability to ensure data security.

The third recommendation is related to misuse of an authorized, de-identified dataset. Some have expressed concerns that a de-identified dataset may be “re-identified” by matching de-identified variables with personal identifiers in other available data sources. Fortunately,

computer programming methods are available to thwart one's ability to re-identify individuals in a de-identified IDS dataset. For example, programs can be designed to ensure that only aggregate data with minimum cell size limits are returned based on researcher queries. Additional safeguards can include a limited number of statistical queries or the introduction of "noise" to the data in a way that ensures re-identification is not possible without impact on the proposed analyses.

Finally, threats of misuse can be greatly reduced with the implementation of a remote access portal. Here, research-ready, encrypted datasets would be made available remotely to analysts through a secure portal, through which queries could be sent and run against the data. With this option, individual data, even de-identified data, would never leave an IDS managing agency. External researchers would remotely run their analyses on de-identified datasets residing at the IDS managing agency site, use the statistical software available at the remote site, and only receive statistical output. Furthermore, the statistical output generated from these queries could be run through automated disclosure filters, and all analyst queries could be monitored to ascertain that outputs and queries conform to approved purposes.

Today, all of these technological data security solutions exist to actualize the prime value of the IDS approach—protecting personal data in integrated administrative datasets, while using these data to improve public human services. There is no doubt that additional security measures and technologies will become available with time, which is why the IDS must remain attuned to evolving security threats and appropriate technological responses.

Infrastructure Component Three: Data Management and Analytics

With an effective and ethical governance structure, cooperative legal agreements to access administrative data, and data security in place, the IDS approach provides a rich ecosystem for rigorous IDS data-driven inquiry. This component represents both the *system* and *data* core tenets of the IDS approach, as it builds the infrastructure required for an ongoing inquiry process informed by data. Data management and analytics utilize the fuel of high-quality, relevant data elements to feed the engine of inquiry. Data management and analytics provide a structure and generate a capacity for an ongoing process of iterative inquiry.

Data Management. The next step in building an effective IDS infrastructure is to ensure that all cross-sector administrative data accessible to the IDS through data-use agreements are high-grade fuel for the engine of the inquiry process. The reality is that state and local jurisdictions collect thousands of data elements across scores of datasets as part of their administrative duties and historically these administrative data were not collected to be used to drive a robust problem-

solving process. Typically these data are collected and stored as part of a bureaucratic compliance and fiscal appropriations process. In the IDS approach, on the other hand, data management involves repurposing selected administrative data elements for use in an ongoing inquiry process of planning, research, and evaluation. To accomplish this, the prime objective of data management is selecting data elements that are relevant to high priority IDS inquiries, are of sufficient quality for research and evaluation purposes, and are integrated with precision at the individual level across idiosyncratic agency databases.

Amidst the sea of data elements collected by any jurisdiction, the saving grace for the data manager in the IDS process is the *relevancy* of data elements. Relevancy is defined in two important ways in this approach. First, the governance process of each jurisdiction identifies their distinctive priorities that drive the authorization of IDS (e.g., early childhood, homelessness, juvenile justice). These priorities selectively make relevant certain agencies in the government that must be included in data use agreements and designated databases within the partnering agencies that have the most relevant data. Second, as stated above, the IDS approach is a systematic logical approach where the inquiry process is guided by theories of change that logically identify relevant, evidence-based variables (data) to be included in the inquiry. Relevancy sharpens the focus on a smaller, selected set of data elements that are under consideration for a particular priority and a particular set of inquiry projects in the problem-solving process.

Once relevant data elements are identified, the next major consideration is the quality of these data elements to be used in the inquiry process. Putting impure fuel into a precision engine will render the engine inoperable, so ensuring quality data elements is critical to a successful IDS inquiry process. This necessitates that the data managers of an IDS have in place a set of data quality standards that they use to determine if key data elements are of sufficient quality. Many steps in the data collection process can introduce unwanted errors and render the data inadequate for use (e.g., invalid measures, poorly trained data collectors, computer entry error, etc.). Thus it is essential, within an IDS approach, to establish strategies by which quality may be built into the processes of measurement, collection, record transfer, and analysis. This can include the adoption of national data standards, clear procedures for data collection and entry, the use of software applications to minimize formatting errors, and ongoing data audits (Rothbard, 2015). It can also include introducing methods for assessing the reliability and validity of relevant data elements being incorporated into the IDS to maximize the utility of the information they contain.

Procedures to evaluate reliability can include variable-level auditing to look for out-of-range codes or codes that may have changed over time. Variables can be scored with a reliability measure such that external requestors are aware of the reliability of a given variable. Common audit routines can measure the completeness of a given variable (degree of missing data), the accuracy (the proportion of valid codes), and the coverage (gaps in time periods reported, or

providers reporting, etc.). These processes ensure that data collected on a relevant data element actually represent the phenomenon in question. Due to its time-consuming nature, this task may only be done on an annual or semi-annual basis. Since most agencies are not equipped to conduct such validity testing on a routine basis, IDS leadership may have to partner with data-sharing agencies to periodically seek funding to accomplish these important audits.

If agency-specific relevant data elements are determined to be of sufficient quality, the data can then be *integrated*. This too can introduce error, as each agency collects its own identifying information that may differ from the information collected by other agencies. To bring together information about individuals across systems, multiple common identifiers must be surfaced and complex algorithms are needed to ensure that the correct clients are matched accurately (reducing false positives) without omitting any matches (reducing false negatives) due to incomplete or incorrectly entered data. These algorithms can and should be refined over time to further minimize error. The rapidly advancing science of data integration has resulted in a number of specific procedures for matching client records with a high degree of accuracy (Kumar, 2015). It is essential that the data managers responsible for data integration stay current with technological developments for this critical IDS process.

Data Analytics. The data analytic component of the IDS infrastructure addresses the heart of the IDS approach-- targeted scientifically valid inquiries of high priority social problems that result in rapid knowledge-to-practice cycles to improve public administration. As Emanuel, Wendler, Killen, and Grady (2004) highlight, for research inquiry to be useful it must adhere to rigorous scientific standards and inform a process of change that has clear social value for the population served. Therefore, the IDS approach identifies three essential capacities of the data analytic component to substantiate its usefulness: researchable questions, scientific validity, and translation of results into actionable intelligence.

First and foremost, the IDS approach requires public administrators to work closely with researchers, practitioners, and community collaborators to help identify the most important issues related to a high priority social problem. The data analytic team must help shape these concerns into *researchable* questions that will serve as the basis for the IDS inquiry project. Researchable questions are those that are capable of being answered given the specifics of the research context and considering current scientific capabilities. IDS users must construct a research design that maximizes the capacities of existing administrative data and is appropriate to answer the identified research questions.

Next, IDS users must select analyses that are scientifically valid for their research questions and research design. Here, scientific rigor is the responsibility of data analysts, who must adhere to the established scientific standards associated with each analysis used (Boruch, 1997). Each statistical method has its own science of use, which involves adherence to basic

assumptions, tests of significance, and fit of models. The analyses are more likely to have a high level of integrity if the analyst(s) has the appropriate credentials and experience addressing the research questions using the proposed statistical techniques. To ensure that scientific validity is maintained, an internal institutional review board (IRB) should provide oversight. Operating independently from the IDS's governing board, an IRB is composed of individuals with the necessary expertise to evaluate the appropriateness of the proposed inquiry project (e.g., research questions, design, and analyses). The IRB has the power to require changes to any proposed study before data are provided or can deny data requests entirely. If such expertise does not reside within government, the IDS governing body can establish an external research advisory board to fulfill a similar function. Members of a research advisory board are often researchers from local universities or research organizations who agree to serve voluntarily in order to provide guidance to the governing board on appropriate research methodology.

Finally, the data analytic component requires that research findings be translated and appropriately presented to all relevant stakeholders (executive leadership, practitioners, and citizens). Here the crescendo is placed on how *useful* the inquiry findings are to the government leaders and practitioners. In the IDS approach these leaders will use the findings in conjunction with relevant stakeholders to derive actionable intelligence to benefit the citizens of their jurisdiction. Researchers should expend the effort to make their findings clear and easily comprehensible to all the non-researchers involved in the social problem-solving process. Clear communication of the findings is necessary to foster valuable dialogue, a cornerstone of the IDS approach. In these dialogues the analysts are thoughtful contributors, joining other key contributors to maximize the usefulness of the findings to improve services and advance IDS inquiry. Since any one inquiry project will not resolve a complex and vexing social problem by itself, dialogue with policy makers and practitioners is critical. Deliberations should then consider the need for additional inquiries in the iterative social problem-solving process.

Infrastructure Component Four: Economic and Political Sustainability

At the top of the IDS infrastructure hierarchy is the ability of an IDS to demonstrate its political and economic value to sustain its use for future problem-solving inquiries. The IDS approach is an iterative process of problem solving that requires time and resources to produce actionable intelligence. Therefore, an important dimension of the IDS infrastructure is for its key stakeholders to demonstrate to its constituents that the IDS is effective in producing tangible benefits that are also efficiently using taxpayer dollars. This infrastructure component represents the *integration* tenet of the IDS approach, as it creates the opportunity for stakeholders to generate political and economic will for the IDS. This component is akin to weatherizing the

vehicle, as it ensures that the vehicle will remain useful regardless of the climate in which it must drive.

As such, the sustainability of an IDS hinges on its capacity to show that the team driving this vehicle has found short-term or long-term cost savings through data-driven inquiries to improve public services. A careful consideration of the economics of IDS use provides stakeholders with important information about the costs of both unaddressed social problems and the interventions implemented to reduce or resolve them. This includes consideration of the value of an intervention both to the government—in terms of reducing the need for expensive interventions later—and to society at large—in terms of broader social goods that can also have economic value (Beatty, 2009).

An IDS is especially well positioned to consider cost implications of policy and practice improvements because administrative data track monetizable service impacts, and because the impacts of a policy are often broad, long-term, and spread across multiple service agencies. The investment by one agency may not return a direct benefit but may, in fact, benefit another related agency. Fantuzzo et al. (2015) use the example of the benefits of investing in education for single mothers. Such interventions could potentially impact employability (workforce capacity), improve access to and use of early childhood education programs for their children (education), reduce obesity (health), and reduce the need for public assistance (public welfare). The economic implications of education for single mothers could only be surfaced because of its capacity to examine cross-agency integrated data that follow individuals over time. An intentional process of making all relevant IDS stakeholders more aware of the costs of social problems and the actions taken to resolve them helps hold government accountable for efficiency as well as effectiveness. This enhances the value of IDS use, provides substantial political capital to support the government's investment in the IDS, and helps to ensure future inquiries.

Throughout this paper there has been a consistent focus on making IDS use clear and transparent to the public. From co-constructed mission and vision statements to giving the public representation in the IDS governing process, and clear communications of IDS inquiry findings and actions taken, the IDS approach seeks to give the public *voice* and *choice* in IDS use. Political sustainability relies on assertive public communications about the benefits of an IDS approach and ongoing efforts to make certain that personal data are secure. If clear and regular communications are heralding the benefits and data security of IDS use, then the risks of prevailing public mistrust of government is lessened and sustainability is better ensured. The IDS approach necessitates promoting accountability through public transparency and public engagement. The AISP Network is partnering with national organizations, like the Future of Privacy Forum (FPF, <https://fpf.org>), to support IDS sites in providing more tools to effectively engage with the public. The AISP IDS approach agrees wholeheartedly with FPF's mission, "As

'data optimists,' we believe that the power of data for good is a net benefit to society, and that it can be well-managed to control risks and offer the best protections and empowerment to consumers and individuals." The political and economic sustainability component of the IDS approach along with governance keeps the IDS squarely *of the people, by the people, and for the people*, giving the IDS a future.

Using an Integrated Data System to Generate Actionable Intelligence

This final section demonstrates how a fully functioning IDS is used to create actionable intelligence once the fundamental components of the IDS infrastructure are in place. What has been built can now be *used*. First, this section will explore the IDS problem-solving process by looking closely at the heart of the process—the *completion of a single inquiry project*. This section will explicate the roles of both the governing body and the specific inquiry project personnel in generating actionable intelligence necessary to move problem solving forward. Then, this section will discuss how multiple inquiry project cycles build on one another over time, contributing to the overall life course of the problem-solving process, which is made up of three strategic types of inquiry projects.

A Single IDS Inquiry Cycle

The work of generating actionable intelligence is done through commissioned inquiry projects (see Figure 5). Each inquiry is focused on a high priority social problem targeted by the governing body and has specific questions that are answered using integrated data from the IDS. With all the components of the IDS infrastructure in place, a single inquiry project begins when it is approved and commissioned in accordance with the protocols and priorities established by the IDS governance body. The goal of one project is not to solve the social problem in its entirety, but rather to address specific questions, which the governing body believes will provide actionable intelligence toward a sustainable, data-driven solution to the social problem. The data analytic team presents an analytic plan for answering the questions posed. This plan is then reviewed by a research review board on behalf of the governing body to make sure that it has adequate scientific integrity and protection for clients to proceed. Once approved, each inquiry project is executed through a systematic, logical sequence of activities which must be carried out by the governing body and designated project team approved to conduct the inquiry.

First, IDS data management personnel work alongside the project data analysts, who may be internal to government or part of an external research group working in partnership with the government, to identify relevant data elements required to conduct the appropriate inquiry. Legal

documents are reviewed or executed, specifically an MOU between the IDS and data owners. Once appropriate legal and security measures are in place, the quality of these relevant data elements is assessed, and if satisfactory, all data are transferred to the IDS. Once transferred, data are cleaned, linked at the individual level, de-identified, and prepared for analyses.

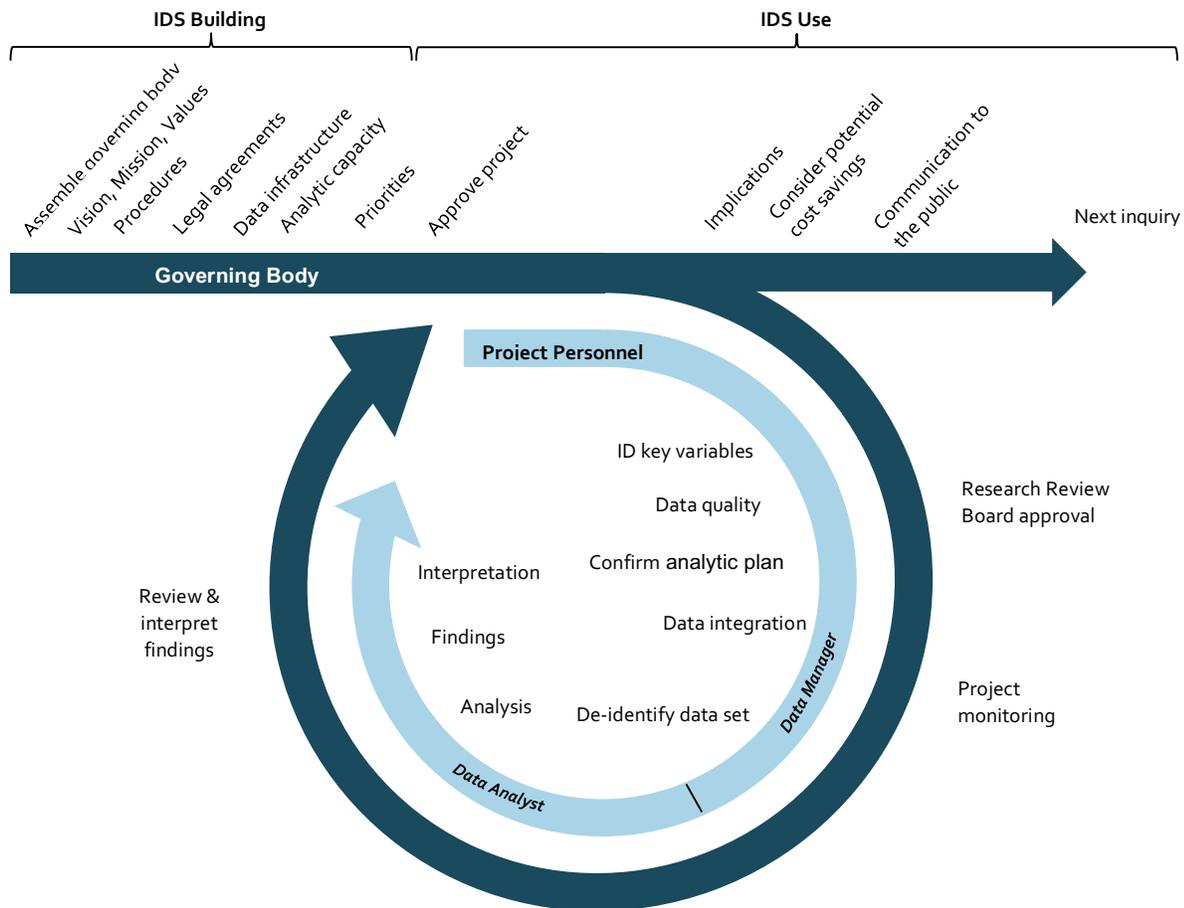


Figure 5. A single IDS project inquiry cycle.

Prior to receiving a de-identified dataset, members of the research team must sign a Data Use License (DUL) (see Petrila et al., 2017). The data analytic team then uses the de-identified data set to execute the approved analytic plan. Sometimes this process proceeds smoothly, without any obstacles. Other times, researchers will uncover issues with the data only after it has been integrated and de-identified. For example, while the extent of missing data might be within

acceptable ranges for individual variables, when all of the variables for a particular study are examined holistically, a problematic level of missing data may emerge. This may prompt a cycling back to earlier stages of the process to reconceptualize the analytic plan or conduct a different data pull.

Once the analyses are completed, the findings are shared with the governing body. This sharing of results creates an important bidirectional dialogue between the project team and the IDS governing body to make meaning of the results. The project personnel must present the findings of their inquiry in a common language that matches the data literacy of all members of the governing body to maximize their full participation in the dialogue. The governing body is responsible for asking thoughtful questions that probe the conclusions and limitations of the study as articulated by the project researchers. The purpose of these rich exchanges is to reap actionable intelligence from this inquiry and point to closely related policy and practice decisions.

Once the findings of the study are understood, the governing body has four main responsibilities. First, the governing body must translate the actionable intelligence generated in collaboration with researchers into recommended policy actions. Second, the governing body should consider whether this inquiry project generated knowledge that will result in any cost savings to the government. This step, while difficult for a nascent IDS, is essential for its long-term sustainability. Typically, with time, the ability to do these types of cost-benefit analyses becomes more developed and cost-savings can be estimated with greater precision. Third, the governing body must share the project findings, implications, and potential cost savings with the public. The public should have the opportunity to provide their feedback about the interpretations of the findings and the proposed actions that will result. Such ongoing communication and transparency generates public support for the specific findings of the inquiry cycle and for the continued use of the IDS process in government. Finally, the governing body must decide what next steps should be taken to address the social problem. This may include asking additional questions surfaced during the previous cycle of inquiry or may point to particular actions that can be taken to improve practices, programs, or policies. This is how actionable intelligence produced by IDS inquiry leads to data-driven decision making in government.

Phases of IDS Inquiry across the Life Course of Social Problem Solving

Investigations of the use of the IDS approach in the AISP Network have identified common phases in the life course of the IDS problem-solving process. This process follows a sequence of three major categories of inquiry that build on one another over time (see Figure 6). The first state of this process is the descriptive epidemiological or observational study of high-priority social problems. Inquiry projects in this phase are designed to provide a better population-based

understanding of the problem (e.g., extent of the problem, distribution across key population groups, societal cost associated with the problem, etc.). In Philadelphia, for example, the AISP Network site conducted a descriptive epidemiological inquiry related to the distribution and location of children experiencing evidence-based early risks and of high-quality child care centers throughout the City in an effort to inform the implementation of a city-funded preschool expansion effort (LeBoeuf et al., 2017). A previous iteration of IDS inquiry, utilizing data from vital

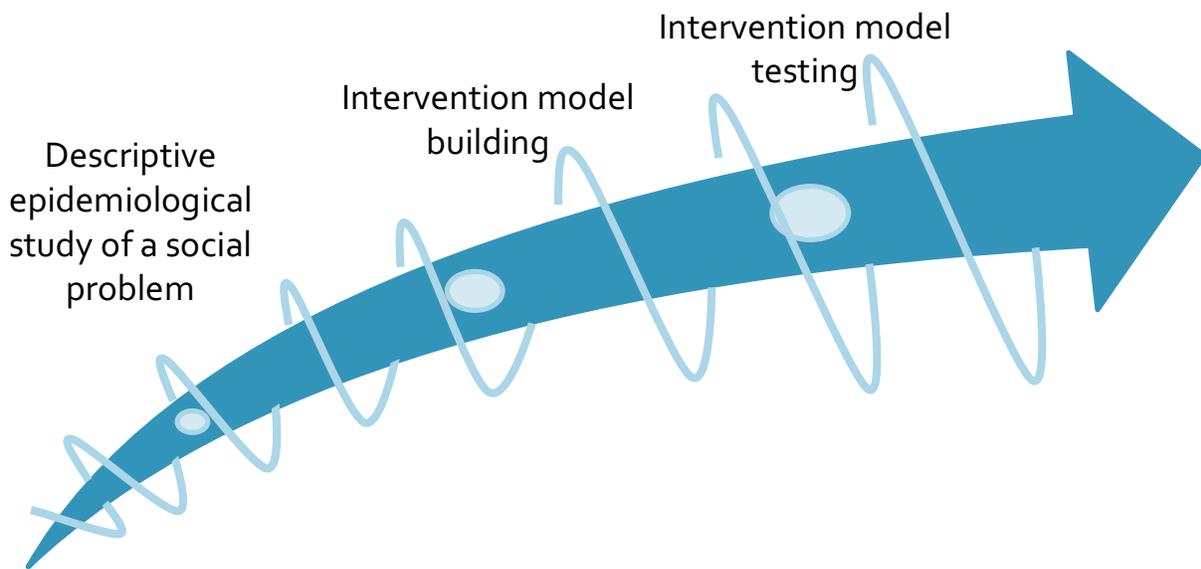


Figure 6. The three phases of the IDS inquiry process for social problem solving.

statistics, public health, child welfare, and supportive housing, had established seven risk indicators that were predictive of negative academic and behavioral outcomes in elementary school (Rouse & Fantuzzo, 2009). Using these evidence-based risk indicators, the IDS mapped their distribution across Philadelphia to identify neighborhoods where high concentrations of children with multiple risk factors were living. In some neighborhoods, more than 40% of children had experienced multiple early risks such as child maltreatment, homelessness, high lead exposure, and inadequate prenatal care. This information, together with information taken from the state's Quality Rating Improvement System for Philadelphia on existing quality preschool services, allowed officials to prioritize where to develop new quality preschool programs in the highest need communities (i.e., neighborhoods with the highest density of at-risk preschoolers and the lowest density of high-quality preschool programs). It also allowed them to conduct community-level outreach to ensure that the new services were utilized by the children with the greatest needs.

The second phase of problem solving involves predictive inquiry projects that help identify factors associated with positive outcomes for those affected by the social problem identified in the first phase. These inquiries point to malleable factors that can be incorporated into effective intervention strategies (inductive intervention model building). For example, the AISP IDS in Allegheny County, Pennsylvania prioritized child welfare investigations as an area of interest for their work. They wanted to ensure that children at greatest risk of harm received a timely investigation and, if needed, intervention to ensure child safety. Aware that only about half of all child maltreatment allegations lead to full investigations, and that callers are often unable to provide much useful information about the child, the county decided to integrate data from nearly 30 sources to help prioritize the highest risk cases. Based on past cases of serious harm to children, researchers developed and tested a model that would identify children at highest risk (Vaithianathan et al., 2017). Now, when a caseworker receives a new allegation of abuse, the model provides the caseworker with a score which he or she can take into consideration when prioritizing cases for investigation. Rather than supplant caseworker judgement and experience, the model complements it, simply providing an additional source of actionable intelligence while still protecting the confidential specifics of a child's administrative data.

The third phase in the life course of problem solving is evaluative and tests the effectiveness of interventions that previous inquiries have indicated are promising to improve outcomes. Since the IDS has ready access to population data across time and a logical problem-solving process in place, it can engage in multiple, low-cost investigations to find out what works best for whom, adjusting the intervention between inquiry cycles as needed. In South Carolina, an IDS was employed to test a new approach for the delivery of mental health crisis services to citizens in rural areas. The telemedicine system connected psychiatrists to people in areas with few psychiatric resources via video conference. By randomly assigning hospitals to receive the telemedicine program, researchers could observe positive changes in the treatment population, while continuing to monitor emergency room and outpatient services in the control hospitals. The study demonstrated that the program decreased the length of psychiatric hospital stays. Recipients of the telemedicine intervention were also 30% more likely to engage in outpatient follow-up care within 30 days of discharge, which has proven important in preventing future ER visits and inpatient hospital stays (AISP, 2015).

Although these phases typically proceed linearly, it is not uncommon for there to be several project inquiries within a phase before advancing to the next phase. Likewise, work in a later inquiry phase may indicate a need to go back to an earlier phase to better understand the problem and potential solutions. For example, if the telemedicine intervention had been ineffective at providing mental health services to rural communities, researchers might have decided to engage in additional descriptive inquiries to better understand the population of individuals needing crisis mental health services before proceeding with a new intervention

strategy. The goal is for the accumulation of actionable intelligence to proceed in a systematic way. Through an iterative and logical process, the results of inquiries shape and refine interventions over time until they are maximally effective and efficient in impacting the targeted social problem.

Conclusion

The U.S. currently faces a crisis of faith in American government, marked by citizens' waning trust and confidence in government's ability to effectively address vexing social problems, like homelessness, the opioid epidemic, child maltreatment, and public education. The government seems to be stuck in a cycle of trying a myriad of bureaucratic approaches to social problem solving with disappointing results. These approaches are marked by a flood of regulations and requirements to collect and store more administrative data in agency siloes to justify funds received for services that they are mandated to perform. There is no shortage of doing or spending by our government agencies. However, public dissatisfaction is grounded in the lack of beneficial outcomes and substantial movement toward demonstrable solutions to these seemingly intractable social problems. What, then, do these bureaucracies and the good men and women providing public services need?

Do they need more data? **NO**. Our bureaucracies are deluged with data. The cost of collecting it, storing it, and reporting it far exceeds the degree to which it is used to make a substantial difference in what is done or what is spent to meet the needs of those served. We have plenty of data that remains in bureaucratic silos, for the most part undisciplined and relatively use-LESS with respect to informing decisive action.

Do we need more research? **NO**. Despite increasing mandates for "evidence-based" policies and practices, there is an enormous discrepancy between the amount of research produced related to social problems and the extent to which that research is actually used by providers of public human services. Academic research publications continue to accumulate, only to be shared within scholarly forums and journals that are not relevant to or respectful of the contextual realities of policymakers and practitioners. Do we continue to entertain a fantasy that we need researchers to drop in from helicopters like Navy Seals to conduct randomized control trials to "save" the uninformed? **NO**. We do not need more decontextualized, presumptive research. We do not need more one-off research projects that fail to demonstrate any useful or practical understanding of the realities of complex government programs and policies and sustainable solutions.

Do we need more performance management over our government agencies? **NO**. The seemingly unending mandates requiring more data collection, reporting, and strategic planning

have not changed the fact that government agencies and officials do not live and work in a data culture where they are routinely engaged in systematic processes to derive data-driven intelligence to inform their policies and practices. And even if they were, high-stakes accountability measures do not give them the space to try out new approaches that might work better with some trial and error. Agency-level actors are drowning in a sea of top-down, mandatory managerial regulations with little room or time to innovate, making rapid knowledge development-to-practice cycles that are more responsive to the needs of public service practitioners and clients nearly impossible.

This is the context from which the IDS approach emerged. Exceptional executive leaders, practitioners, researchers, and the public in selected state and local jurisdictions across the country have instituted this new approach to American public administration and are demonstrating exciting results. Fundamentally, AISP Network sites operate a **System** that utilizes an iterative, logical process of inquiry based on a testable theory of change. The inquiry process advances through analysis and interpretation of high-quality administrative **Data** relevant to the theory of change. The IDS is established and maintained by an **Integrated** team that is collaborating within and across departments and organizational hierarchies using a common language of logical inquiry and data use. Through bidirectional data-based dialogue, actionable intelligence can be routinely produced targeting high-priority social problems. This actionable intelligence allows public administrators to make better decisions on behalf of the citizenry they serve and move toward solutions to complex social problems. With the establishment of a governance process, careful adherence to ethical, legal, and data security standards, the creation of a data management and analytic infrastructure, and transparent communications to the public about the costs and benefits of IDS use, a fully functioning IDS may be built and sustained. By committing to such a sound approach to public problem solving, both administrators and the public can have renewed confidence in government.

We have presented in this paper the conceptual frame for the IDS approach and the anatomy of its infrastructure designed to fit government and foster relevant uses to improve public administration's ability to address pressing public problems. Now more than ever, we need approaches that have demonstrated that they can work to produce actionable intelligence for policy that fit government. As has been demonstrated in AISP state and local network sites, when components of the IDS infrastructure are in place and fully functioning, and when the core tenets of this approach are actualized, the IDS approach can advance us toward more respectful and responsible data-driven solutions within and across government bureaucracies. As such, this approach offers an effective, efficient, and ethical vehicle to advance social problem solving in government.

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