
IBM Center for The Business of Government

# Data-Driven Government:

## The Role of Chief Data Officers

**Jane M. Wiseman**

Ash Center for Democratic Governance and Innovation
Harvard Kennedy School

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20 years of research for government:
informing today, envisioning tomorrow

1998-2018

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# FOREWORD

## On behalf of the IBM Center for The Business of Government, we are pleased to present this report, *Data-Driven Government: The Role of Chief Data Officers,* (CDOs) by Jane Wiseman, Harvard Kennedy School.

DANIEL J. CHENOK

ZBYNEK KROBOT

Governments at all levels have seen dramatic increases in availability and use of data over the past decade. For example, this increase was demonstrated at the city level in a 2016 IBM Center report by Alfred Ho, *Ten Actions to Implement Big Data Initiatives: A Study of 65 Cities,* which describes the active use of data to improve city operations and decision-making.

The push for data-driven government currently has intense interest at the federal level, as the US Government develops an integrated federal data strategy that drives a cross-agency priority goal to "leverage data as a strategic asset." And pending federal legislation would require agencies to designate chief data officers.

This report focuses on the expanding use of data at the federal level, and governance frameworks to manage data most effectively. Ms. Wiseman says: "The purpose of this report is to advance the use of data and data security in government by describing the work of pioneering federal CDOs and providing a framework for thinking about how a new analytics leader might establish his or her office and use data to advance the mission of the agency."

Ms. Wiseman's report provides rich profiles of five pioneering CDOs in the federal government and how they have defined their new roles in making their agencies more "data-driven." Based on her research and interviews, she offers insights into the evolving roles of agency CDOs in different agencies, and the reasons agency leaders have established these roles to improve agency capacity for leveraging data effectively. She also offers advice on how new CDOs can succeed in this effort at the federal level, based on the experiences of these federal pioneers as well as successful state and local CDOs.

This report continues the Center's longstanding area of research into how government can leverage data to carry out missions and deliver services more effectively, dating back to our four-part *Data to Decisions* series published with the Partnership for Public Service.

We hope these insights and recommendations provide government leaders a roadmap to help their agencies become more data-driven.

Daniel J. Chenok
Executive Director
IBM Center for The Business of Government
chenokd@us.ibm.com

Zbynek Krobot
Partner, Digital, Shared Services, Strategy & Performance Analytics
IBM Global Business Services
zbynek.krobot@us.ibm.com

# EXECUTIVE SUMMARY

## The idea of using data to make decisions in government is not new; it's just getting increased attention now, in the age of "big data," and with the mention of a federal data strategy in the President's Management Agenda.

As agencies become increasingly data-driven, the rapid acceleration of the volume of data available has generally exceeded the pace of growth in the ability of government to manage and use that data to make decisions. Many government agencies are awash in data but struggling to analyze and make sense of it. The exception is in cases where a government agency has appointed a leader to manage the transition to a data-driven culture.

While there are many roles in government that relate to data—data analysts, data scientists, performance officers, evaluation officers, etc.—one key role is becoming increasingly common but is not yet well-studied: the Chief Data Officer (CDO).

The past few years have witnessed the appointments of an increasing number of CDOs in government. As their ranks grow, there is little roadmap for success—both for how these key drivers of data-driven government should successfully execute their missions and how they should support an ecosystem of government excellence and innovation.

The purpose of this report is to advance the use of data in government by describing the work of pioneering federal CDOs and providing a framework for thinking about how a new data leader might establish his or her office and use data to advance the mission of the agency. While the focus of this report is on those with the official title CDO, the insights apply as well to all leaders seeking to advance data-driven government.

With the possible passage of legislation requiring every federal agency to hire a CDO, and with the 2018 President's Management Agenda calling for a federal data strategy, it is timely to gather existing best practices and promising approaches to inform the data-driven government efforts of any future CDOs in the U. S. federal government.

When interviewing CDOs in federal agencies, along with other data and analytics experts, a number of key insights emerged about the current environment and the key factors for success for CDOs in government.

## Observations About the Current Environment for Federal CDOs

- **Federal CDOs are few relative to the size of the federal government.** While there are many pockets of data and innovation excellence across the federal government, particularly in the scientific and statistical agencies, there are few people with the official title of CDO at the department or bureau level. Most the largest federal agencies lack enterprise-wide data leadership, with only three cabinet-level CDOs among the 10 largest agencies. This means that CDOs are far less common in federal than in state and local government.
- **Current CDOs are doing excellent work.** Those federal CDOs who are in place excel at levels to be admired across both the public and private sectors. Successes range from predic-

tive analytics models to root out fraud to transformational open data programs that provide large volumes of high-quality data for assessing government results. Many current federal CDOs have been in their positions for several years, far surpassing the average tenure of CDOs in city and state government, providing a strong foundation for continuous improvement and talent development. They have assembled highly capable teams and delivered important results for their agencies—including, in one case, a documented return on investment of $5 for every $1 in staff cost. These CDOs use creative staffing and procurement models, and they find innovative ways to partner with state and local government.

- **Operating models are diverse.** No two federal CDOs share the same portfolio of responsibilities, as each one has adapted the role to the unique needs of his or her agency. Federal CDOs view themselves as enablers of data-driven decision-making capacity in their organizations and execute on that in different ways, ranging from being centralized providers of "analytics as a service" to creating the tools and platforms that enable employee self-service across their departments.

## Observations About Conditions That Enable a Federal CDO to Be Successful

- **Executive support amplifies success.** CDOs are most successful when they have the full support of their senior executives and are able to leverage that authority when necessary. A high-profile mandate helps them gain credibility and the respect of their peers.
- **Clarity of purpose keeps the team focused.** Successful CDOs are clear about their scope and can describe their goals succinctly. This is enormously helpful in motivating and focusing the efforts of staff and in avoiding "scope creep" or misunderstandings about the mission.
- **Data teams do best when they tap diverse skills.** CDOs are successful when they build and deploy teams with a range of specialized skills. The CDOs profiled in this report have thought carefully about the skills and resources needed to accomplish their mission—in some cases, revising their organizational structure as they learn from experience.

## The Keys to Having an Impact as a CDO

- **Solving high priority customer problems makes value visible.** Each CDO described the importance of listening to the owners of business processes in their agencies, and most engage in direct one-on-one conversations with leaders to fully understand their challenges as well as how data can help resolve pain points in their operations.
- **Investments in data governance and data literacy fuel culture change.** One common theme among successful CDOs was the importance of data governance and the improvement of data quality. Efforts at improving data literacy were common across all of the CDOs interviewed, highlighting the importance of their roles as enterprise-wide culture change agents.
- **The most impactful projects span boundaries.** A department-wide CDO is in the unique position to connect data across the enterprise, and often to connect to data outside the organization as well. This can amplify the value of data. For example, the Department of Transportation facilitated cross-agency development of a standard federal data schema for the National Address Database, now adopted by 22 states.

## The Three Core Competencies of Successful CDOs

A successful CDO is one who can balance a vision for new ideas with the ability to get things done. CDOs who excel in each of the three dimensions described below are most likely to achieve success.

- **Infrastructure competence:** At a minimum, a CDO must competently manage the basic data infrastructure of the organization, supporting open data and data visualization platforms and maintaining the data warehouses and tools needed for the organization. These operational "nuts and bolts" form the core of what a CDO must do well.
- **Openness to innovative ideas and approaches:** A great leader is open to pushing his or her organization forward, to innovation, to new ways of thinking, and to new methods and tools. Each of the CDOs profiled here has nudged his or her organization along the journey toward data-driven government while keeping an open mind and being able to adapt to changing opportunities.
- **Delivery capability:** While openness to innovation makes for a visionary leader, the vision can only be realized with consistent attention to delivery. This is an often-overlooked but critically important element to success.

## Recommendations

- **Recommendation One: The Office of Management and Budget (OMB) and Congress should recognize the value of federal CDOs and give them the appropriate resources.** This would include requiring that CDOs be full-time positions with the authority and resources to drive data-driven government for their organization, provide them authority to facilitate the sharing of best practices, establish a regular intergovernmental data dialog, and supporting the development of widespread data literacy.
- **Recommendation Two: Federal agency leaders should establish a data leader or CDO position in their agency.** Every leader of a government agency, regardless of the agency's size or mission, should consider the value that could be achieved for the public by hiring a data leader such as a CDO. The data leader should have the authority, executive support, and mandate to advance data-driven government. Agency leaders should hire a data leader such as a CDO who demonstrates competency across the domains of infrastructure, innovation and delivery.
- **Recommendation Three: New CDOs should let strategy drive operations and should focus on delivering value for their customers.** An agency's business challenges should drive CDO work, and CDO teams should solve the most important public problems, as expressed by the managers and executives in the organization.
- **Recommendation Four: CDOs should create a skilled and diverse team.** A CDO should bring together specialists across disciplines such as business process analysis, data science, data management, and data visualization. In hiring, CDOs should not underestimate the importance of people skills, and should use creative hiring strategies.
- **Recommendation Five: CDOs should create a culture of data and innovation.** A CDO should be a data evangelist and advocate for data-driven government across the organization. He or she should build data literacy into culture change for the broader organization and, within the team, allow staff the "freedom to fail."
- **Recommendation Six: CDOs need to deliver on analytics by getting the basics right and providing data stewardship.** A CDO needs to solve the problems that matter most to their organization's customers, deliver timely and useful results in a customer-friendly format, and leverage existing tools and resources.

# Creating A Data-Driven Federal Government

# Introduction

## The Use of Data in Government is Gaining Momentum

The idea of using data to make decisions in government is not new; it's just getting increased attention now, in the age of "big data," and with the mention of a federal data strategy in the President's Management Agenda.

Data-driven government has a long history, but a significant development was the 1970 creation of the OMB, tasked to measure the effectiveness of government and to bring that function into the budgeting process. The Government Performance and Results Act of 1993, and its successors over the past two decades, have tried to bring greater use of data into the process of managing the daily operations of the federal government as well as the allocation of resources. Open data and digital data efforts in the 2010s have sought to increase transparency and improve access to government data for the public and for government managers.

More recently, the velocity and variety of data initiatives in the federal government has accelerated. There is growing consensus that, as stated in a 2017 CIO Council report, "Efficiently managing government data and information can increase operational efficiencies, reduce costs, improve services, and better safeguard personal information." [1]

Two forces have accelerated the use of data across all levels of government over the past decade—demonstrable results and democratization of data management and analysis. Demonstrable results have been seen in the success of performance "stat" and data analytics programs, particularly at the state and local level. As the big data revolution has drastically increased the volume of data available to government and lowered the cost and complexity of the tools for storing and analyzing data, the field of data-driven government has grown to include a new class of leaders and managers who have the skills and interest to exploit the power of data. Vast amounts of data that used to be inaccessible or unintelligible—perhaps in paper files stored in different parts of the same building, or maybe in different buildings across the country—are now easily combined and compared to gain insight. In short, data-driven government is now possible on a scale impossible to contemplate a decade ago.

## Leadership Can Dramatically Accelerate Adoption of Data-Driven Government

The rapid acceleration of the volume of data available has generally exceeded the pace of growth in the ability of government to manage and use that data to make decisions. Many government agencies are awash in data but struggling to analyze and make sense of it. The exception is in cases where a government agency has appointed a leader to manage the transition to a data-driven culture.

## The Most Common Title for a Data Leader is Chief Data Officer (CDO)

While they go by many different names—chief data scientist, chief data analyst, and so on, the most common title for this new class of leaders driving the move toward greater adoption of data-driven government is CDO. Note that the term CDO is used in this paper to refer both to those who have the official designation as CDO and more broadly to the data leaders who perform this function without the title.

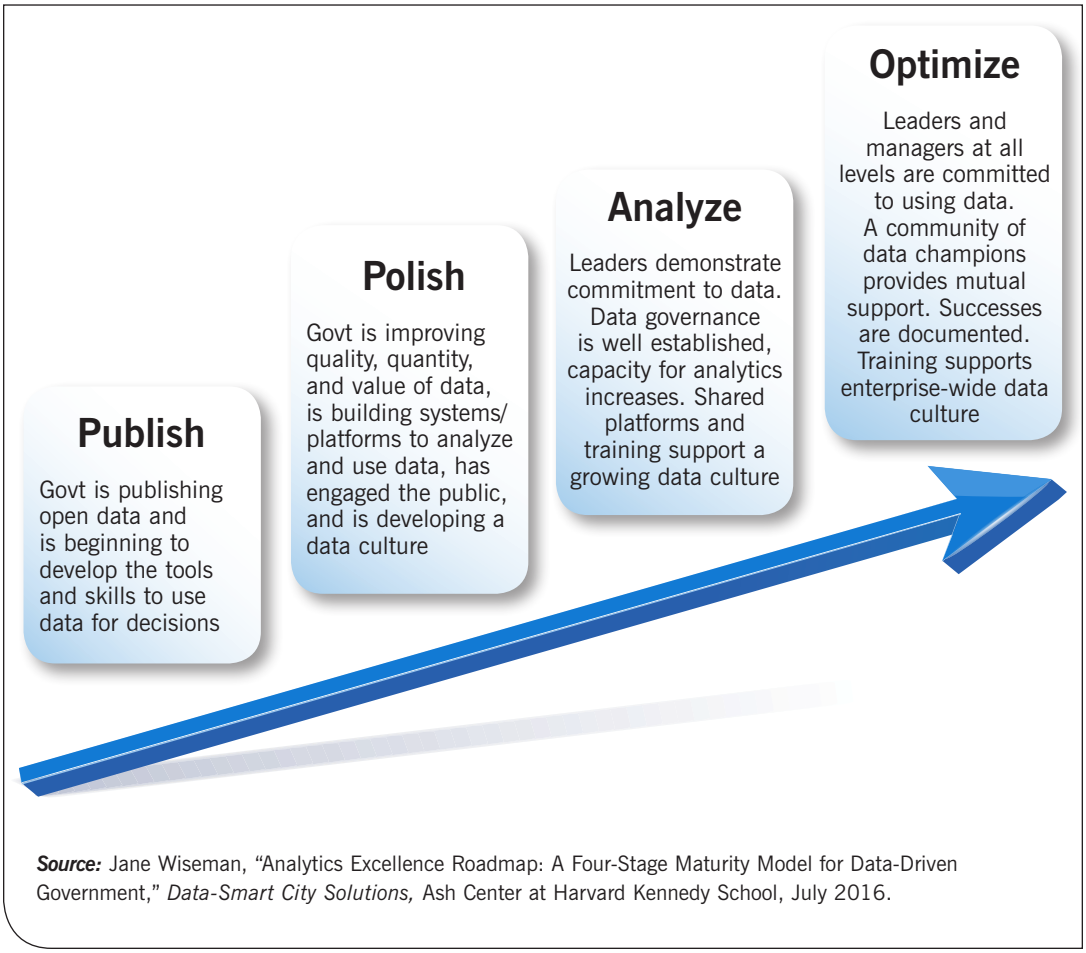
The CDO title is still new enough that many in government don't know what it is. One federal press officer, when asked for their agency's CDO, replied "We don't have one. That sounds like

1. CIO Council, *State of Federal Information Technology,* CIO Council, January 2017, 61, https://s3.amazonaws.com/sitesusa/wp-content/uploads/sites/1151/2017/05/CIO-Council-State-of-Federal-IT-Report-January-2017-1.pdf.

something from the private sector"—and this was in an agency that does sophisticated data work in its fraud detection analytics program.

A data leader such as a CDO can motivate and inspire an organization to grow its capacity to produce and consume data for the benefit of better public results. As shown in the four-stage capability maturity model in Figure 1, a CDO's responsibilities are associated with creating and improving data in order to develop the analysis, knowledge development, and insight that help make government more effective, efficient, and customer-responsive.

**Figure 1: Data-Driven Government: A Four-Stage Capability Maturity Model**




***Source:*** Jane Wiseman, "Analytics Excellence Roadmap: A Four-Stage Maturity Model for Data-Driven Government," *Data-Smart City Solutions,* Ash Center at Harvard Kennedy School, July 2016.

As shown in this model, data powers knowledge and impact—when data is available and exposed to analysis, valuable insight is possible. A CDO can be thought of as the maestro of an enterprise-wide orchestra, pulling forth a more cohesive and resonant outcome than would have resulted if each part of the enterprise acted alone or not at all.

## Data Leaders Deliver Significant Financial Returns from Their Work

Where data leaders and CDOs exist, they demonstrate their financial value. For example, the CDO at the Department of Health and Human Services Office of Inspector General (HHS OIG)

returns $5 for every $1 of cost by using data to find fraud.[2] The CDO at the United States Postal Service (USPS) Office of Inspector General (OIG) has returned significant public value using analytics models to find waste and abuse of funds, with more than $920 million returned via analytics in 2016 alone.[3]

Here are some of the quantifiable public financial returns from city analytics projects:[4]

- Boston will save $5 million and 20,000 pounds of carbon emissions with an algorithm to optimize school bus routing. The city also saves $1 million a year on city building energy costs with real-time monitoring and an energy manager who can strategically adjust consumption during peak cost times.
- The city of Louisville calculates a five-to-one return for every dollar of cost to the city for its analytics and performance management efforts. For example, the city increased collection of fees and fines to $2.5 million (a seven-fold increase) by adding data analysts to examine the data and identify collectible funds—paying the data analysts' salaries 20 times over. The city also cut overtime by $3.1 million by using data analysis to identify patterns and proactively manage and monitor budgeted to actual amounts for corrections, law enforcement, and fire department employees.
- Staff in the city of San Francisco save the city $1.7 million a year by applying their technology and data skills training to find efficiencies on the job.
- The CDO in the city of Syracuse led a project that saved $400,000 in 2017 and will save $800,000 in 2018 on emergency water main repairs, using predictive analytics to target preventive maintenance.

The positive financial returns are consistent with research that shows private sector companies with an executive responsible for data analytics outperform peers on financial metrics.[5]

## Data Leaders Also Deliver Intangible Return on Investment

The value that data leaders deliver is sometimes hard to measure. There is significant public value in providing the public with timely and accurate information via open data programs, but this value is hard to quantify. In addition, data-driven improvements in the quality or efficiency of public service, or the integrity and accuracy of service delivery, are not easy to measure. Yet, they are essential to improving results and to restoring faith in our government.

The City of Buenos Aires, Argentina, recently measured the effect of open data on its residents by running an experiment. After being shown a dashboard of performance data on the mayor's public performance commitments, survey respondents unfamiliar with the mayor's goals showed a 64 percent increase in their level of trust in government (from 22 percent to 36 percent). This is consistent with a Harvard Business School case study showing that as the public learns more about government operations and has more visibility into activity, trust and satisfaction levels increase.[6]

2. Department of Health and Human Services, *Fiscal Year 2019 Justification of Estimates for Appropriations Committees,* Food and Drug Administration, 2018, https://www.fda.gov/downloads/AboutFDA/ReportsManualsForms/Reports/BudgetReports/UCM603315.pdf.
3. CDO Club, *Kelly Tshibaka,* CDO Summit Speakers, July 2017, http://dc.cdosummit.com/speakers/kelly-tshibaka/.
4. Jane Wiseman, "Discovering the True Value of City Data Experts," *Data-Smart City Solutions,* Ash Center at Harvard Kennedy School, November 2017, https://datasmart.ash.harvard.edu/news/article/discovering-the-true-value-of-data-experts-who-are-showing-cities-the-money.
5. Yang Lee et al., *A Cubic Framework for the Chief Data Officer: Succeeding in a World of Big Data,* Massachusetts Institute of Technology, March 2014, 2, http://web.mit.edu/smadnick/www/wp/2014-01.pdf.
6. Michael Norton and Ryan Buell, "Think Customers Hate Waiting? Not So Fast…" *Harvard Business Review,* Harvard Business Publishing, May 2011, https://hbr.org/2011/05/think-customers-hate-waiting-not-so-fast.

Another example of improved perception of government through transparency into operations came from a snow removal effort in Kansas City, Missouri. After seeing low citizen satisfaction ratings on snow removal, the city went on a media blitz. It provided information to help educate residents on what to expect—curb-to-curb plowing on main arteries, one lane of travel on residential roads, and the expected timeframe for plowing. In addition, the City Manager did a "Tweet-along" while driving in a snowplow, providing real-time updates on the city's progress. Newly-enabled GPS data allowed the public to track snowplows. Survey data showed an improvement in customer satisfaction. Nothing about core operations changed—what changed was the amount of information the public had and their expectations of city performance. Satisfaction went from 50 percent (three years prior) to 62 percent based on these efforts.[7]

The value of having a CDO was clear to the Commission on Evidence-based Policy Making. Their 2016 report to Congress inspired legislation to bring greater use of evidence and evaluation into government and directed federal agencies to create the role of the CDO in federal departments.[8]

While there are a growing number of CDOs in government, and more could be in place if the legislation is passed, there is very little documentation of what CDOs do, who they are, and the insights they've gained from their experience. There is no annual survey of CDOs in the federal government, nor are there published case studies of the data transformation efforts led by federal CDOs. This report seeks to advance the state of knowledge by documenting the current environment and providing a framework for thinking about how CDOs are advancing data-driven decision making in government.

## The Role of a CDO May Vary, but It Typically Starts with Data Management

The term CDO has existed for less than a decade in the public sector. No two public sector CDOs have the same set of responsibilities, but the critical common element is being the designated leader for data. As one CDO pointed out, the reason his role was created was that, until then, no one had full-time responsibility for data across the organization. As a result, when the cabinet secretary asked simple data questions, not only was there no single go-to person, but the various answers would often conflict, with no central "single version of the truth."

A CDO can be one of a handful of data and innovation leaders, or he or she can be the sole party responsible for data and related innovation tasks. The most common starting point for a CDO is leading an open data program, but additional responsibilities vary across digital and analytics services. Table 1 describes the range of activities CDOs and their data and innovation peers can undertake.

7. Jane Wiseman, "Customer-Driven Government," *Data-Smart City Solutions,* Ash Center at Harvard Kennedy School, August 2015, https://datasmart.ash.harvard.edu/news/article/customer-driven-government-721.
8. "Foundations for Evidence-Based Policymaking Act of 2017," H.R. 4174—115th Congress (2017-2018), https://www.congress.gov/115/bills/hr4174/BILLS-115hr4174rfs.pdf; "Foundations for Evidence-Based Policy Making Act of 2017," S. 2046—115th Congress (2017-2018), https://www.congress.gov/115/bills/s2046/BILLS-115s2046is.pdf

**Table 1: Data, Governance, Infrastructure and Related Activities of CDOs and Their Peers**

| Common Activities of CDOs | | |
|---|---|---|
| **CDO functions focused on the organization** | **CDO functions focused on business users** | **CDO functions that span boundaries** |
| **Data Infrastructure**<br>• Establish and maintain data warehouses<br>• Master data management<br>**Data Governance**<br>• Govt-wide standards and policy<br>• Data quality<br>• Stewardship across organization<br>• Data privacy and security tools and policies | **Data Analytics**<br>• Descriptive statistics<br>• Predictive models<br>• Data visualization and dashboards<br>**Training/Data Literacy**<br>• Tool/skill training for data staff<br>• Capacity building for leadership and decision-makers<br>• Community of practice<br>**Self-service Platforms/Tools**<br>• Provisioning of common tools<br>• Support of tools<br>**GIS/Mapping***<br>• Service coverage maps, gap analysis<br>• Hot spots, interaction and overlap | **Open Data**<br>• Publish large volume of high quality data<br>• Establish and share meta data and data dictionaries<br>• Regularly update and improve quality<br>• Developer APIs<br>**Smart Technology***<br>• Sensors<br>• IoT and connected devices<br>**Digital Services***<br>• User-centric design for high-volume transactions<br>• Ease of access to information<br>• Robust civic engagement |

** Indicates tasks sometimes done by CDO and sometimes by other innovators*

***Source:*** Developed by author

While no CDO covers every element in the possible portfolio of activities, the chart shows how many of the activities interrelate or overlap. Some areas of activity are more internal-facing (such as data governance) while others are more external-facing (such as open data programs). However, in most cases, the internal-facing and external-facing activities are complementary and mutually reinforcing. For example, metadata, data dictionaries, and data standards are internal data governance efforts that enhance the external customer experiences for open data programs.

## Most CDOs are Responsible for Core Data Infrastructure and Management Functions

While no two CDOs have the exact same job responsibilities, there is a good deal of overlap. Most are responsible for open data, data governance, and data management. Where analytics programs exist, the CDO typically leads. Many are responsible for geographic information systems, data visualization, and smart technology. Some are responsible for, or connected to, performance management efforts. Regarding the tools used by CDOs, a recent survey[9] by the Center for Digital Government shows that common data tasks taken on by CDOs in government include the following:

9. Tod Newcombe, "Big Data or Big Hype? Has data analytics delivered on its radical promise?" *Public CIO Special Report,* Center for Digital Government, 2018.

**Table 2: Common Data Tasks Taken on by CDOs in Government**

- 79% use dashboards and portals
- 51% use a data warehouse
- 34% use data mining
- 34% use predictive modeling
- 23% use master data management and
- 10% are using or considering using Artificial Intelligence/AI

***Source:*** Tod Newcombe, "Big Data or Big Hype? Has data analytics delivered on its radical promise?" Public CIO Special Report, Center for Digital Government, 2018.

## Data-Driven Government Remains a Partially Realized Goal

In the current environment, with data increasingly plentiful, the time, skill, and tools to make sense of data is lacking in many government agencies. According to McKinsey, while 90 percent of all digital data has been created within the last two years, only one percent of it has been analyzed, across both public and private sectors.[10] The gap between the volume of data available and the capacity of government employees to analyze it has grown exponentially as the tools for managing and making sense of big data have proliferated. As noted by Doerr and Gibbs, the large volume of data collected by government is "underappreciated, underdeveloped and underused."[11]

## The Challenge as Described by Federal Employees

CDOs and other data leaders in government have expressed eagerness to advance along the lines of the data maturity model described in Figure 1. One theme that came through repeatedly in interviews was that CDOs feel their organizations are still at an early stage in adopting a data-driven mindset and that culture change takes time. In their own words:

- "We can get data about more things all the time, and we can even get more reliable data, but it takes a while to get the stage of having knowledge or insight."
- "What we've seen in the past 5-10 years is a greater awareness of the power of data, and now there's more desire to not just pull up numbers on how many of this or that activity we do, but what deeper meaning can we gain from the vast amount of data we have about our operations."
- "It can be painful. I've been trying to push the organization into the new and innovative space for years and am still making slow progress."
- "Our organization fights itself. We're not even a family as an agency. We need to get better about data sharing."

10. Nicolaus Henke, Ari Libarikian, and Bill Wiseman, "Straight Talk About Big Data," *McKinsey Quarterly,* McKinsey & Company, October 2016.
11. Robert Doar and Linda Gibbs, Unleashing the Power of Administrative Data: A Guide for Federal, State, and Local Policymakers, Results for America, October 2017, 3, https://results4america.org/tools/unleashing-power-administrative-data-guide-federal-state-local-policymakers/.

In 2016, the Comptroller General of the U.S. hosted a forum on Data and Analytics Innovation—and published the proceedings, a document that one CDO keeps handy as a desk reference. The forum addressed both the benefits and challenges of using data and explored the impact on the economy and jobs, as well as privacy issues. Reflecting on how some leaders in their organizations fail to grasp the power of data to improve government, one participant said, "They don't get it … and they don't get that they don't get it."[12]

The Commerce Department's National Technical Information Service facilitates ongoing dialog among federal data leaders, hosting an annual Federal Data Meeting. At the 2017 session, attended by 200 data professionals and external data experts, there was a sense that more data leaders were needed as expressed in the summary report of the meeting:

> **"Participants expressed that agencies were often missing a champion—someone who would promote data-driven decisions within their organization.** Alternatively, agencies identified a champion but the champion struggled to connect across all organizational levels. In addition, some agency participants expressed success through a "top-down" authority, primarily driven by their organization's mission. In contrast, other agencies worked from the bottom levels upward and struggled to find well-positioned colleagues and decision-makers who could help drive successful outcomes."[13] (emphasis added)

These observations are consistent with survey results. A 2016 survey by MeriTalk showed that 58 percent of federal IT and data survey respondents grade their agency's data management at a C or below, and 93 percent of those who do not have a CDO in their agency believe that having one would bring positive impact.[14]

## Data Culture Requires Data Literacy, yet Most CDOs are Just Beginning to Address it

Many senior managers in government do not fully understand what big data is, much less how to harness its power for their organizations' benefit. CDOs are hampered in their ability to change their organizational culture toward greater use of data when the managers and executives who make decisions lack the confidence and curiosity to embrace the advantages of big data. Some CDOs are beginning to tackle this via data literacy efforts. When typewriters replaced handwritten correspondence with typed letters, executives quickly saw how the typist could be of value. When word processors allowed workers to type, edit and revise documents, the value was obvious. The embrace of data as a tool to manage organizations hasn't followed this same path of ease of adoption for a variety of reasons. Basic data literacy training for managers and for all employees would go a long way toward helping CDOs drive greater use of data to inform and improve operations. Most CDOs are still in the early stages of taking on the significant challenge of organizational transformation.

12. U. S. Government Accountability Office, *Emerging Opportunities and Challenges: Data and Analytics Innovation,* GAO-16-659SP, 2016, 43.
13. National Technical Information Service, Federal Data Meeting: Summary Report, U.S. Department of Commerce, 2017, https://www.ntis.gov/assets/pdf/april4-summaryreport.pdf.
14. MeriTalk, Calling the Plays: The Evolving Role of the CDO and Federal Big Data, MeriTalk, December 2016, https://www.meritalk.com/study/calling-the-plays/.

### There is Significant Untapped Potential in Government Data, as Shown by Third Parties

According to an estimate by the consulting firm McKinsey, open data from the government could unleash $3 trillion in value for the economy.[15] Public data is being used wisely and widely—yet often simply not by the public sector itself. Sometimes, it's an academic or journalist who finds public data and exploits its value. Some examples of open government data being used by third parties to find patterns and trends include:

- In New York City, a concerned member of the public used available city data from traffic cameras to identify patterns of when cars were creating a safety hazard by traveling in the bike lane.[16]
- The Murder Accountability Project (MAP), founded by a retired journalist interested in serial murders, uses public federal data such as the FBI Uniform Crime Report and the Supplemental Homicide Report to identify clusters of related unsolved murders. The algorithm created by MAP founder Thomas K. Hargrove is available for any law enforcement agency to use in solving murders—essentially a free way to bring "big data" skills to any size department.
- Open data enthusiast Ben Wellington used open data published by the New York City Police Department to identify and map thousands of parking tickets, totaling millions of dollars, that had been issued erroneously.[17] After he published his results and his map, the city changed its policy, demonstrating the power of open data.

In summary, it is clear that the value returned for analytics efforts can optimize the time and effort of government employees.

## The Landscape: Where Federal CDOs Are Today

In describing and assessing the impact of CDOs in the federal government, the first step was to identify the CDOs. This was not nearly as easy a task as one might imagine, since there is no centralized public repository of CDOs, nor were they particularly easy to find based on publicly-available information.

### Origins of the Public Sector CDO Role

CDOs began to be appointed in the private sector in 2003, first in the financial and technology fields and then continuing into consumer and retail industries as the value of big data became more apparent for targeting marketing to customers.

By 2007, Allegheny County, Pennsylvania, had appointed a full-time data analytics officer for its Health and Human Services Department. In 2010, the City of New Orleans appointed a data leader, again without using the CDO title. In 2011, the CDO title was first used in the City of Chicago, in the same year that New York City began its analytics program. The success of these early adopters helped establish the credibility of the role of CDO in government and, since the early days, the role has evolved from a novelty to a growing movement.

15. James Manyika et al., "Open data: Unlocking innovation and performance with liquid information," McKinsey Quarterly, McKinsey & Company, October 2013, https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/open-data-unlocking-innovation-and-performance-with-liquid-information.
16. Sarah Maslin Nir, "Bus Lane Blocked, He Trained His Computer to Catch Scofflaws," *The New York Times,* March 15, 2018, https://www.nytimes.com/2018/03/15/nyregion/bike-lane-blocked-new-york.html.
17. Max Galka, "How an open data blogger proved the NYPD issued parking tickets in error," The Guardian, July 26, 2016, https://www.theguardian.com/cities/2016/jul/26/open-data-blogger-parking-tickets-new-york-nypd.

## Origins of the Federal CDO Role

The first federal CDO was appointed in 2013 by the Federal Reserve Board. In 2014, others followed, including the Department of Transportation—the first cabinet agency to appoint a CDO—and the United States Agency for International Development. Some of today's CDOs were performing the duties before taking on the official title, while others were selected from outside of government. Many CDOs started on their journey of organizational data transformation leadership when tasked with supporting the 2009 Open Data Initiative which required agencies to make more data available to the public. As described in the four-stage capability maturity model in Figure 1, publishing open data is a natural precursor and accelerant to data-driven government, enabling greater volumes and higher quality data to be available for analytics.

In February 2015, the U.S. federal government got its first Chief Data Scientist when DJ Patil was appointed to that role. The White House role put a spotlight on a job title that, at the time, was in its formative stages for government organizations. With his exuberance and energy, Patil generated excitement in data circles across federal, state, and local government, as well as in the private sector. Patil amassed a team of data scientists and data analysts at the White House and created a movement toward the greater use of data in federal agencies. Several federal agencies followed suit and named their own CDOs, growing the ranks of data leaders in federal government.

To create a peer network of support for data leaders, Patil established the Data Cabinet, which met regularly to share ideas and provide mentoring and support. With the change in administration, the Data Cabinet is now hosted at the Commerce Department's National Technical Information Service (NTIS), and while the group continues to meet, it no longer holds the high profile provided by being connected to the White House.

## Most of the Largest Federal Agencies Do Not Have CDOs

For an initial answer to the question "which federal government agencies have CDOs?" the table below examines the ten largest federal non-defense agencies by appropriation and finds that only a handful had a secretariat-wide CDO as of mid-2018. There may well be individuals serving as data leaders in these agencies with titles other than CDO, and there may be CDOs at the bureau or office level. For example, the Federal Communications Commission which does not have a CDO, does have CDOs in each of its bureaus and offices.

For a first answer to the question regarding the reach of the CDO role, this analysis looks at the largest operational non-defense agencies. The methodology for collecting the data is provided in the appendix.

Of the top 10 federal non-Defense agencies (by size of budget), only three have a chief data officer. As shown below, as of mid-2018 based on public information, only three department-level CDOs were found, at the Department of Health and Human Services (HHS), the Department of Agriculture, and the Department of Transportation. And only one agency has had the CDO position more than a few years. HHS, the largest of the federal agencies to have a CDO, has only had the position in place for one year.

**Table 3: CDOs in the 10 Largest U.S. Federal Government Non-Defense Agencies July 2018**

| | Department | Budget | Department CDO? |
|---|---|---|---|
| **1** | **Dept. of Health and Human Services, 2017** | **$1.01 trillion** | ✓ |
| 2 | Social Security Administration | $908 billion | |
| 3 | Dept. of the Treasury | $544 billion | |
| 4 | Dept. of Veterans Affairs | $159 billion | |
| **5** | **Dept. of Agriculture, 2016** | **$133 billion** | ✓ |
| **6** | **Dept. of Transportation, 2014** | **$75.5 billion** | ✓ |
| 7 | Dept. of Education | $60.2 billion | |
| 8 | Dept. of Labor | $44.8 billion | |
| 9 | Dept. of Homeland Security | $42 billion | |
| 10 | Dept. of Housing and Urban Development | $35.8 billion | |

***Source:*** CDO information from public information on department websites as of July 2018. Appropriations data found at https://www.whitehouse.gov/issues/budget-spending/

By comparison, 18 states have a CDO, and the population of those jurisdictions with a CDO covers 58 percent of total U.S. population (see appendix). Of the 10 largest U.S. cities by population, 80 percent have either a CDO or someone who fills the role but holds an alternative title such as Chief of Enterprise Data Services (see appendix). The two largest cities without someone in this role both operate under a mayor-city manager form of government and may have a more complex distribution of activities including those that would fall under a CDO.

## A Number of Smaller Departments and Sub-Cabinet Agencies Have Active CDOs

Next, a snowball sampling method was used to identify CDOs located at the bureau level below and at departments smaller than the top ten by appropriation. This proved a more fruitful method of identifying federal government CDOs. By reviewing public speaking engagements of data officers in federal government, searching LinkedIn profiles, reviewing websites for smaller federal agencies, and asking federal CDOs to name their peers in other agencies, a much wider list was created. Table 4 represents the most current compilation of those with the CDO role in federal government, shown by tenure of when the CDO position was created by the agency.

**Table 4: CDOs Across the Federal Government**

| Department/Division | CDO | Reports to | Year position created |
|---|---|---|---|
| Federal Reserve Board | Michael Kraemer (as of 2015) | COO | 2013 |
| United States Agency for International Development (USAID) | Brandon Pustejovsky | CIO | 2014 |
| Consumer Financial Protection Bureau (CFPB) | Linda Powell | CIO | 2014 |

**Table 4: CDOs Across the Federal Government (cont.)**

| Department/Division | CDO | Reports to | Year position created |
|---|---|---|---|
| Department of Health and Human Services Center for Medicare and Medicaid Services (HHS/CMS) | Vacant (Niall Brennan served 2014-2017) | Administrator | 2014 |
| Department of Transportation (DOT) | Dan Morgan | CIO | 2014 |
| General Services Administration (GSA) | Kris Rowley | CIO | 2015 |
| United States Postal Service Office of Inspector General (USPS OIG) | Kelly Tshibaka | NA | 2015 |
| Department of Health and Human Services Office of Inspector General (HHS OIG) | Caryl Brzymialkiewicz | Deputy Inspector General for Mgt & Policy | 2015 |
| Department of Commerce | Vacant (Ian Kallin served 2015-2017) | NA | 2015 |
| Environmental Protection Agency (EPA) | Robin Thottungal (Chief Data Scientist) | Office Director | 2015 |
| United States Department of Agriculture (USDA) | Bobby Jones | NA | 2016 |
| Department of Labor, Wage and Hour Division | Brandon Brown | NA | 2016 |
| Department of Health and Human Services (HHS) | Mona Siddiqui | CTO | 2017 |
| Federal Aviation Administration | Natesh Manikoth | CIO | 2017 |
| National Oceanic and Atmospheric Administration (NOAA) | Ed Kearns | CIO | 2017 |

***Source:*** LinkedIn profiles of CDOs

## A New CDO Explains Why the Role Matters: Leading NOAA's Massive Data Enterprise

The National Oceanic and Atmospheric Administration (NOAA), a scientific agency with a strong data culture, named Ed Kearns as its CDO in 2017. Kearns' portfolio includes leading NOAA's open data effort, creating a data strategy, and leading his agency's signature Big Data Alliance. This collaboration with a handful of private sector vendors is intended to test rapid, scalable solutions to allow the public and industry to easily and equally access, explore, and create new products from the vast stores of NOAA data. NOAA collects 20 terabytes of data every day—more than twice the data of the entire printed collection of the Library of Congress. Data sources are diverse, including Doppler radar, weather satellites, buoy networks and stations, tide gauges, and real-time weather stations, as well as ship and aircraft data. This public-private collaboration was formed through a Cooperative Research and Development Agreement (CRDA). Under this CRDA, no funding is given by the government to the companies, but they are able to create products of value and then monetize the value of their solutions and services built on top of the data.

After his appointment, some of Kearns' peers at NOAA pushed back, asking "why do we need a CDO?" They wondered with thousands of data scientists already in the agency, with a lot of grassroots centers of excellence, and with data stewards who have been working for over a decade to develop common data standards, was there a need for an officially designated data leader?

Kearns' answer is a resounding yes. He sees value in forging a coherent view of all data across the enterprise—something that doesn't currently exist. While the agency shares data readily, there isn't a strong governance, management, or oversight structure so that he can know where data is or who's using it. He has a data strategy that maps out key resources and creates a roadmap for driving value from the data. As of now, there are more than 70,000 NOAA datasets on Data.gov, but they vary widely in scope and scale—from a data point listing a single ship that went out on one mission to a 30-year longitudinal history of weather data. Some data assets require 10 clicks to get to the underlying data, and some others require only two. Kearns wants to use his role as CDO to improve data standards, consistency, and quality for this public data, while improving internal data management as well.

## CDOs Are Not the Only Data Leaders in Government

Data specialists with the official title of CDO are by no means the only data and innovation leaders in federal government. As one CDO said, "the federal government employs exceptionally bright people who have been innovating for decades." Data scientists and data innovators are found across a wide range of federal agencies.

### *Scientific Agencies*

The skillset of a CDO abounds in the federal government's scientific agencies, and the agencies are teeming with experts in science, data science, engineering, and statistics—even when they do not have a formal CDO.

Few scientific agencies have CDOs, but many are pursuing important advanced analytics projects. For example, the National Science Foundation, which supports and coordinates research in the sciences, does not have a CDO and yet has a wide range of data and innovation activity, including its Big Data Regional Innovation Hubs. Its Computer & Information Science & Engineering (CISE) Directorate advances the use of computer algorithms in government and research, and its various fellowship and grant programs advance the sophistication of data science in the field. The National Institutes of Health, another agency without a CDO, has significant data and analytics efforts, including the Big Data to Knowledge project to extract insight from big data collected via federal research projects.

### *Statistical Agencies*

The thirteen federal statistical agencies (Table 5) all employ mathematicians and statisticians, many of whom have skills similar to those cultivated on CDO teams. One federal official described the economists and statisticians at agencies such as this as having "analytics as a hobby."

**Table 5: Federal Statistical Agencies**

- Bureau of Economic Analysis
- Bureau of Justice Statistics
- Bureau of Labor Statistics
- Bureau of Transportation Statistics
- Census Bureau
- Economic Research Service
- Energy Information Administration
- National Agricultural Statistics Service
- National Center for Education Statistics
- National Center for Health Statistics
- National Center for Science and Engineering Statistics
- Office of Research, Evaluation, and Statistics (SSA)
- Statistics of Income (IRS)

***Source:*** Council of Professional Associations on Federal Statistics, Links to Federal Statistical Agencies, Council, Council of Professional Associations on Federal Statistics, accessed August 2018, http://www.copafs.org/about/links_to_federal_statistical_agencies.aspx.

### *Fraud Detection in Benefits Programs*

Several large federal benefits programs have fraud detection efforts that rely on sophisticated predictive analytics algorithms to identify patterns that may indicate fraud or abuse of program funds. The Fraud Reduction and Data Analytics Act of 2015 and attention from General Accountability Office (GAO) and OMB have helped provide focus at agencies with large volumes of financial transactions. Financial and operational staff at those agencies are working to establish controls to prevent, detect, and respond to fraud. In some cases, the work is done internally and in other cases private-sector firms support the work. For a variety of reasons, agencies may not seek attention for their anti-fraud efforts. Some prefer not to highlight their fraud detection results out of fear of criticism that the fraud existed in the first place. Others want to avoid letting fraudsters know their methods.

### *Centers of Data Excellence Embedded in Agencies*

Even in non-scientific agencies, there are pockets of data excellence. One great example is the Department of Veterans Affairs (VA), where there is no official with the CDO title, but there is an abundance of data analytics to inform policy. For example, the National Center for Veterans Analysis and Statistics collects, analyzes, and publishes a vast array of statistics on the veteran population at its website.[18] The website includes the highly sophisticated Veteran Population Projection Model, which uses advanced analytics and data from across federal sources to predict the number of living and deceased veterans per year for the next 30 years, segmented by state, Congressional district, and other geographic slices, broken down by key demographic characteristics such as age, gender, period of service, and race/ethnicity. The VA website also has a wealth of public data on important policy issues, such as an interactive map showing the last five years of opioid prescriptions from VA facilities.[19] In another example of data innovation success, the VA created the digital tool Vets.gov to give veterans a streamlined way to discover, apply for, track, and manage the benefits they have earned in one place using any device. While the VA does not have a CDO, it's an agency where the proliferation of data innovation continues, albeit without the orchestration of a senior enterprise-wide visionary to guide, coordinate, and optimize the efforts.

18. U.S. Department of Veterans Affairs, *National Center for Veterans Analysis and Statistics,* U.S. Department of Veterans Affairs, accessed August 2018, https://www.va.gov/vetdata/index.asp.

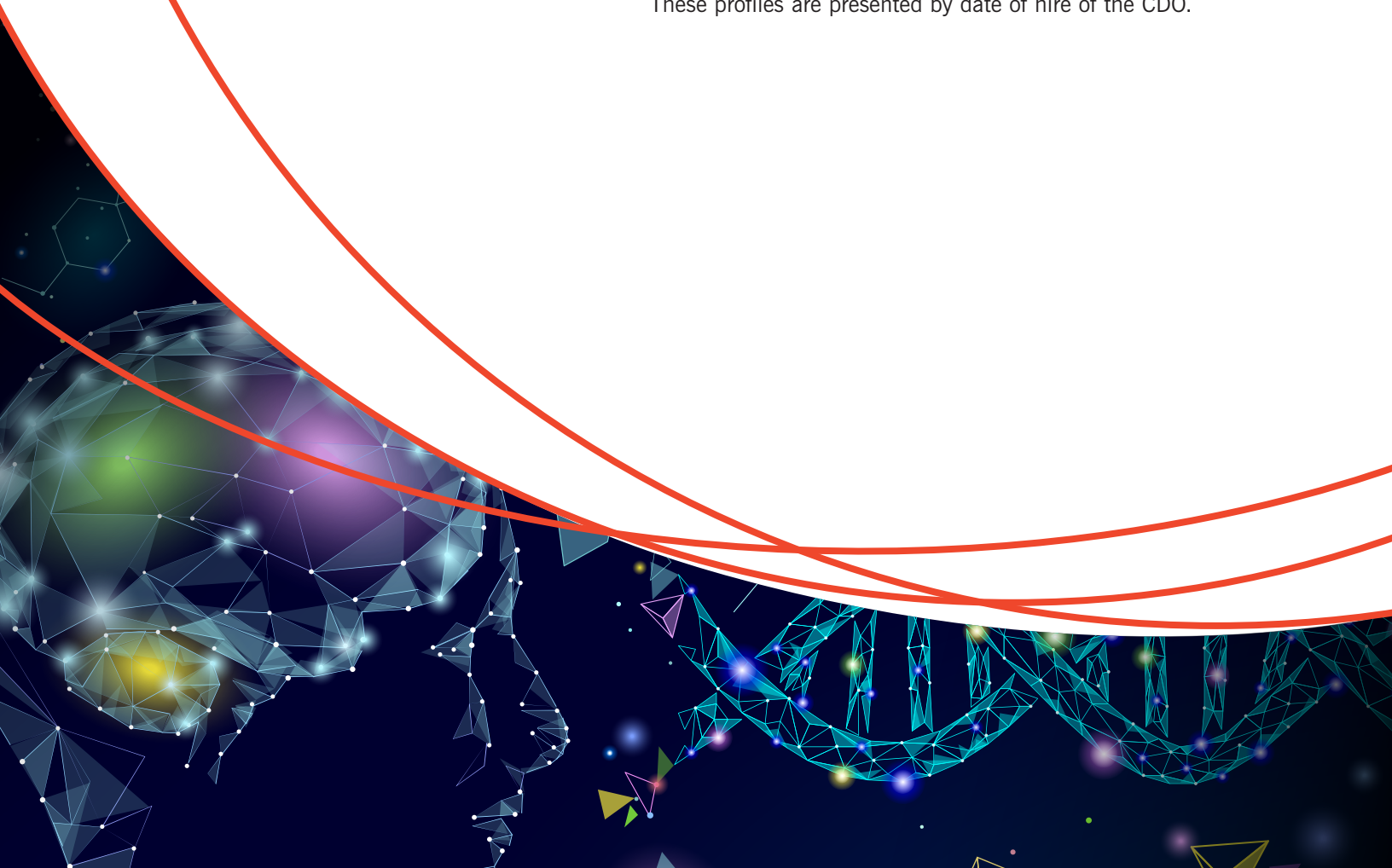
19. U.S. Department of Veterans Affairs, *Department of Veterans Affairs Opioid Prescribing Data,* U.S. Department of Veterans Affairs, accessed August 2018, https://www.data.va.gov/story/department-veterans-affairs-opioid-prescribing-data.

# Profiles Of Pioneering CDOs In The Federal Government

Following are profiles of individual CDOs and their agencies that describe the diverse ways successful CDOs deploy their talents and the varied backgrounds they bring to the task. The profiles describe CDOs in the following agencies:

- **Profile One:** U.S. Agency for International Development (USAID)
- **Profile Two:** Department of Transportation (DOT)
- **Profile Three:** General Services Administration (GSA)
- **Profile Four:** Department of Health and Human Services, Office of Inspector General (HHS OIG)
- **Profile Five:** Federal Aviation Administration (FAA)

These profiles are presented by date of hire of the CDO.



# Profile One: U.S. Agency for International Development CDO Brandon Pustejovsky—An Open Data Leader and Data Culture Change Agent

## Summary

The U.S. Agency for International Development (USAID) is among the leading federal agencies in using data to drive decisions and has embedded a culture of data, performance measurement, and evaluation across the organization. CDO Brandon Pustejovsky has created an enterprise-wide view of data as a strategic asset and has developed the platforms that support an ecosystem of data culture and innovation.

### USAID SNAPSHOT:

The U.S. Agency for International Development (USAID) was created in 1961 and leads international development and humanitarian efforts to save lives, reduce poverty, and strengthen democratic governance. With a budget of $39 billion, USAID works in 100 countries around the globe.

### USAID CDO SNAPSHOT:

- Position created 2014
- Reports to CIO
- Pustejovsky's background is development policy and management; MA in International Relations

### USAID CDO SNAPSHOT:

- Team of 40
- Responsible for enterprise data analytics and reporting, open data, data governance, and data literacy

## The CDO Role at USAID

USAID CDO Brandon Pustejovsky is responsible for enterprise data analytics and reporting, open data, data governance, data literacy, and encouraging public data use and partnerships to generate new insights. He also provides policy guidance and technology support for USAID peers who specialize in geospatial analysis, digital services, and programmatic innovation.

The impetus to create the CDO role at USAID came from the 2013 Executive Order regarding open data, and the requirements of the federal Open Data Policy. As the first CDO at USAID, Pustejovsky was selected from within the agency—which gives him the credibility of someone who has lived the agency's mission. As he said, "I have been on the ground in over 50 countries and been shot at. I've been in refugee camps for extended periods of time. I've slept on the ground with rats pulling at my mosquito net and been woken up the next morning by earthquake aftershocks."

In the early days, the CDO's team was small—just the CDO and one contractor. The team gradually grew and now includes 40 staff people. One factor in the growth of the team was an organizational reporting move—from the agency's Bureau for Management in the Office of Management Policy, Budget, and Performance to the Office of the Chief Information Officer where the position currently reports. Moving into the CIO office meant taking on new responsibilities for data management. Pustejovsky finds that operating under the authority of the CIO has benefits from a legal, IT, and data security perspective. And, he finds that advocating for data management resources across the agency is easier from the CIO office.

## Lessons Learned

**The work of the CDO team is driven by a theory of change.**

Pustejovsky has developed a theory of change for how he will advocate for and advance the culture of using data to drive decisions across all levels of the agency. Pustejovsky said "All four things are necessary to improve data usage across the agency. Any one of these elements, acting alone, is insufficient."

**Table 6: USAID CDO's "Theory of Change" for Advancing Agency-wide Data Culture**

| **Data Culture Concept** | **Availability:** Have the agency's data assets been inventoried and comprehensively listed so that the staff and general public have a sense of what is available to them? | **Accessibility:** Can people actually use the data in an intuitive way to answer key business questions? | **Awareness:** Do people know the full extent of the evidence base that can inform their decisions? | **Capacity:** Do staff have the skills needed to extract meaning from the data? |
|---|---|---|---|---|
| **USAID challenges** | One of the challenges at the start was having an incomplete understanding of what data was available within the agency or to the public. | The challenge here was that if there are barriers to use it means that something isn't available. For the non-data person, it's "not enough to open up the box of zeros and ones." | The challenge is that staff and particularly managers may not be as aware as they could be of the data available that can inform data-smart decisions. | Data is useless unless it can be turned into insight via analysis. If people do not have the basic data literacy skills and self-service analysis skills, then there is a problem unlocking value from data. |
| **Actions to address the challenges** | To address this challenge, one of the first things the CDO did was to create an enterprise-wide open data inventory. Data stewards were recruited in each part of the agency to contribute to the inventory. Then, a strategy was put in place to determine which datasets could or should be shared. | To address accessibility, the CDO has created visualizations and dashboards for the executive or program person who's not an IT person. This took the addition of reporting and dashboarding and customer experience staff. | To address this, the CDO is putting a focus on change management and using social media, interest groups, and partner networks to make sure people know about updates to systems and data resources. | To address this, the CDO is building a core curriculum of data literacy training, with beginner, intermediate, advanced paths that can be customized by individual operating units based on their needs. Fortunately, at USAID, training is not viewed as a punitive measure but rather as a sign that the agency is investing in the person. This existing training culture helps accelerate the adoption of data culture. |

***Source:*** Brandon Pustejovsky interview with the author

**USAID is serious about open data and has worked hard to create an enterprise-wide program that spans the globe.**

USAID views data as a strategic asset and has taken an enterprise-wide approach to improving access to data for both its employees and the public. The data managed by USAID covers a diverse range of topics, from women's empowerment programs in Afghanistan to HIV prevention activities in Zambia, along with all of the typical internal management data on finance, administration, and personnel. The open data philosophy is well-stated in the most recent Open Government Plan:

> "Open data efforts have the capacity to empower citizens, improve public service effectiveness and timeliness, create economic opportunities, and enhance government transparency. For example, in response to a drought in the Horn of Africa, USAID partners were able to reposition food supplies based on maps and visualizations created from open data. M-Farm, an organization in Kenya, created a mobile application using publicly available crop price data to connect farmers with markets and to help them select crop varieties likely to yield the greatest income."[20]

In describing his open data philosophy, CDO Pustejovsky says, "With data dispersed across 80 missions around the world, the first directive I was given was to create an inventory of this data as quickly as possible and to create a framework for determining which data assets could be shared with the public. We work from the assumption that there is a customer out there somewhere for every piece of data, and that the data's too valuable to be locked in the vaults of the agency. The taxpayer paid for this data, and we owe it to them to make it available, as long as doing so does not jeopardize national security, USAID operations, or personal privacy."

USAID's open data policy reflects the agency's commitment to open access and transparency while balancing the responsibility to protect the vulnerable populations it serves. The policy articulates a data clearance process that guides the agency's review of individual datasets and its actions to mitigate risks of public release. Teams go through the data, scrub it to remove sensitive material, and then publish it. The rigorous clearance process includes review by privacy, operations, legal, and data experts. The open data program also addresses data resources for developers. USAID has created the self-service platform www.usaid.gov/developer to connect citizen developers with the tools they need to unlock USAID data, using automated techniques.

**Data governance is challenging in a distributed environment, and with so many contributors, but USAID has excelled at creating standards and supporting distributed implementation.**

Data governance is clearly spelled out in the USAID Open Data Policy. An Information Governance Committee meets regularly to set priorities and provide feedback on data management activities across the enterprise. This group oversees data policy implementation and establishes best practices for data management as well as the proper protection of USAID's data assets and resources.

**Integrating data across various sources is a high priority for USAID, to provide internal insight and to drive operational improvements.**

Data management efforts include attempts to integrate various types of data to make sense of financial, procurement, program, operations, and human resource functions—to gain insight across silos of operations. There is an internal enterprise reporting portal that staff can use to create queries from the available data sources. The goal is to integrate data that have been stored according to various standards and formats which have evolved organically over time, based on the needs of individual agencies but not the enterprise. Pustejovsky said:

> "The challenge now is finding a way to relate these data assets to each other, to yield a more comprehensive view of taxpayer investments, even if the underlying data structures are different. You can't simply assume that the term "district" in one dataset means the same thing as it does in another dataset, for example. This is a monumentally complex task but one that's absolutely worth addressing."

20. U.S. Agency for International Development, *Open Government Plan v 4.0,* U.S. Agency for International Development, September 2016, https://www.usaid.gov/sites/default/files/documents/1868/USAID_OpenGovPlan2016.pdf.

**Data stewards across the organization are well-supported by resources from the CDO team, forging a data culture that spans the globe.**

The data governance structure establishes "data stewards" in every USAID operating unit, including missions in locations around the globe. Data stewards provide guidance on policy, help mainstream best practices, and help clear datasets for public release. One of the keys to success in advancing data culture is the compendium of references for data stewards to draw upon as they lead data-driven efforts within their operating units. These include best practices on data protection, codebooks and data dictionaries, data management plans, and standard operating procedures. A significant investment in training is also helping to accelerate this movement.

Like many government entities, USAID initially selected data stewards who were staff members from a variety of backgrounds. Sometimes, the data steward role fell into "other duties as assigned" and didn't get much attention. Pustejovsky wants data stewards to be leaders within their environment who care about data quality, timeliness, and public value. His vision is that data management is not seen as a clerical task, but that data science is embraced as a promising path for career growth, driven by data stewards with a passion for evidence-based analysis and a commitment to participate in ongoing trainings to refine skills.

**All contractors and grantees are required to submit data to a public data repository, the Data Development Library (DDL), which facilitates scholarly sharing and reuse of data.**

As part of its open data efforts, all contracts, grants, and cooperative agreements stipulate that recipients of USAID funding must submit data on their work to the agency's central, public-facing repository, known as the Development Data Library (DDL). This open data platform and digital repository streamlines the process by which USAID partners submit data to the agency and conforms to current best practice data management protocols used by the academic and data science communities for greater extensibility and reuse of data. To facilitate adoption of the new data platform and reporting requirements, USAID engaged with more than 180 organizations, seeking feedback to improve ease of use. This outreach has facilitated adoption.

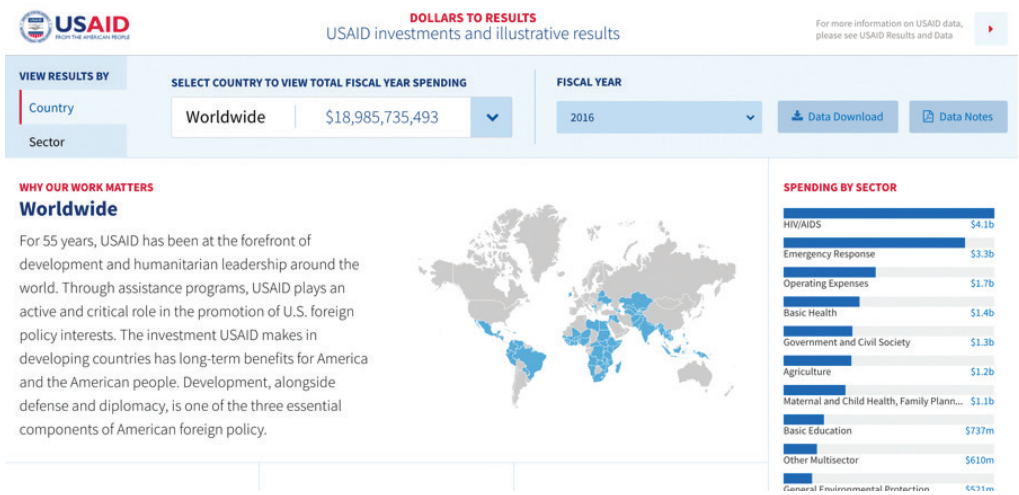
**To help the public understand how USAID spends its funding, the Dollars to Results (D2R) portal shows investments and results around the globe.**

As part of its transparency and open data efforts, USAID created the D2R website[21] (Figure 2) that pulls data directly from the USAID financial and progress reporting system to populate visual snapshots of USAID's work around the world. D2R displays results with reader-friendly explanations by country or by sector, such as HIV, agriculture, basic health, general government, and more. Users can create their own queries and can download resulting data in a machine-readable format. As shown in Figure 2, the site is very intuitive and visual.

21. U.S. Agency for International Development, *Dollars to Results,* U.S. Agency for International Development, accessed August 2018, https://results.usaid.gov/results.

D2R is an excellent step forward in transparency. The next step will be for it to connect expenditure data to performance reporting and evaluation data, so that not only can the public see what was spent but also whether the results were delivered according to plan and with the anticipated dosage and effectiveness.

**Figure 2: USAID Dollars to Results**

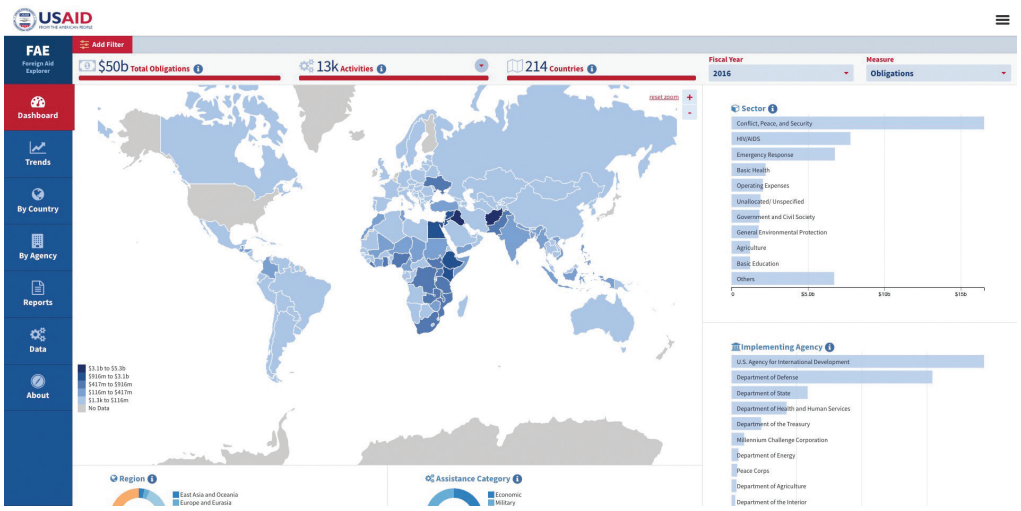



***Source:*** USAID, *Dollars to Results,* USAID, accessed August 2018, https://results.usaid.gov/results

**The Foreign Aid Explorer combines USAID and other federal sources into a single user-friendly snapshot of foreign aid for or any given country or region.**

The Foreign Aid Explorer (Figure 3) is a web-based central source for U.S. foreign assistance data across the various federal agencies involved in each country. The data on U.S. investments is combined with international socioeconomic data, for context. Dashboards show an integrated picture by country for all U.S. investments regardless of the agency. This view required working across government silos to incorporate not only USAID data but also data from the Department of Defense, the Department of the Treasury, the Department of Health and Human Services and the Department of State. It includes all funded activities, such as research, training, and technical assistance. Activities are shown by type, such as peace and conflict work, HIV/AIDS interventions, and environmental efforts. Drill-downs allow the user to dig into the details. The site also allows user-defined queries and allows download of the results in multiple formats for ease of use.

**Figure 3: USAID Foreign Aid Explorer**




***Source:*** USAID, *Foreign Aid Explorer,* USAID, accessed August 2018, https://explorer.usaid.gov/.

## ADVICE TO A NEW CDO

With a tenure longer than most government CDOs, and with a lot of successes to his name, Brandon Pustejovsky has some good advice for anyone new to a government CDO role.

Regarding the importance of listening to customers outside of the CDO organization who have specific business needs that can be addressed, Pustejovsky says:

> "Never forget the mission of your agency, and be a good listener. If, at any point, you silo yourself in the technology shop and forget the people you are there to serve, you won't be effective. A new CDO should expend significant energy reaching out to learn about the business of the organization. We simply cannot succeed without listening to the needs of our partners."

Reflecting on the balancing act between being in a technology role but being effective only when closely trusted by the operational parts of the organization, Pustejovsky offers the following advice:

> "Be frank and transparent about what you know and what you don't know. You need to be very-well versed in the IT and the business, but an expert in neither, so there is a certain amount of ignorance you need to be comfortable admitting to. Once you admit you're not an expert in everything, then surround yourself with good people because, if you're not an expert, you need someone who understands your vision and can advise you in areas where you're not an expert."

## Profile Two: Department of Transportation CDO Dan Morgan—A Data Innovation Catalyst

### DOT SNAPSHOT:

The Department of Transportation (DOT) was created in 1966 to ensure our nation has the safest, most efficient, and modern transportation system in the world, to improve quality of life, and increase American productivity and competitiveness. DOT has a budget of $76 billion and 56,000 employees.

### DOT CDO SNAPSHOT:

- Position created 2014
- Reports to Chief Technology Officer
- Morgan's background is logistics/supply chain and management consulting; Mechanical Engineering degree

### CDO TEAM AT A GLANCE:

- Team of three
- Responsible for open data, data governance, self-service data infrastructure

### Summary

The Department of Transportation (DOT) was the first cabinet department to recognize the need for a full-time data leader and to appoint a CDO. In 2014, Dan Morgan was selected for this role and remained the sole cabinet-level data leader until recently. Leading a small team and serving a large and geographically distributed department, Morgan works as a strategic collaborator and a catalyst for cross-governmental efforts. He is a pioneer among federal CDOs in working across levels of government, and is currently engaged in innovative partnerships with state and local transportation and data leaders.

### The CDO Role at DOT

In 2013, the CIO of DOT found he was fielding many more data requests than ever before, both from inside and outside the agency. Each request required a different set of players, and sometimes data requests couldn't be answered quickly or accurately. Frustrated that there wasn't anyone in the department whose full-time job was data, he decided to create the role of a CDO. In choosing to create the role, the CIO also decided that it should be a career job—that was a way to signal that the department was making an investment in data as an agency. The mandate for the CDO at DOT is open data, data governance, and self-service data infrastructure. What began as a one-person team is now a team of three.

The selected CDO, Dan Morgan, was familiar with data in the federal government from his time as a consultant, but came in as an outsider. His experience prior to the role was in supply chain and logistics consulting. Morgan said that makes a good fit, since a lot of DOT work is about logistics. He describes coming into the role as a unique challenge, saying that working in a newly-created position in a big bureaucratic institution was both "fun and painful."

### Lessons Learned

**Morgan's first goal was straightforward: to improve data quality and utility.**

After being appointed, Morgan went on a listening tour so that he could understand the key issues his colleagues around the department were facing. Based on the needs he heard, he developed a plan to accomplish three key objectives:

- **Improve data governance:** He tried to get the right people around the table to set policies that improve data quality, availability, and usability.
- **Accelerate open data:** He facilitated engagement with users and the public for the increased release of data on key operational and transactional activities at DOT.
- **Enable technology:** He aimed to "build the right tools to get stuff done," allowing employees to better leverage data for self-service analytics.

Morgan said his first goal was to advance the quality and utility of data for both DOT employees and the public. With a small team, he knew he had to work across the silos of the organization to "build relationships to get results for the department."

**Without other federal cabinet-level CDOs to turn to, Morgan found ideas in academic and private sector models.**

Knowing he was a pioneer, Morgan started his job with a curiosity and a quest for outside expertise. He talked to federal data leaders such as Donna Roy, who was then leading a data standardization project for the National Information Exchange Model (NIEM), as well as state and local data leaders and innovators. He also found mentors in academics and data management scholars. He was particularly inspired by the work of thought leaders at the Sloan School of Management at MIT, developers of the cubic framework for the CDO, based on observations of public and private sector CDOs and how their roles evolve to suit changing needs of their organizations.[22]

**With a small team, Morgan had to be a collaborator and had to develop innovative staffing strategies.**

Morgan was challenged to fill the federal roles on this team, and had to be creative in finding talent. He took advantage of alternative hiring paths, like the Oak Ridge fellowship program which places a PhD graduate in a federal agency for a one-year post-doctorate fellowship. He also leveraged outside contract staff and relied on data staff from other parts of the department via a shared services model. Of this necessity to be creative, Morgan said "There's a benefit to growing up poor. You have to learn to collaborate and work in the white space of the organizational chart." His team is small, lean, and effective, and his ideal future state is about five to seven federal full-time employees, supplemented by loaned fellows. His vision is to have a team that is truly consultative and egalitarian, using the soft skills of his management consulting trade to build effective partnerships of trust.

**DOT has been a leader in open data by providing easy-to-use platforms for self-service.**

DOT collects vast amounts of data from state and local government on the condition of their roads, vehicle crashes, how many cars are traveling on them annually, transit usage, rail-related injuries and deaths, worker fatalities on the railroad, flight safety, and more.

Morgan and his team have created an open data portal that provides the public and researchers access to large volumes of data and the ability to integrate across datasets. As Morgan points out, the most interesting answers in transportation are integrative. As a result, he wants users to be able to look across DOT for answers to transportation challenges.

His vision is to have a truly integrated dataset across the department or, as he says, data that can "cross the white space of the org chart." He wants to make it easy for DOT staff, the public, and researchers to share and do integrative work, "horizontally, vertically, and diagonally," and realizes this is a culture change for many in government who are used to operating in their own silos.

**The National Transit Map was an early win for the DOT CDO team, demonstrating the power of focused attention by a small team and the value of asking for data.**

The National Transit Map was created because the senior leadership at DOT got tired of being

22. Yang Lee et al., *A Cubic Framework for the Chief Data Officer: Succeeding in a World of Big Data,* Massachusetts Institute of Technology, March 2014, http://web.mit.edu/smadnick/www/wp/2014-01.pdf.

asked why Google provides transit data that DOT doesn't have. The CDO's simple answer was, "because we haven't tried yet." Once they tried, it was a matter of six months before every transit agency in the country had been asked, and data was collected from agencies that cover 50 percent of the service volume of the country.

Within a year, the map was pulling together standardized local data from across the country—the map was launched and has received accolades ever since. The map is a geospatial database that can display transit agencies' stops, routes, and schedules. It supports both public transit user decisions and the research, analysis, and planning needs of academics and public officials. The initial launch in 2016 included data from 270 transit agencies, providing information on more than 398,000 stops and stations and almost 10,000 routes. The map's development is an ongoing process that continues to add agencies and routes.

Morgan has a vision for how the National Transit Map can become something even bigger. He noted that there is point-in-time data from transit agencies and DOT, but there is no longitudinal dataset that shows how transit changes over time. He hopes to be able to build this longitudinal dataset as the Transit Map dataset grows over time. This dataset will enable a whole new body of research on transit. Morgan hopes this can help build the body of knowledge about whom is served by transit and where there are gaps.

**Aiming to reduce highway fatalities, DOT's Safety Data Initiative will crowdsource real-time data input.**

Morgan has led a public-private data sharing project that aims to help predict and prevent highway crashes by examining speed and roadway characteristics. With traffic fatalities increasing in recent years, DOT is turning to big data for insight. A partnership with Waze has allowed DOT to accumulate a terabyte of data that is updated hourly with vehicle crashes on national highways across the U.S. Leveraging additional external data sources will allow DOT to review prevailing speeds from anonymized data. This will help DOT identify where there are design changes that can be made in roads to reduce the likelihood of crashes by reducing average speeds at the most dangerous locations. Connecting to external data sources such as these will help DOT examine if user-reported hazards can help predict, and in the future prevent, crashes.

**The Smart Cities Challenge engaged mid-sized cities in a collaborative innovation effort with DOT and generated significant energy around applying Internet of Things and smart data technologies to urban transportation challenges.**

In December 2015, Morgan worked with others at DOT to seek new ideas via a competition with a $40 million prize, the Smart City Challenge. Countless cities engaged and 78 submitted applications to use new technologies like sensors and self-driving cars to solve problems such as traffic congestion, moving people and goods more efficiently, and connecting urban dwellers to jobs, education, and other opportunities. DOT chose seven finalists and worked collaboratively with them on their ideas about a wide range of topics, such as streamlining how people pay for transit, improving bicyclist and pedestrian safety, and coordinating data collection and analysis across city systems—all leveraging new smart technologies such as sensors, cameras, and vehicle-to-infrastructure communication.

Columbus, the winning city, has ambitious plans to connect low-income residents to opportunity by addressing public transportation's "first and last mile gap" with electric self-driving vehicles. Other plans include a "smart corridor" where vehicles and buses can share real-time data that makes the movement of private vehicles and public transit all more efficient. The vision also includes better routing and parking optimization via smartphone apps. Insights and lessons on how data can drive more efficient transportation from the innovations in this city will be shared nationally by the DOT CDO and his team.

**Creating the National Address Database shows how DOT has learned to lead cross-departmental collaboration efforts.**

One project that shows how the DOT CDO team leverages partnerships across the federal government is the effort to create a National Address Database. While many federal agencies collect address data, they all do so using their own methods and formats. In some cases, there are statutory restrictions against sharing data. For example, the USPS is unable to share personal addresses and the Census Bureau can't share its address database.

For other federal agencies without statutory prohibition, only inertia and status quo processes stood in the way of a standard national address database. Leveraging Next Generation 911 as the incentive to get a National Address Database completed across federal agencies, the DOT team facilitated a larger discussion among federal partners.

Addresses are typically created locally by a city, town, or a county. They each use their own standards when setting up addresses and parcel identifications, and not all addresses are geotagged when created locally. A pilot effort now compiles address data from 22 states following a standard schema. This publicly-available data schema can become a truly national standard if it achieves enough adoption and can make more efficient use of resources to keep federal agencies from duplicating efforts on collecting, creating, or purchasing address data.

## ADVICE TO A NEW CDO

As the first cabinet-level CDO and one of the data leaders with the longest tenure in federal government, Dan Morgan has plenty of good advice to offer a new CDO.

- **Solve real problems.** Morgan advises a new CDO to listen for the most vexing business problems of the agency. In his case, it was his work on the transit map that was most transformational in making colleagues feel successful, and in turn having them recognize the power of data. As he went on his initial listening tour, he heard repeated over and over from different parts of the organization that they needed a single consolidated, real-time transit map. And yet, nobody could figure out the legal, regulatory and technology limitations. So, he set about fixing that so that he could solve this concrete and high-priority problem for his agency. He said "I was the glue for the team," which included staff from all across the department and worked over the course of a year to create an entirely new and widely useful data product. The consistent attention to the problem paid off when the transit map was released.
- **It's not about data; it's about people.** Morgan says he's "continually surprised by the human element of the job. It's really easy to get focused in on data or technology problems, but you're really solving a human problem—an organizational problem." He encourages CDOs to stay focused on the ways their work will help make others' jobs easier. He encourages CDOs to be intentional in their interactions with peers and collaborators, and to learn the art of "appreciative inquiry" and listening with empathy. By understanding the motivations and concerns behind the business processes and data, he suggests that projects will be more successful in meeting the true needs of users.
- **Don't get overwhelmed; just stay focused on keeping data as your full-time job.** Morgan admits that the pace of innovation and new idea generation at DOT can create a feeling that he is constantly moving from initiative to initiative. He finds that staying true to the mission of being a full-time data person helps. He said "You have to be somebody whose full-time job is data. Period. The rest of it will come. Sometimes, I feel like I'm ping-ponging forward, but it's forward and that's enough."

## Profile Three: General Services Administration CDO Kris Rowley—An Enabler of Enterprise-Wide Analytics

### GSA SNAPSHOT:

GSA was established in 1949 to consolidate administrative functions across the federal Government to avoid duplication, reduce cost, streamline the acquisition and distribution of supplies, and centralize the management of Federal buildings. With 2017 revenues of $21.7 billion, GSA has 11,000 employees in 11 regional offices across the country.

### GSA CDO SNAPSHOT:

- Position created 2015
- Reports to Chief Information Officer
- Rowley's background is finance, policy, and management; MA in Public Administration

### CDO TEAM AT A GLANCE:

- Team of 10
- Responsible for open data, data governance, self-service data infrastructure, and data literacy

### Summary

The General Services Administration (GSA) was among the first agencies to appoint a CDO. Kris Rowley was named CDO in 2015 and is now among the longest-tenured CDOs in government. His steady leadership has contributed to a growing data culture at GSA, where he is creating capacity for self-service data analytics by establishing common central platforms and then training staff to use them. The government-wide Data to Decisions (D2D) platform allows both GSA staff and other federal data teams to create and share dashboards and reports with standardized tools using a growing number of common databases. A newly created Data Science Virtual Desktop is being deployed for GSA staff as a cloud-based self-service data analytics platform.

### The CDO Role at GSA

GSA CDO Kris Rowley reports to the agency Chief Information Officer. Rowley is responsible for data governance, for creating the platforms that GSA staff use for data analytics and presentation of results, and for training staff on how to use the self-service platforms. As CDO, Rowley is responsible for the GSA strategic vision for data, as well as operational management, oversight, standards, and support for all GSA Enterprise Data Warehouse (EDW) activities, data marts, and business intelligence reporting. He oversees the creation and release of GSA data assets and establishes the clearance processes for data released to the public.

Rather than coming to the job as a life-long technologist, Rowley has a background in budget, finance, performance management, and IT project management. This gives him a deep appreciation for the value to the organization of having the IT and data infrastructure necessary to execute on mission. His team includes 10 full-time employees who are divided into two groups: one that supports legacy data tools and another that supports the new data platforms and related trainings.

The CDO role at GSA is a high-profile position, linked to supporting the data scientists called out in the most recent agency-wide strategic plan:

> "Our success relies on bringing together a talented and diverse workforce—including data scientists, real estate experts, architects, acquisition specialists, technologists, and policy analysts—to build a cohesive, customer-focused team." (GSA Strategic Plan 2018-2022, emphasis added).[23]

23. U.S. General Services Administration, *GSA Strategic Plan: Fiscal Years 2018–2022,* U.S. General Services Administration https://www.gsa.gov/cdnstatic/GSA%20FY%202018-2022%20Strategic%20Plan%20-%20FINAL.pdf.

## Lessons Learned

**The early days for the CDO at GSA were focused on IT consolidation.**

When Rowley was named CDO in 2015, he was among the earliest CDOs in government. His early tenure as CDO was focused on IT and managing IT spending, especially looking for ways to consolidate the many disparate legacy data systems to create more centralized capacity. In hindsight, Rowley thinks he too-aggressively tackled the central technology effort and wishes he had instead led with data governance. He thinks this approach "hindered my ability to think about data governance very early and think about education on data quality early." He believes he could have gotten more executive buy-in if he'd instead focused on data quality and on use cases for applications that solved high-priority business problems for the key executive stakeholders, working within existing business processes so that he wasn't proposing too much change too quickly.

**Early on, a community of practice around data gained momentum under the CDO's leadership.**

After his appointment, Rowley noticed that, one by one, data practitioners began reaching out to him. Until then, they'd had no leader to organize their community, and yet throughout the agency there were staff who were coders or understood and used data visualization tools, or were using Google Sheets to organize and present data for decision-makers. And as Rowley says, "people started to come out of the woodwork and contact me."

One of his early successes was to harness this enthusiasm by bringing people together to share ideas. To reach beyond the self-selected group, he did a lot of proactive outreach around GSA, and that brought additional people into the growing community of practice. Now, years into his tenure, this community of practice is increasingly formalized. It has an online platform as well as in-person opportunities such as periodic information-sharing meetings, training sessions for skill building, and peer exchange "GSA Tech Talks."

**The early identification of the need for data quality at the source was an inspiration for later data governance work.**

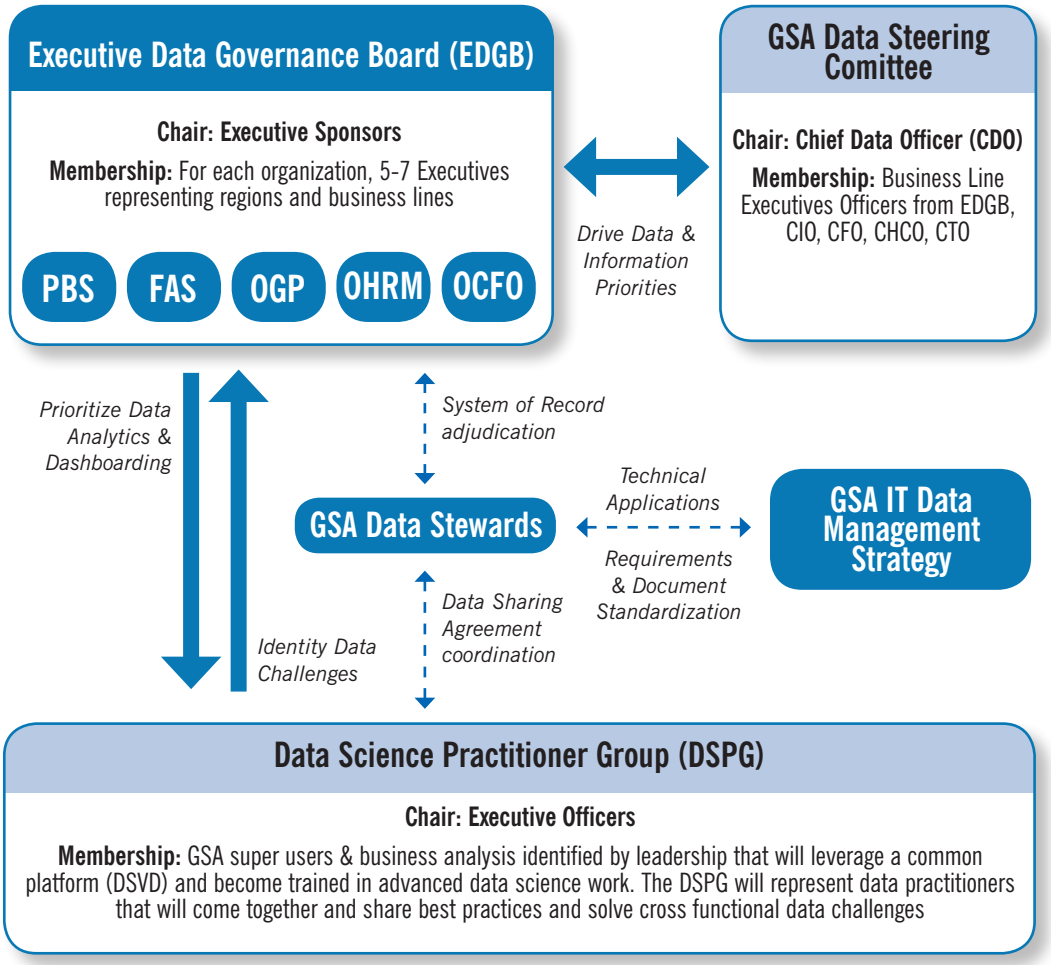
One thing that concerned Rowley was that data practitioners were often working from independent data sources that could produce different answers to the same queries. The reason could be innocuous enough—the source systems were built 10 to 15 years ago when current uses and visualizations of the data could not be anticipated. He also noticed people trying to fix data errors in their results, rather than in the source systems. This presented a structural problem for him. As he said, "I don't want them manually cleaning up data for particular presentations. It's so easy for people to say, "I'm going to change a number for my presentation." I keep telling them changes have to be made in the source system, otherwise you'll never stop cleaning up data manually."

As a result, he decided to standardize some of the source systems that data analysts were using, and to build in quality at the source. Standardizing the data input at the source and the governance of that data has additional benefits beyond data quality—it improves security and privacy controls when the central IT team can orchestrate one set of standards and business rules, rather than myriad independent standards.

**The GSA needed a detailed data governance structure.**

In the drive for greater data accuracy and consistency across the agency, Rowley created a data governance structure that is far more detailed and sophisticated than in most government entities with a CDO. Figure 4 shows the structure:

**Figure 4: GSA Data Governance Structure**




***Source:*** GSA

Governance includes a **steering committee** to set strategy and priorities, a **working group** for ongoing operational and tactical guidance and problem solving, and a **data community** comprised of **data stewards** and **data practitioners** in the operating divisions. A data steward is an organization's staff person who is designated to coordinate with others in GSA on data standards, and is responsible for data consistency and promotion of data education in their operating unit. In addition, there is a Data Science Practitioner Group for peer exchange, open to anyone in GSA working on data analytics and visualization projects.

Data governance is also being advanced via common templates for data sharing agreements among and between GSA divisions, as well as across lines to other federal partners. The data sharing agreements will document the minimum requirements that need to be addressed in a data sharing agreement, allowing data stewards to confidently share data with appropriate controls in place.

**The self-service philosophy for analytics is scalable across the vast GSA workforce and geography.**

Instead of providing analytics services to GSA staff, the CDO team enables them with the tools and training to do their own analytics in a fully decentralized self-service model. This approach is far more scalable than if his team served as data consultants working on individual projects

for all GSA operating units. Rowley is committed to a self-service culture where he provides the platform, training, and tools to the business units and they are empowered to solve their own problems in near-real time, rather than waiting for support from a central IT shop. He said "We have seen an uptick in the requests going from "build me something that does this" to "give me access to the data and to the tools so I can build something myself."

Greater self-service in the GSA operating units means that staff can perform more of the data and analytics work and rely less on outside vendors contracted to maintain and report on the legacy systems they have built. This can both drive down cost and increase enterprise-wide consistency and security of data work. Self-service tools also accelerate the degree to which the culture of data-driven decision making is bottom-up as well as top-down.

**Data culture and training are enabling a growing community of practice.**

Unlike many government agencies, GSA offers a wide range of training opportunities to staff seeking to build skills in data use, data analytics, and data visualization and presentation. In FY16, GSA trained 300 employees—and another 250 in FY17. In addition to the software training, GSA launched a new Data Science Practitioner Training Program in FY18, designed to enhance selected data practitioners' skills through 13 advanced courses. Courses include:

- **Programming and data modeling:** beginner, intermediate, and advanced data science, data engineering, data modeling and data visualization using a common set of tools
- **Analytics and reporting:** beginner, intermediate and advanced training on analytics and data visualizations
- Content and portal management: content management classes address creating and sharing content on the D2D portal, including adding and editing data, dashboards and data models
- **Storytelling and briefing:** how to take a final data product and present it in a way that is consumable by leaders, managers and decision-makers who may not have data expertise—the GSA Chief Customer Officer helps support this training content

Courses are open to any interested GSA staff, and training materials are available on the GitHub site.[24]

**The Data to Decisions platform provides quick access to a variety of data sources and data dashboards and visualizations, accelerating the development of a data community of practice.**

GSA faced a challenge—with manager demands for faster and more accurate information, data analysts are being asked to provide near real-time answers to important business questions. This requires the analysts to access and analyze data quickly. The solution for that challenge is Data to Decisions,[25] a self-service analytics platform that GSA staff can use to create and share dashboards for both internal decision making and external agency information sharing. This platform provides a central site for agency-wide data storage as well as the dissemination and discussion of data insights—a digital commons for the agency. Every office within GSA has become active to one degree or another on this platform, and access can be granted to other federal employees as well.

One of the goals of D2D is to increase public access to consistent, high-quality data. Part of

24. U.S. General Services Administration, *training-pathway-data-practitioner,* GitHub, accessed August 2018, https://github.com/GSA/training-pathway-data-practitioner.
25. U.S. General Services Administration, *Data to Decisions,* U.S. General Services Administration, accessed August 2018, http://www.D2D.GSA.Gov.

the effort includes trying to identify all enterprise data and make it available and accessible to all users. CDO Rowley said "Our goal is to not only improve GSA with data, but to share that information and open the data so that it's not just benefiting us—it's also informing our agency partners and the public."

One of the most common products resulting from an analytics inquiry is a new dashboard for a manager to view real-time updates or comparisons of various benchmarks. These concrete management tools can then be shared with others on D2D. D2D has grown to the point that there are now 160 dashboards shared across all of GSA and 5,000 people in other agencies. As a centrally-managed repository and toolset, D2D abides by the security and privacy standards set by the CIO and CDO of the agency, providing greater consistency than if each individual business unit established its own standards.

**The Data Science Virtual Desktop (DSVD) will serve as a secure, cloud-based data analytics work space and peer sharing community for GSA staff.**

To create a secure and closed digital community solely for GSA staff with more sophisticated developer tools, the D2D has a new enhancement called the DSVD. This cloud-based platform will be a private workspace with role-based access granted via data stewards designated by senior leadership in each GSA office, with the possibility of creating a wide community of practice bounded only by self-selection and interest.

The DSVD will allow GSA staff to virtually access a wide variety of data and tools via secure sign-on without needing physical access to data files, software, or hardware. The privacy and security settings for the platform will provide enhanced data protections as they are standardized rather than ad hoc by office. Beginning with easier-to-digitize content such as numerical and financial transactional data, later content additions will include building blueprints or lease documents—not just the cost per square foot or other easily quantifiable metrics.

## ADVICE TO A NEW CDO

As one of the longest-tenured CDOs in federal government, Rowley is frequently asked for his advice to others. In addition to the early focus on data governance and training mentioned earlier, he has the following suggestions for a new CDO in federal government:

- **Prioritize the business needs of your customers.** Rowley feels he can't be successful unless he understands the priorities for business users in the agency. He spends three to four hours a year with each senior executive across the agency to provide a briefing on the state of data in GSA, and then elicit their priorities and issues that most need attention and data resources. He recommends having an executive champion in the front office of a bureau, since that's what drives adoption.
- **Find the super users and connect with them regularly.** Right from the start of his tenure, Rowley began gathering data professionals from across GSA. He advises other CDOs to do the same, and to learn what they're doing and how you, as CDO, can make it better.
- **Don't let the perfect be the enemy of the good.** Rowley encourages analysts to use best available data whenever possible—he advocates for using data that's "good enough" rather than shying away and rejecting data-driven government by hiding behind criticism of data quality. He said "As long as there's 80-85 percent accuracy, the data is worth presenting and using to drive the discussion toward greater efficiency, maybe even better data quality."
- **Spend a lot of time listening.** Rowley advises spending time not in large group meetings, but in one-on-one meetings that allow airing of various levels of concerns and issues.

## Profile Four: Health and Human Services, Office of Inspector General (HHS OIG) CDO Caryl Brzymialkiewicz—A Focus on the Customer and Delivering Value

### Summary

The first CDO for the HHS OIG, Caryl Brzymialkiewicz, has taken a customer-centric approach to her role and said her team is "only successful by supporting and teaming with our component partners." She and her team are creating internal tools to increase data access across the enterprise and working to present results in ways that are easy for the customer to understand. As the leader of strategic planning efforts, and as a peer to those running inspections, audits, and evaluations, she is well-positioned to know agency priorities and can align her analytics resources in support of the highest priorities. Her work generates $5 in value for every $1 of cost.[26]

### HHS OIG SNAPSHOT:

Established in 1976, the mission of the HHS OIG is to fight waste, fraud, and abuse in Medicare, Medicaid and 100 other HHS programs. HHS OIG oversees nearly $1 trillion in HHS expenditures, with approximately 1,600 employees.

### HHS OIG CDO SNAPSHOT:

- Position created 2015
- Position holds the rank of Assistant Inspector General, on peer status with the agency CIO and CFO, and Assistant Inspectors General for investigations, evaluations, and audits
- CDO Brzymialkiewicz's background includes public sector data and policy positions; educational background: PhD and BA in Engineering

### CDO TEAM AT A GLANCE:

- Team of 24 leverages fellowship and other creative hiring strategies
- Responsible for strategic planning, data governance, platform operations, and data analytics

### The CDO Role at HHS OIG

The CDO role at HHS OIG holds the rank of Assistant Inspector General and is on peer status with the agency Chief Information Officer and Chief Financial Officer, as well as the Assistant Inspectors General leading the agency's investigations, evaluations, and audits. This strategic decision to create the position grants a level of authority and seniority that many other government CDOs do not have. As a peer, this CDO can work as a "servant leader and partner" with business lines within the HHS OIG organization.

The selection of Brzymialkiewicz as CDO was also significant. Her background includes many years in research, data, and analytics in risk and threat prevention roles. She holds a PhD in Biomedical Engineering and said "I was a data scientist before the term existed." Unlike CDOs who come from a strictly technical or more performance and policy background, her engineering and data analytics experience makes her a strong leader for executing projects—she understands both analytics tools and how the pieces of a business process fit together.

### Lessons Learned

**Like other CDOs, the HHS OIG CDO has a diverse portfolio of responsibilities.**

This CDO's scope includes analytics as well as data governance and data quality improvement efforts. As a partner to the CDO, the CIO is responsible for data infrastructure, information security, and providing the tools necessary for the CDO's work. The CIO and CDO work closely to coordinate efforts and meet bi-weekly to stay aligned on major projects.

26. Frank Konkel, "Better Data Just Saved Taxpayers $900 Million in Medicare Fraud," *NextGov,* Government Executive Media Group, June 23, 2016, https://www.nextgov.com/analytics-data/2016/06/better-data-just-saved-taxpayers-900-million-medicare-fraud/129357/.

More broadly across HHS, the data landscape is growing, with an existing CDO position at the HHS Centers for Medicare and Medicaid Services (CMS) and the appointment of a CDO for HHS. The Chief Technology Officer for HHS leads several data and innovation activities, such as the Data Science CoLab training program, a new international Data Analyst exchange program with the UK, and the annual public event Health Datapalooza.

**In addition to the typical CDO scope of responsibilities, a key difference is the HHS OIG CDO role in strategic planning.**

The HHS OIG CDO is charged with facilitating the agency's strategic planning efforts, a charge which provides significant insight into enterprise-wide priorities and enables the strategic planning process to be data-driven. Placing the strategic planning function in the data office helps embed data thinking in the enterprise-wide priorities and helps keep the CDO office closely tied to senior leadership across the enterprise. As shown in Table 7, the CDO organization includes 24 full-time equivalent employees who are divided among three teams.

**Table 7: HHS Office of Inspector General CDO Organization and Team**

| Advanced Analytics | Strategic Performance and Organizational Management | Data Operations |
|---|---|---|
| • Performs work on behalf of investigators and auditors throughout HHS OIG<br>• Conducts trend analysis, outlier identification, peer comparisons, social network analysis, risk profiling, data mining, geospatial analysis, and predictive modeling<br>• Staff have mathematical, engineering, and policy backgrounds<br>• Works with HHS OIG auditors, evaluators and investigators in a collaborative back and forth to identify the types of analysis to run and how to structure their data queries | • Supports the HHS OIG strategic planning and performance management efforts<br>• Strategic priority setting drives OIG and CDO activity—for example, one high-priority goal now is tackling the opioid crisis<br>• Tracks performance data and progress toward established milestones and the publication of results | • Responsible for data governance and data use agreements<br>• Formed in 2016, works to improve the quality and availability of data across HHS OIG and helps HHS OIG offices when they need to enter data-sharing agreements with any federal partner outside of HHS |

***Source:*** Caryl Brzymialkiewicz interview with the author.

**The CDO looked to innovative pathways for growing the team.**

The team has grown each year since it was created, largely based on the strength of the work's returns to taxpayers. The analytics group has tripled in size since 2015, when the group referred to themselves as "a garage band" for the way they tried to do so many different tasks for so many parts of the organization, excelling in effort and improvisation more than process and structure. To grow the team, Brzymialkiewicz leverages flexible and innovative staffing strategies like the Presidential Management Fellow program and the Pathways intern-

ship program. She likes the fresh thinking that comes from outsiders rotating in on the fellowship program—one fellow brought deep change management experience from a prior role at Home Depot. She thinks the federal government should do more to reach out to campuses and recruit students, and should be more deliberate in efforts to hire digital natives.

**Creating an organization-wide community of practice is accelerating the adoption of data culture.**

The CDO's team are the core data scientists who serve the agency, but there are many other HHS OIG staff members with data skills who work as supportive partners. There is currently an informal network of 100 staff members who use the data warehouse, and Brzymialkiewicz is hoping to create a formal community of practice to support peer exchange, skill development, and data culture across the enterprise.

**Early efforts built credibility by being customer-focused, patient, and strategic.**

Brzymialkiewicz has been successful in part because of how she got started—her motto was "start small and show impact no matter what." At the time of her appointment, HHS OIG was undergoing a significant IT infrastructure upgrade. She wanted to jump right in and improve data governance during the upgrade but realized it would have been too much too soon: "If I had talked about data governance at the start, then no one would have listened to me. People tend to roll their eyes when you talk about data governance." And yet, she knew that data governance and data standardization was a critical first step for her to be able to compare data across systems. Some of the source systems couldn't be mapped directly with one another due to differences as simple as sometimes naming the source differently—for examples, sometimes the terms "CMS" and "Centers for Medicaid and Medicare Services" indicate the same organization and data source, making it hard to connect data into an enterprise system.

Instead of asking for buy-in on data governance, Brzymialkiewicz built tools to help the organization better understand and manage the data they had and tools to help investigators and auditors better understand relationships in the data. She developed a dashboard to present a full view of the available data resources, leveraging a unique procurement tool, the Joint Venture Partnership (JVP). The JVP, run by the National Technical Information Service (NTIS), allows for a back-and-forth dialog with pre-approved vendors. This dialog allowed her to develop a much more robust problem statement as vendors asked for clarifications that pushed her to refine her initial thinking.

Brzymialkiewicz was pleased with the results, and said "The proposals we got back were fantastic. There was a much higher quality and quantity of proposals than we get in a regular FAR (Federal Acquisition Regulation) process. Some of them were truly visionary—some were literally shooting for the stars, and I wasn't sure my organization could absorb it so quickly. It was eye-opening when the proposals came back how thoughtful they were."

The dashboard gives HHS OIG leadership more visibility into the data assets in the various legacy systems. Of the success of the dashboard, Brzymialkiewicz notes that "It used to take weeks, months or years to complete an audit report because we didn't have data at our fingertips. Now we have real-time access to data so we can do it in days, hours, or weeks."

By taking on this project first, and by quickly delivering results that were visible and directly useful to senior leaders, she built credibility as someone who delivers and works with the best interests of the rest of the organization in mind.

**Predictive analytics successes have identified significant financial returns for the government by exposing major fraud.**

The results achieved by the Advanced Analytics team, working in supportive partnership with investigators, have been impressive—including some high-profile prosecutions of fraud. Some examples include:

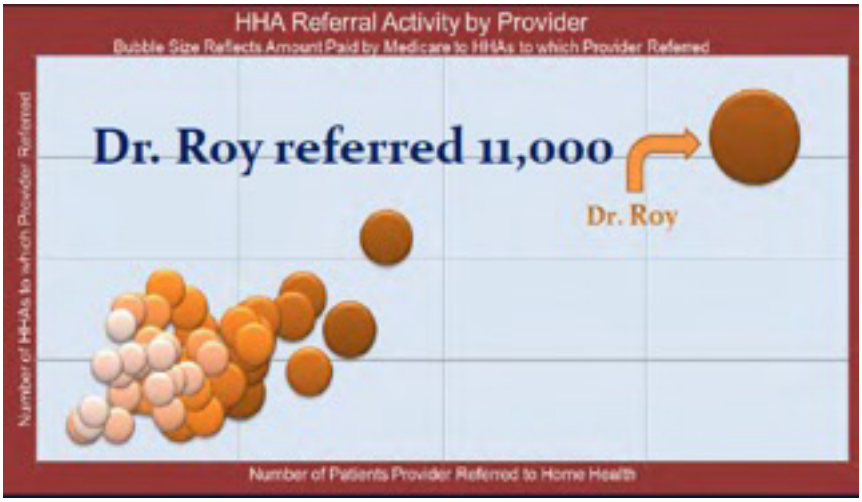
- A $1.3 billion 2017 anti-fraud "takedown" brought to justice 57 physicians, 162 nurses and 36 pharmacists for fraudulent prescribing of opioids. This largest-ever takedown of fraud resulted from analysts working with investigators to uncover patterns of prescribing that indicated fraud.[27]
- Data analytics helped uncover $1 billion in fraud in 2016, charging 301 people with unnecessary treatment, bribes and kickbacks, identity theft, and false prescriptions. These fraudsters "had figured out how to hide in the data," said Brzymialkiewicz. Her data modelers and statistics experts examined more than a petabyte of Medicare payment data. Comparing it with external intelligence derived from field agents, the analysts were able to uncover the fraud.[28]
- A Detroit doctor was sentenced to 45 years in prison for fraudulently receiving $18 million for using cancer treatment drugs on hundreds of patients who didn't need them, including patients who didn't have cancer.[29] Data analytics caught him by identifying the pattern of his misuse.

**Data visualization and customer focus are important.**

Brzymialkiewicz learned the importance of making data easy to understand visually when she showed a former boss a graph and he asked "Which one is the y axis?" She created a data visualization working group to serve as a community for sharing best practices. She used the NTIS-sponsored contracting Joint Venture Partnership to bring consultants in for customer-oriented thinking so that data visualization can be customized to the type of customer, given that investigators, auditors, attorneys, and evaluators are all different in the way they approach data and consume content. One example of her success with data visualization is shown in the graphic below. Examining payment data and sifting for patterns helped spot a doctor who was a significant outlier. As shown below, Dr. Roy referred 11,000 patients to home health services, while the typical doctor referred less than 100.[30] This visual helped the data team make clear that this doctor needed to be investigated. He has since been prosecuted.

27. Ruth Ann Dorrill, HHS OIG: *Federal Healthcare Insights,* Lone Star Winter Institute (presentation), January 2018, http://lonestarh-fma.org/wp-content/uploads/2015/06/180105-Dorrill.pdf.
28. Frank Konkel, "Better Data Just Saved Taxpayers $900 Million in Medicare Fraud," *NextGov,* Government Executive Media Group, June 23, 2016, https://www.nextgov.com/analytics-data/2016/06/better-data-just-saved-taxpayers-900-million-medicare-fraud/129357/.
29. Sonia Moghe, "Patients give horror stories as cancer doctor gets 45 years," *CNN,* July 11, 2015, https://www.cnn.com/2015/07/10/us/michigan-cancer-doctor-sentenced/index.html.
30. Caryl Brzymialkiewicz. "Predictive Analytics at HHS-OIG," April 4, 2017.

**Figure 5: HHS OIG Data Visualization Depicts Outlier in Referrals to Home Health Services**




***Source:*** Caryl Brzymialkiewicz. "Predictive Analytics at HHS-OIG," April 4, 2017.

## ADVICE TO A NEW CDO

Reflecting on successes and challenges from her three years of experience, Brzymialkiewicz has the following advice for other CDOs in government:

- **Do a listening tour.** Talk to your people and find out what matters to the organization. You can't know the priorities of your customers and what's going on in the organization without asking. At the start of her job, Brzymialkiewicz went to every Deputy Inspector General, met with them one-on-one and shared her vision of what the CDO role could be. She then asked, "What are your biggest concerns and where do you need help?"
- **Document your strategy.** Based on her listening tour, Brzymialkiewicz wrote out her organizational strategy. She continues to carry it around with her and finds staff also refer to the document, which has weathered the years with "coffee spilled on it."
- **Foster curiosity.** In addition to data skills, Brzymialkiewicz notes the importance of curiosity when her team looks at patterns and trends in data, saying "'What if' and 'why not' are my favorite questions."
- **Communicate well and often.** The ability to motivate and to pull people together depends on good communication skills and a bit of marketing. Brzymialkiewicz found that, without proactive communication, suspicion can arise, and people ask questions like "Why are we creating a data catalog; are you looking over my shoulder?"
- **Think early about change management.** Brzymialkiewicz is hoping to instill in her team the need to think early about implementation and how a data insight will affect business processes for customers. She said "change management is not the afterthought, but the first thought."

## Profile Five: Federal Aviation Administration (FAA) CDO Natesh Manikoth—A Platform Creator Who Generates Interest in Data

### Summary

A year ago, the FAA named Natesh Manikoth its CDO. In a short time, and with a small team, Manikoth has achieved impressive results toward his long-term goal of greater leverage of enterprise data assets for mission-connected decision-making. The two main areas of success to date are establishing the infrastructure for data analytics and raising awareness of the power of data.

### The CDO Role at the FAA

In 2017, the FAA created the CDO role to be responsible for data governance, data analytics. and driving a culture of data. The FAA CDO currently has a team of six people and reports to FAA CIO, who reports to the Director of Finance and Management.

### Lessons Learned

**Create the infrastructure for distributed self-service analytics.**

With a small team, the key to forging a data culture is to create the tools and platforms for self-service analytics. The cornerstone of Manikoth's effort to improve employee access to accurate actionable data is a project that was already underway when he was appointed—a cloud-based analytics platform. The Enterprise Information Management (EIM) Platform effort at FAA will bring all major data sources onto a single platform that users can easily access for their own analytics, rather than having to separately query each database across the agency's many operational systems.

When complete, the EIM Platform will serve as a self-service platform that automates manual processes and allows immediate access to accurate data. The new platform will provide users with relevant, trusted information in an actionable format to enable agile decision-making. The goal is to put the information in the hands of those who can use it. Says Manikoth, "Ideally, someone shouldn't have to ask for permission for data that is useful to their work."

The most important goal of the EIM Platform is to help people use analytics to solve business problems tied to the agency's mission. A critical step is to improve data access and control to allow seamless data sharing throughout the agency. Manikoth said "Ultimately, we want to reduce friction in accessing data."

In creating the EIM Platform, an important first step was cataloging all the various data systems and databases that will be included in the platform. At the start of the project, there was no comprehensive catalog of databases and data systems.

One planned use of analytics with the new platform is to develop a predictive model to determine, for compliance purposes, which airplane manufacturers to inspect and how often—based on their safety data and the risk profiles developed with that data. This is the type of

#### FAA SNAPSHOT:

The Federal Aviation Administration (FAA) was founded in 1958 and has as its mission to provide the safest, most efficient aerospace system in the world. The FAA has an annual budget of $15 billion and is part of the Department of Transportation. The FAA advances safety through regulation of the aerospace industry and operates the air traffic control system.

#### FAA CDO SNAPSHOT:

- Position created 2017
- Reports to FAA Chief Information Officer (CIO) who reports to the Director of Finance and Management
- CDO Manikoth's background combines public and private sector technology work experience; educational background: Masters in Engineering and MBA

#### CDO TEAM AT A GLANCE:

- Team of six includes three on detail from elsewhere in the FAA
- Responsible for data governance, data analytics and driving a culture of data

"risk-based decision making" that the FAA has declared a priority in its annual Strategic Initiatives.

**Raise data awareness to accelerate agency culture change.**

Awareness raising is the area that's attracted press attention, but it's not the centerpiece of Manikoth's work. Rather, it is a way to draw attention to that cornerstone work. In December 2017, Manikoth hosted a Data Awareness Week for FAA which reached 1,600 employees and contractors via its in-person events and webcast. What had started as a half-day event grew into a week of educational workshops and events, culminating in an agency-wide data challenge. There were presentations by outside speakers with inspiring stories of data use in government operations, on topics ranging from crime control and elections to the Census. Workshops helped to identify agency business processes that could be improved with data, and these will inform the agency's data analytics strategy going forward.

**Adding an element of fun with the Shark Tank Data Challenge helped generate positive energy.**

The team wanted something fun to close out the week of activities from Data Awareness Week for FAA, so the team created the Shark Tank Data Challenge. Its goal was to draw attention to the value that could be leveraged in the future data analytics platform, the EIM, and to add an element of fun. Outside judges were brought in to assess ideas on how to use enterprise data to improve aspects of the agency mission. Through the competition, people pitched ideas and had to quickly and persuasively, in a competitive environment, demonstrate that their analytics idea could create a large mission impact in a short period of time.

Judges evaluated dozens of submissions and chose a winner that used existing technology in a new way, combined with outside data to predict turbulence more quickly. These predictions can provide direct benefit to the flying public and flight crews, giving pilots more precise and timely information about potential turbulence to help avoid it. The idea uses the FAA's existing Automated Dependent Surveillance-Broadcast (ADS-B) data about air traffic, weather, and flight conditions. Currently, turbulence data is provided via pilot report to the FAA rather than generated from the existing data already in FAA systems.

The winning Shark Tank idea would use geospatial location, speed, altitude, and vertical speed data to predict turbulence closer to real time. The idea was developed using post-event data to develop a conceptual model for real-time data collection and analysis, identifying specific areas of turbulence at cruise altitudes and quantitatively measuring the effect on aircraft.

Matthew Thompson, an Air Traffic Control Specialist at the FAA, submitted the winning idea. Thompson is now partnered with an FAA researcher to test the idea with data generated in an operational environment. The project is entering a research and testing phase, and will of course only be rolled out if it is exhaustively tested for safety. Thompson said "Turbulence information derived from ADSB data would be a major improvement from our current turbulence reporting model that relies on pilot reports that are often subjective."

## ADVICE TO A NEW CDO

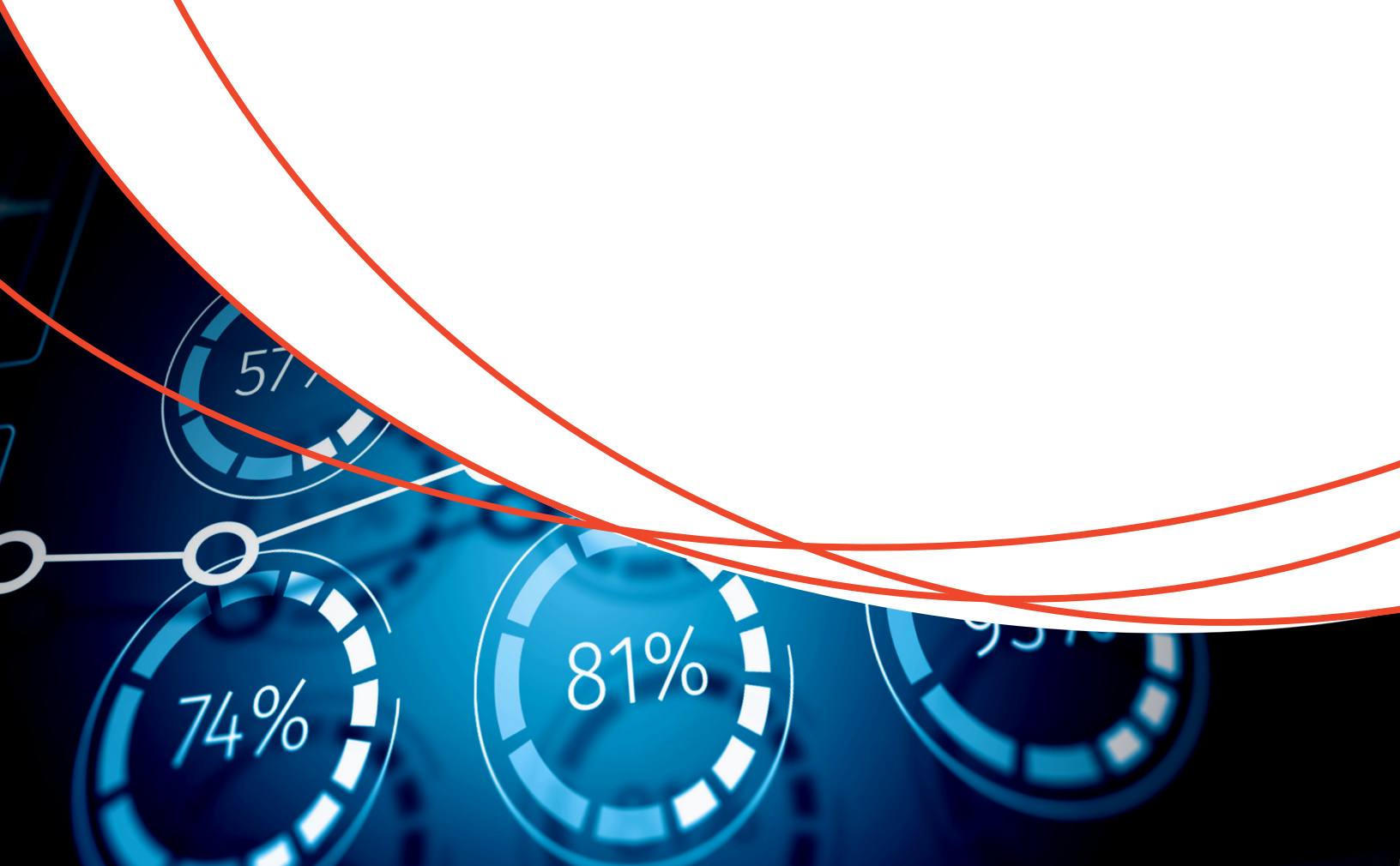
After his first year of serving as FAA CDO, Manikoth offers the following advice to new government CDOs:

- **Use creative staffing methods to find talent.** As a small organization with limited staffing, the FAA CDO team made liberal use of internal detail assignments to tap high-quality talent from within the FAA. Loaned staff from elsewhere in the FAA come at no cost and are also able to help expand data culture when they return to their original assignments.
- **Facilitate consensus rather than trying to impose change.** As CDO, Manikoth does not have direct responsibility for project management of the EIM Platform project, but he chairs the steering committee allowing him to guide the direction of the effort. He believes organizational change isn't successful when it's imposed, but rather happens through patient facilitation of organically-generated consensus. So, rather than impose data standards via the EIM project, he's created communities of interest for data users in various agencies. These communities of interest discussions are identifying the areas where data standards would help interagency data sharing. Then, the data standards they develop will directly provide benefit to their operations.
- **Curate data to make it actionable for non-technical staff.** The FAA CDO wants to use the self-service analytics platform to curate data in creative ways to make it meaningful to the staff as well as to the public. Manikoth says, "Use of big data can help identify operational patterns. I see the new analytics platform as our opportunity to develop new concepts and methods for looking at how to improve safety."
- **Inject an element of fun to generate ideas and momentum.** At the end of the Data Awareness week, the team created a Shark Tank Data Challenge. The event had a very different feel than a typical federal government meeting—one judge even wore a sharkskin-print suit to the event. Manikoth said "We needed a fun way to discuss ideas and to make people aware of the creative ways that folks are using data throughout the agency. We're excited about advancing the winning idea, and even the ideas that didn't win gave us a lot to think about."

# Putting The CDO In Context

This section places a federal CDO into context by:

- Describing the CDO organization's relationship to other data innovators in government
- Describing models for how CDO organizations engage with and serve their customers
- Providing perspective from beyond the beltway, reflecting leading cities and pioneering international digital and data leaders



## The CDO Is a Key Player in the Technology, Data, and Innovation Landscape

CDOs are key to many related innovation and technology efforts in government, because often these efforts are fueled by, or evaluated with, data. This section describes the relationships between the CDO and other key data and innovation players in government.

### CDOs are Essential Partners to Other Innovation and Technology Leaders in Government

A CDO is one of many emerging data and technology innovation roles in government. The table below describes, at a high level, some key differences among the CDO and selected other technology and innovation roles in government. No federal, state, or local government has named someone to each of the roles listed below; and, where they have, the roles are often still being defined. It is common to find that early on there is flux in how roles are defined, but over time the scope is solidified.

For the CDO, as increasing numbers of data-driven efforts are being created and funded it is important to be aware of the roles and how they could mutually reinforce each other. While the CDO need not be "driving the bus" for all technology or innovation projects, it's important that he or she either be on that bus or be getting real-time status updates along the route to innovation.

With or without other innovation and data leaders as partners in good government efforts, a CDO can be the valued leader who orchestrates efforts to embed data-informed decision-making in an organization's culture. When working in partnership with others, a CDO can be a great catalyst for the innovation ecosystem.

### Most Federal CDOs Report to the CIO

The majority of CDOs in the federal government report to a Chief Information Officer (CIO) (six of 11 in Table 4). This is consistent with the reporting structures of state CDOs. A recent survey by Pew Charitable Trusts found that, of 18 states with CDOs, all but a handful report to their CIO or technology department (see appendix).[31] However, city and private sector CDOs report to a CIO less frequently. City CDOs are more diverse in where they report in the organizational structure, with a small minority reporting to a CIO, while others report to a Chief Technology Officer, administrative or operations leader, the mayor, or through a performance office (see appendix). In the private sector, it is far less common for a CDO to report to the CIO, since the CDO often reports to the Chief Operating Officer or Chief Executive Officer.[32]

31. Pew Charitable Trusts, *How States Use Data to Inform Decisions: A national review of the use of administrative data to improve state decision-making,* Pew Charitable Trusts, February 2018, http://www.pewtrusts.org/en/research-and-analysis/reports/2018/02/how-states-use-data-to-inform-decisions.

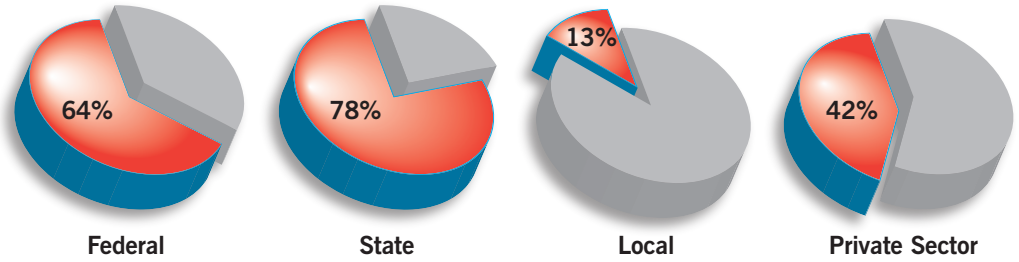
32. Yang Lee et al., *A Cubic Framework for the Chief Data Officer: Succeeding in a World of Big Data,* Massachusetts Institute of Technology, March 2014, http://web.mit.edu/smadnick/www/wp/2014-01.pdf.

**Table 8: Responsibilities of the CDO and Other Innovation and Technology Leaders in Government**

| Title | Key responsibilities |
|---|---|
| Chief Data Officer | • Establish data governance<br>• Create data infrastructure and platforms<br>• Create capacity for data-driven decision-making<br>• Lead analytics projects |
| Chief Information Officer | • Lead enterprise-wide information technology initiatives<br>• Maintain systems and platforms for enterprise and resource management<br>• Responsible for procurement and vendor management |
| Chief Technology Officer | • Set technology policy and select platforms and standards<br>• Lead technology deployment across the enterprise<br>• Provide customer support for enterprise systems |
| Chief Information Security/ Privacy Officer | • Develop policies to protect privacy and security of data across the enterprise<br>• Establish systems and protocols to protect enterprise systems (and the individual data in those systems) from intrusion and fraud |
| Chief Digital Officer | • Establish digital brand for government or agency<br>• Work toward uniform look and feel to digital interaction and improved customer ease of use<br>• Lead digital community and public engagement efforts<br>• May help advance civic tech as an economic development goal |
| Chief of Performance | • Work with operational departments to gather data for stat programs<br>• Analyze operational data for trends and to assess operational results<br>• Develop deep understanding of key business issues in operational departments |
| Chief Innovation Officer | • Use data to understand key problems to be addressed<br>• Generate ideas for new ways to tackle important problems<br>• Design solutions and hand off implementation to operational departments<br>• Track performance data on innovation to show results |
| Chief Geographic Officer | • Use Geographic Information Systems (GIS) to understand trends and patterns in public need for government services, and gaps in service<br>• Deploy GIS to analyze programs and policies to determine if services meet needs<br>• Foster GIS community of practice internally and externally |
| Chief Customer Officer | • Advance the use of human-centered design and design thinking in government<br>• Lead efforts to gather customer feedback, such as via surveys or follow up on 311 requests<br>• Provide multiple channels for hearing the voice of the customer |

***Source:*** Based on author literature review

**Figure 6: Percent of CDOs That Report to a CIO**




***Sources:*** See Table 4, Appendix 2, and Appendix 4. Private sector data is from: PwC, *Global Data and Analytics Survey,* PwC, accessed August 2018, https://www.pwc.com/us/en/services/consulting/analytics/big-decision-survey.html

## CDO and CIO Roles are Complementary and Mutually Beneficial

Comparing the CDO and CIO roles is challenging, because the CIO role has been around for decades while the CDO role is relatively new. Nearly all CIOs have some common responsibilities for enterprise technology services and applications, and the differences among public sector CIOs are often more of style and emphasis.

CDO is, by comparison, a newer role and there is not yet a standard set of duties and expectations. This allows far more customization of the role to unique preferences and skill strengths. While some academics have posited that the role of CIO may wane with the advent of the CDO[33] this author disagrees. To the contrary, the roles are complementary and mutually reinforcing. The CIO can be seen as the provider of the tools and platforms that are necessary for the CDO to do his or her job. Some of the CIO duties are more operational, providing infrastructure, systems, and platforms, and generating data, while the CDO role can be more strategic at times, as shown in Table 9.

**Table 9: CDO's Internal and External Roles**

| Role | Internal Data Responsibilities | External Partner Responsibilities |
|---|---|---|
| CIO | • Lead enterprise-wide information technology initiatives<br>• Build and maintain enterprise data systems that produce large volumes of data | • Run procurement process and select vendors<br>• Manage vendor relationships<br>• Identify and develop external pro bono partnerships |
| CDO | • Use data in mapping and modeling to derive business value and policy insight<br>• Develop and implement data governance and data management programs | • Work with contracted vendors<br>• Identify, develop and sustain external partnerships by working collaboratively on analytics projects. Partners can include civic tech community, business partners for pro bono work and academic partners |

***Source:*** Based on author literature review and interviews

33. R. Bean, "Organizational Alignment is Key to Big Data Success," *Sloan Management Review,* Massachusetts Institute of Technology, 2013, https://sloanreview.mit.edu/article/organizational-alignment-is-key-to-big-data-success/.

## Public Sector CDO Organizations: Two Models

No two federal government CDO organizations are alike. They range in size from one staff person to nearly 100, and range in scope from department-wide to a specific bureau or office. The priorities they take on are a mix of those dictated by the agency mission and those that best exploit their unique talents. While there is no way to generalize about all CDO organizations in government, a new CDO may find it helpful to understand one of the most significant differences, which is the way they engage with and support other parts of their organization.

A government CDO can advance data-driven government across his or her organization in a variety of ways. How a CDO chooses to engage with customers will depend on a variety of factors, including how ready the key executives and managers in the organization are to make use of their data and how open leaders and managers are to adopting data-driven approaches. The type of engagement will vary from developing data dashboards and maps to creating predictive analytics models and deploying sensors and IoT technology. The level of engagement will likely vary by executive and, as one data leader said, "you have to understand their appetite for change." Regardless of how deeply an executive or manager engages with a CDO organization, the overall philosophy of engagement can be established by the CDO.

One of the largest decisions is how to balance the centralization or decentralization of data and analytics work. The conceptual framework below describes the characteristics of the centralized model, where analytics are delivered by a team of experts on the CDO team to users across the enterprise, as well as the decentralized model where data and analytics tools are built centrally and then skills are developed so that users can perform their own analytics projects. While no CDO operates in a completely centralized or decentralized fashion, and organizations change over time, examining the framework of two distinct and opposing models can help a new CDO determine the right balance for his or her organization's needs.

While the centralized and decentralized models present opposite ends of a spectrum, most organizations employ a blended or hybrid model that uses the best elements of the two basic models. For example, with IT, it's not unusual for key agencies to have their own IT department, while the organization also has a central IT office as well. The hybrid model has been found to be the most effective in the private sector.[34] In cities, most CDO offices follow the hybrid model.

Boston is a good example of a city that uses a hybrid model, neither fully centralized nor fully decentralized. Led by a CDO who reports to the CIO, the excellent Citywide Analytics Team includes a variety of roles, from data scientists, data engineers, and GIS specialists to performance analysts. For some city departments, the team functions in a decentralized mode, supporting staff located in the department. Some, like the police department, have their own data analysts who can support day-to-day operations. For other departments, the team functions in a centralized manner, doing analytics work directly. For these efforts, the analytics team builds goodwill and relationships of trust with the department by solving tactical problems, which often means building a dashboard or map to meet a specific request of the department head.

One example is the Boston Fire Department, which relied heavily on the Citywide Analytics Team for help implementing a process to monitor how firefighters swap shifts—something that came under scrutiny after a series of negative reports in the press about abuse of the system and fraudulent behavior. At the time, the department didn't have the recordkeeping capacity, technology, tools, or analytic capability to make sure it was following the rules. The central-

34. Brad Brown and Josh Gottlieb, "The Need to Lead in Data and Analytics," McKinsey & Company, April 2016, https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-need-to-lead-in-data-and-analytics.

**Table 10: Two Models for a Government CDO Organization**

| | Centralized, or Analytics as a Service | Decentralized, or Self-Service |
|---|---|---|
| CDO Focus | • Analytics resources in a single team under the CDO's leadership<br>• CDO team provides data and analytics services to key executives and managers, functioning as an internal consultant<br>• Work in partnership with executives and managers to define scope and project needs<br>• Some bureaus or agencies may have their own analytics resources, typically the better resourced or statistics-driven ones, but the majority rely on the centralized CDO team | • CDO team creates distributed capacity across government by embedding talent in bureaus through training and coaching<br>• CDO team creates tools, platforms, and data standards that speed adoption of data skill in bureaus<br>• Each bureau/agency/office is responsible for developing its own analytics capability, which can range from budget and policy analysts who can complete basic descriptive statistics and dashboards to analysts with the skill to perform data science tasks such as predictive analytics |
| Ideal for | • Specialized skills or subject matter expertise needed for highly technical work<br>• Analytics projects that require a high degree of confidentiality such as investigations | • Large-scale enterprises with similar or low-complexity operations spread across many bureaus, divisions, or geographies<br>• Agencies with a high level of existing data skill or broad adoption of data literacy (such as scientific or statistical agencies) |
| Benefits | • Centralized pool of analytics talent allows sharing of specialized skills across the enterprise from a common hub, saving money since highly-trained analytics staff can be expensive for government<br>• Efficiencies are gained via peer support and collaboration among team members<br>• Centralized team is better able to standardize tools and processes across government, which can save time and money and help develop deeper expertise in the chosen tools and methods<br>• Team can facilitate cross-organizational data initiatives due to its enterprise-wide view of data assets and needs | • Leaders and managers in bureaus have more control over their analytics resources, may get more timely responses to their requests, and may also more immediately deploy analytics insights<br>• Analysts embedded in bureaus develop subject matter expertise that makes them valuable to their leadership and speeds time to results<br>• Embedded analysts can foster greater adoption of data culture across enterprise which can lead to faster organizational culture change<br>• Skills gained in self-service analytics are transferrable across government, spreading benefit |
| Limitations | • Slow growth of sustainable analytics talent in the bureaus<br>• Can be challenging to achieve scale with a small centralized team, as surge capacity may need to be deployed for a high-priority task | • Putting decision-making and control of analytics in the hands of bureau heads leads to uneven attention and results, with some investing heavily and others giving it low priority or not appointing an analytics officer unless compelled to do so<br>• Decentralized model limits peer cohorts for data-focused employees and may result in a more limited career ladder |

***Source:*** Author literature review and interviews

ized analytics team stepped in and helped with this concrete task, which met an immediate need. This built their credibility and created a spirit of partnership, which has carried over to other analytics projects, such as the recent project that alerts firefighters to building hazards when they are en route to a call, bringing together seven separate datasets from across the city into a single visualization.

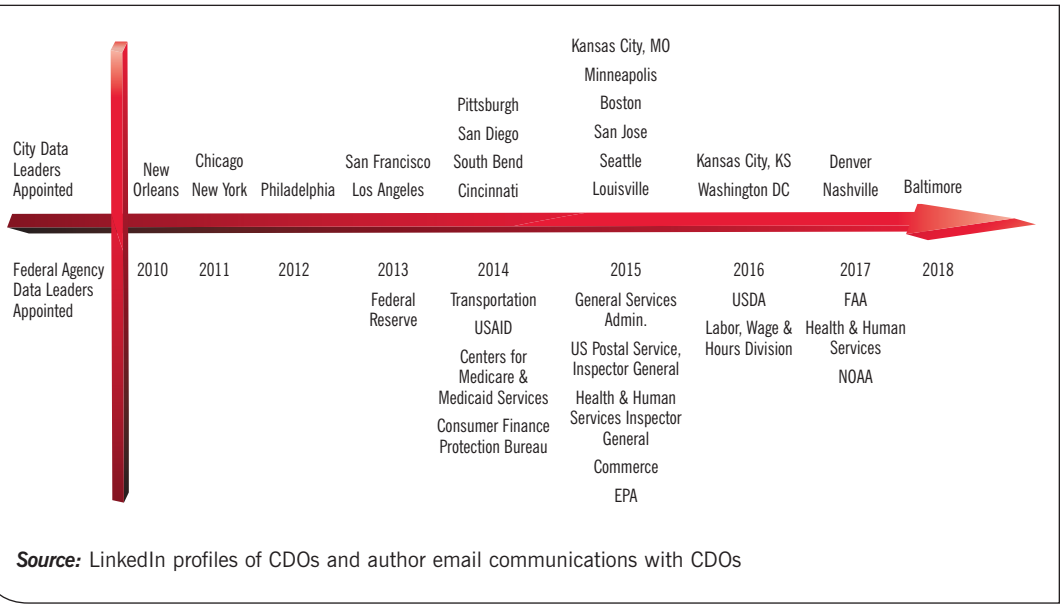
## Insight for Federal CDOs from Beyond the Beltway

This section reflects the experience of pioneering city CDOs, and of international data and digital leaders.

### Insights from the Experience of City CDOs

CDOs are far more prevalent in the largest cities than in the largest federal agencies. The early adopter cities have had the role longer than most federal agencies, making cities an interesting source of insight for new federal CDOs. As shown in Figure 7, not only are there more CDOs in cities than in the federal government, many city CDOs have been in place for a longer time.

**Figure 7: City-Level vs. Federal-Level CDOs**




***Source:*** LinkedIn profiles of CDOs and author email communications with CDOs

**Successful city CDO organizations and activities share common characteristics.**

In looking at the experience of city CDOs over the past few years, a handful of lessons emerge about what makes them effective:

- **Support from the chief executive sets the CDO up for success.** Whether a city CDO reports to the mayor, CIO, or elsewhere, the key thing is to have the support of that chief executive and have the resources, credibility, and authority that go along with executive sponsorship—simply holding the title of "chief" is not enough.
- **Strong open data programs lead to strong analytics programs.** Advanced analytics require large volumes of high-quality data, and one of the ways cities have been successful is through their open data programs. Long-time Chicago CDO Tom Schenk led one of the most cutting-edge analytics programs and cut his teeth in the city by growing its open data program. He also chaired a working group of the Civic Analytics Network (a network

of urban CDOs) that published an open letter intended to inspire vendors to make their product offerings more responsive to the unique needs of cities.[35]

- **Cross-departmental collaboration begins with common data infrastructure.** CDOs who achieve transformational change do it by creating extensible and shareable platforms for data analysis and visualization. In Los Angeles, the GeoHub[36] is the city's public platform for exploring, visualizing, and downloading location-based open data. It lets departments across the city plan and do their work in closer coordination with each other and communities. Allegheny County, Pennsylvania, pioneered a shared data warehouse for person-level data by connecting multiple disparate departments and services in its human-services data warehouse. Boston is creating a data warehouse that will span city departments and enable a greater volume of analytics that break down government "silos" of data.
- **Data literacy is important and takes effort.** Most cities are still in the early stages of taking on citywide data literacy for decision-makers and analysts. Innovative approaches include opportunities for data fellowships, loaned and part-time talent, and relationships with local universities and businesses. In addition to bringing in data champions, cities also can develop internal capacity, as was done in San Francisco with its popular and successful SF Data Academy, now copied in several other cities.
- **A spirit of experimentation breeds creative solutions.** The best CDOs are not afraid to try new things, whether it be a chatbot or using human-centered design approaches to put the customer at the core of their operations. Others are experimenting with behavioral economics, nudges, and other new ways of thinking about how to deliver the best results for public value. The most successful city CDOs talk about the power of failure in fueling future creativity and the need to let their staff take risks.

**Successful city CDOs exhibit competency across complementary core skill areas.**

Hiring a CDO is part art and part science, as a balance of skills is required. As can be seen in the case studies, the backgrounds of successful federal government CDOs vary from performance management, finance, and policy analysis to data science. No one CDO can have experience in every possible part of their portfolio, so self-awareness is a key characteristic of successful CDOs. A CDO needs to know where their expertise ends and when to call in others—a key skill of good managers.

As shown in Figure 8 below, a successful CDO is one who can balance three complementary talents. CDOs who excel in each of the three dimensions are most likely to achieve success.

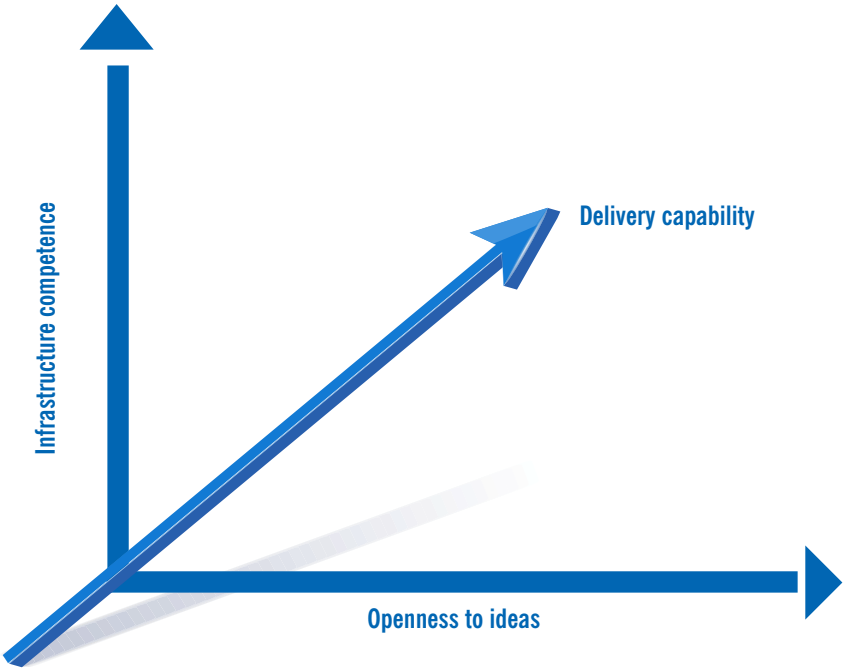
- **Infrastructure competence:** At a minimum, a CDO must be able to manage the basic data infrastructure of the organization, keeping open data and data visualization platforms operational and developing the data warehouses and tools needed for the organization. This operational "nuts and bolts" forms the core of what a CDO must do well. Many CDOs got their start doing this type of work and it forms the foundation of their credibility as CDO.
- **Openness to innovative ideas and approaches:** A great leader is open to pushing his or her organization forward, innovation, new ways of thinking, and new methods and tools. The best city CDOs, and the federal CDOs profiled here, have nudged their organizations along the journey toward data-driven government while keeping an open mind and being able to

35. Civic Analytics Network, "An Open Letter to the Open Data Community," *Data-Smart City Solutions,* Ash Center at Harvard Kennedy School, March 2017, https://datasmart.ash.harvard.edu/news/article/an-open-letter-to-the-open-data-community-988.
36. Open source data, *GeoHub,* City of Los Angeles, accessed August 2018, http://geohub.lacity.org/.

adapt to changing opportunities. Many city CDOs work alongside innovation teams, digital services, or customer engagement teams—all who are successful listen to ideas from outside their own teams. Being part of an overall innovation culture is key to the success of a CDO.

- **Delivery capability:** While infrastructure competence and openness to innovation make for a visionary leader, only with consistent attention to delivery will the vision be realized. This is an often-overlooked but critically important element to success. Systems for monitoring progress, relentless follow-up, and the willingness to make mid-course corrections are essential.

**Figure 8: The Three Core Competencies of Successful CDOs**




***Source:*** Author

**City CDOs accelerate their success with a peer network.**

In 2015, when the federal government named its first Chief Data Scientist, an informal network of urban CDOs was becoming a formal network. The cities of New York and Chicago were the first to name an official leader of their analytics programs, while New Orleans had even earlier created its Office of Performance that later became the home of its data analytics efforts. By 2015 the early adopter cities found that the peer support of a formal network would accelerate their success.

Today, 22 city CDOs constitute an official peer network for mutual support and problem solving. The Civic Analytics Network,[37] hosted by the Harvard Kennedy School and funded by the Laura and John Arnold Foundation, provides city CDOs with a forum to share ideas, challenges, and solutions. There are numerous instances of source code being redeployed from one city to the next, or toolkits and training materials being shared among the network. While each city is unique in its specific policy challenges, each participating CDO now has a go-to source for approaches to common data and operational challenges.

37. Civic Analytics Network, "Summit on Data-Smart Government," *Data-Smart City Solutions,* Ash Center at Harvard Kennedy School, July 2018, https://datasmart.ash.harvard.edu/civic-analytics-network.

**Like federal CDOs, city CDOs take on a diversity of responsibilities.**

No two CDOs among the group have exactly the same responsibilities or relationships to other parts of their city government. Among city CDOs, some have responsibilities for their mayor's performance management or "stat" program, while others do not. Some have responsibility for data visualization and geographic information systems (GIS) while others do not. Most have responsibility for their city open data program or work closely with those who do. In cities with data science efforts, the efforts are nearly all in the CDO office. While the range of duties is similarly diverse for city and federal CDOs, city CDOs have often garnered the most press attention for their predictive analytics work. This led one federal CDO to comment that "cities are where the action is, when it comes to data analytics."

**City CDOs have made effective use of external partnerships.**

Cities have succeeded with sophisticated analytics projects both by using their own staff and by leveraging external partners via pro bono or low-cost agreements with private sector and academic partners. For example, the City of Chicago leveraged more than $1 million in pro bono support from corporate partners. City CDOs who are successful typically leverage a wide variety of external partners, as many city CDOs have small teams serving their entire city.

**City CDOs may face greater diversity in data types than federal CDOs, with data that spans policy areas and levels of government.**

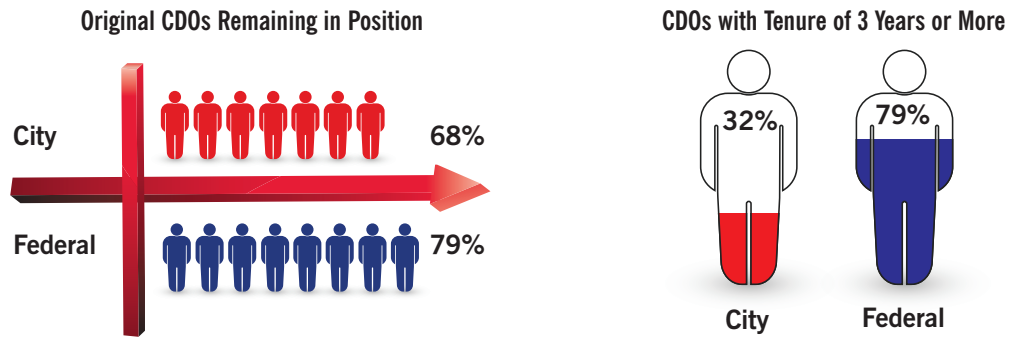
A key difference between city and federal CDOs is the scope of data under their control. Generally, cities create vast quantities of operational data—on basic blocking and tackling of governance such as the number of potholes filled, tax dollars collected, permits issued, restaurants inspected and so on. Most city data is stored in the databases and operational systems of the various departments and agencies of government, rather than a citywide data warehouse. This makes the job of city CDO part data wizard and part data wrangler when making data from operational systems useful for advanced analytics. Federal CDOs are more likely to have access to enterprise-wide systems that provide a head start on analytics projects. They must still work with managers of business operations to determine the policy question to be answered by the analytics project and how the data insights will help drive change.

Another key difference between city and federal CDOs is that federal CDOs have the power to compel data collection by state and local government related to funding provided to them and, in doing so, to set data standards and schema. City CDOs are more likely to work with data in formats created by others.

**City CDOs tend to have shorter leadership tenures than federal CDOs.**

Another key difference between city and federal CDOs is their tenure. While some cities were "first movers" in the CDO landscape and have had the position for a number of years, the individual in the role has turned over among the early adopter cities. By comparison, most federal agencies have not had turnover in the CDO role. As shown earlier in Table 4, only one federal CDO has been replaced and—with the exception of two vacant CDO positions—the remaining initial incumbents remain in place. The majority have been in place for three years or more. By comparison, of the 22 cities in the Civic Analytics Network, seven have had turnover, some multiple times. Less than a third have been in place for three years or more.

**Figure 9: Leadership Tenure of City and Federal CDOs**




***Source:*** Author

Table 11 shows the CDO tenure for cities where the CDO role has turned over at least once. Los Angeles is on its third CDO and, by the end of 2018, New York City and Chicago could be as well.

**Table 11: Early Adopter Cities Have Seen Turnover in the CDO Role**

| City | First CDO name and tenure | Second CDO name and tenure | Third CDO name and tenure |
|---|---|---|---|
| Chicago | Brett Goldstein, May 2011-June 2013 (26 months) | Tom Schenk, September 2014-June 2018 (45 months) | TBH |
| Los Angeles | Abhi Nemani, September 2014-September 2015 (13 months) | Lilian Coral, March 2016-September 2017 (17 months) | Sari Ladin-Sienne February 2018-present |
| New Orleans | Oliver Wise, January 2011-November 2017 (6 years 11 months) | Melissa Schigoda, March 2018-present | NA |
| NYC | Mike Flowers, December 2012-January 2014 (14 months) | Amen Ra Mashariki, November 2014-June 2017 (32 months) | TBH |
| Philadelphia | Mark Headd, September 2012-April 2014 (20 months) | Tim Wisniewski, May 2016-present | NA |

***Source:*** LinkedIn profiles of current and former city CDOs

## Lessons from International Digital and Innovation Leaders

A brief review of international examples demonstrates that the U.S. is in good company in being at an early stage for federal data leadership. Leaders in smart technology adoption and in digital government have yet to widely adopt the model of CDOs or embed advanced analytics widely across government.

***United Kingdom***

In the United Kingdom, one of the most digitally-advanced countries in the world, the user-oriented information and transaction site GOV.UK was developed by the UK Government Digital Service (GDS), a forerunner of the U.S. Digital Service. The UK appointed its first national CDO in 2015, with the stated goals of establishing data standards, advancing open data, and building data into decision-making. That position was filled for only six months before the incumbent (who had formerly led the Government Digital Service) left for another job. Since that time, the position has been vacant.

The 2017 UK Government Transformation Strategy specifically recommends hiring a CDO and identifies the need to "make better use of data—not just for transparency, but to enable transformation across government and the private sector."[38] The report highlights the need to develop better tools and platforms for the management of data in government. Many of the same concerns of U.S. CDOs are echoed in this report, including the need for growing the skills of the workforce for data management and digital services, as well as data literacy for managers and a consistent career path and reward structure for data and digital technology professionals in government. The strategy also calls for establishing a Data Advisory Board to align efforts to make the best use of data across government and align existing best practices.

***Singapore***

In Singapore, one of the leading governments in the application of smart technology, the Smart Nation and Digital Government Office leads a coordinated effort to use data effectively in government. A five-year, $150 million university-public sector Data Science Consortium will likely generate significant future value across government operations by applying data science across various sectors. While there is currently no national-level CDO, many government agencies have named CDOs. The use of data to drive government decisions is thoroughly ingrained in the highly professional workforce, yet the adoption of predictive analytics is in the early stages. Several CDOs are focused on data governance and on data literacy, with fewer working on predictive analytics projects.

Perhaps one of the most ambitious efforts is that of Dr. David Hardoon, CDO of the Monetary Authority of Singapore (MAS). He plans to train every single one of his agency's 1,400 employees on basic data literacy within a year and will offer the option of intermediate and advanced training as well. He also builds capacity through temporary detail assignment of analytic staff from across the agency into the CDO organization for a few months at a time. This accelerates their analytics learning curve—they go back to their original roles more valuable and skilled, and they help seed the agency-wide data community of practice. The MAS, which regulates all financial institutions and transactions, is moving quickly toward a paperless office. By 2020, they will accept only electronic documents and no paper. And they will allow regulated entities to say no to a data request if the information is already available elsewhere at MAS.

Singapore has long been a leader in making it easy for the public to transact with government, beginning with SingPass, a single sign-on for all digital services. Later this year, Singapore will roll out a national ePayment system that can eventually be connected to citizen digital records, allowing seamless payments for government services or receipt of public benefits. Integrating digital identity and payment transaction platforms will provide a wealth of data for analytics for Singapore, and likely in the coming years the integration of data across these and the various sensor platforms will provide ample opportunity for advanced analytics.

38. UK Cabinet Office, *Policy Paper: Government Transformation Strategy,* UK Government Digital Service, February 2017, https://www.gov.uk/government/publications/government-transformation-strategy-2017-to-2020/government-transformation-strategy.

### *Estonia*

Digital government leader Estonia began its journey in 1997, with an eGovernment effort aimed at lowering costs for government operations. Having just regained independence in 1991, it was a young nation when the digital government revolution unfolded. Estonia implemented iVoting in 2005 and has been using blockchain as the backbone for its eServices since 2012. Today, 95 percent of taxes are paid online in Estonia. Owing to data standards and interoperability, and the government's policy of asking a citizen only once for any information, tax forms pre-populate to the degree that it can take three to five minutes for an individual to file his or her taxes.[39] The "once only" rule means that if you give your address to one government agency, another is not allowed to ask you for it again. No department of any government agency can make citizens repeat information already stored in their database or that of some other agency. This reuse of data is something U.S. federal agencies could aspire to in establishing their data strategies.

39. Enterprise Estonia, *e-estonia,* Enterprise Estonia, accessed August 2018, https://e-estonia.com/.

# RECOMMENDATIONS

## A Chief Data Officer (CDO) can make government better by leveraging the power of data for more informed decision making.

A CDO can foster data-driven government by creating a culture that recognizes the value of data, improving data quality, and creating the enterprise platforms for data storage and analytics. CDOs can either serve as a data analytics provider to their organization, or can create self-service tools for others to use. They can transform their agencies by advancing data literacy. In addition, the thought leadership and data evangelism of a CDO can provide value far greater than the cost of his or her salary.

*Every leader of a government agency, regardless of size or mission, should consider the value that could be achieved for the public by hiring a data leader such as a CDO.*

Specific recommendations in this section begin with creating the conditions for success and establishing a CDO office through creating the organization and team to deliver on data culture and results.

**Figure 10: Summary of Recommendations**


### Recommendation One: The Office of Management and Budget (OMB) and Congress Should Create Conditions of Success for Federal CDOs

**Action: Require that CDOs be full-time positions with the authority and resources to support data-driven government for their organization.**

- **Make sure CDOs are full-time positions.** Being a CDO is a demanding, full-time job with wide-ranging scope and enterprise-wide data responsibility. Should legislation require that every department hire one, resources for new positions should be included so that the opportunity is not lost to have a positive impact by leading with data. One CDO noted that some who carry the CDO title in federal government at the bureau level are not full-time in the role, with one example that was less than half time. It would be a wasted opportunity if federal agencies fulfill the Congressional mandate in a perfunctory way, assigning someone who is already busy to be the CDO as part of their "other duties as assigned" responsibilities.
- **Provide resources appropriate to the mission.** Most CDOs in government begin as single-person operations. The most effective ones develop a team over time, building out capacity to address the highest-priority needs of the organization. If CDO positions are created in federal government, they should be appropriately resourced to achieve their mission. There is no magic number or proportion of staff that is adequate—some CDO operations are effective with a handful of staff and others are optimized with several dozen. The size

of the CDO organization should be tailored to the mission, priorities, and needs of the organization it serves.

**Action: Facilitate the sharing of best practices through peer networks and technical assistance.**

- **Formalize a peer exchange network.** The job of a CDO in government comes with unique challenges, making a peer community quite valuable. While the federal Data Cabinet continues to operate, it no longer has the high profile of being a White House initiative. If a federal CDO council is created, or any network formed, it would be opportune to seek feedback from CDOs on what's working well and what additional or different support or resources could enhance this peer network so that they can help each other accelerate success more concretely. One CDO, when asked about the network, said "I don't even know who the other CDOs are."
- **Provide technical assistance to new CDOs.** CDOs in government come to the job from a variety of backgrounds and with a diversity of skills—they don't arrive with prior experience being a government CDO elsewhere. They figure it out while doing the job. Dan Morgan, the first cabinet-level CDO, said he's "learned a lot in the job." New federal CDOs could learn from the pioneering ones, if technical assistance is available to facilitate it. If Congress passes legislation that requires each federal agency to have a CDO, it should allocate resources for new CDOs to receive external support to become conversant in their role, since it is a new one with great potential for public value. Any investment in speeding time to value for CDOs will have a rich return.

## Recommendation Two: Federal Agency Leaders Should Establish a Data Leader or CDO Position in Their Agency

**Action: Situate the CDO so that they have the authority to advance data-driven government.**

- **Choose carefully when deciding to whom the CDO will report.** Where a CDO sits in an organization has enormous impact on their ability to deliver value. The vast majority of current CDOs in federal government report to the CIO. In city government, there are a greater diversity of reporting structures, with some reporting to the CIO, others embedded in the mayor's office, and others in the performance office. The advantage to being coupled with IT in the CIO organization is the alignment of purpose—a CIO creates and manages enterprise systems that generate large volumes of data, and a CDO wants to develop meaningful insights from that data. However, one drawback to a CDO being part of a CIO organization is that it can dampen the effectiveness of the CDO's work if the CIO is not a supporter of the CDO mission.
- **Provide sufficient authority and resources.** Senior executive support sets the CDO up for success. Whether a CDO reports to the chief executive of an agency (Administrator, Secretary, etc.) or to the CIO, COO, performance chief, or some other official, it is important that a CDO have the support of their executive leadership and have the resources, credibility, and authority that go along with executive sponsorship. Simply having the "chief" title isn't enough if it doesn't come with the ability to marshal resources in support of the mission. The personnel and funding available to a CDO should be sufficient to accomplish their mission, as defined by the CDO and the executive sponsor in the organization.

**Action: Hire a CDO with talent for both innovation and delivery.**

- **Hire someone with technical competence.** A CDO will need to be able to lead the technical and operational responsibilities of the organization. Technical background does not need to span every area of the portfolio but should be sufficient to be a competent team leader and to gain credibility from those tasked with carrying out data management and operations.

- **Hire someone with openness to new ideas.** All successful CDOs listen to ideas from outside their organization and build their innovation on the "shoulders of giants" by borrowing from others. This critical ability to think outside organizational and functional boxes is critical.
- **Hire a talented manager with delivery capability.** In hiring a CDO, leaders should look beyond technical skills to management competency. Strong basic management and leadership skills, the ability to clearly articulate the mission and roadmap to achieving it, and the ability to hold staff accountable for results will accelerate success for a CDO. Standardizing tools and processes, including project management tools, will make the work more efficient. As one CDO said, success is dependent as much on technical skills as on "project management and customer service skills."
- **Hire a leader with people skills.** Perhaps underestimated is the degree to which a CDO needs people skills. Since it is the technical results that often receive recognition, it should be noted that many a technical success happens only after diligent work to build successful relationships of trust with individual data owners and business process leaders. That listening and trust building requires people skills that should be part of the job description for any CDO. Also communicating the value of data and persuading others to join the data community, serving essentially as a data evangelist, is important to the success of a CDO in creating organizational transformation. In hiring a CDO, this means balancing people and technology skills. As one data leader said, "The soft skills are the hard part."

## Recommendation Three: New CDOs Should Let Strategy Drive Operations and Focus on the Organization's Customers

**Action: Start with strategy.**

- **Create a vision before starting the job.** Visionary leaders know what they hope to achieve before they begin. They choose their handful of ways in which they'll make a difference before taking the job. As one data leader put it, "If you don't start with a clear vision of the two to three things you want to accomplish, you'll get distracted on day one by the crisis of the day and by other peoples' priorities." For early CDOs, this was a challenge since there were so few precedents. As the first cabinet-level CDO, Dan Morgan had few examples in the federal government when he began. So, he forged his vision based on advice from academic and private sector models. With this perspective, he has developed a successful method of leveraged engagement. Since the early days, he attests that he has amended the initial vision in an iterative fashion as the organization's needs have evolved.
- **Start by developing a strategy.** A new CDO should create a strategic plan that will serve as the roadmap for the first few years. Strategy begins with the charge from the chief executive, which should answer key questions, such as: What role has the CDO been asked to play? Is the CDO expected to take on the full scope of related tasks—open data, geographic information systems (GIS), analytics, civic digital engagement, and data governance, or will some subset of those tasks be in the charter? How does the CDO relate to other parts of government and how are responsibilities divided? What is expected of the CDO on an annual and on a routine basis? What resources have been provided to support the charter? Is the charter made clear across the enterprise with a memorandum, executive order, or policy statement? How is the CDO being announced and introduced to peers within government? With a clear charter from the chief executive, a CDO can define a roadmap describing the difference the CDO team can make in government over a three- to five-year time horizon.

- **Document and widely share the strategy.** Documenting the strategic plan and creating a mission statement is valuable in making clear to the organization the types of support a CDO can provide and, just as importantly, the tasks that are out of scope. For example, a critical element is defining scope—what the central organization does and what tasks are instead done by the rest of the organization with the support and tools provided by the CDO. Early in her tenure, and based on her listening tour, HHS OIG CDO Caryl Brzymialkiewicz wrote out her organizational strategy. She continues to carry it around with her and finds staff also refer to the document, which has weathered the years with "coffee spilled on it."
- **Incorporate external partnerships in the strategy.** Most CDOs will have to rely on external partnerships for at least some of their work. Whether it is contracts with paid vendors or pro bono partnerships with academic institutions, CDOs need to decide what their team will do and what outsiders will do for them. Chicago has been particularly successful leveraging pro bono partnerships, with $1 million in services contributed by private sector partners for data and analytics tools and models. Estonia decided to outsource development of many of its digital tools because they couldn't compete with the private sector for the best talent on their payroll. In many cases, federal government jobs offer competitive wages and good benefits and can attract top talent. But in areas where work is short-term, such as in development, or where specialized expertise cannot be sourced competitively in the marketplace, hiring outside vendors to do the work is wise stewardship of public funds.

**Action: Listen to your customers.**

- **Do a listening tour.** A newly appointed federal CDO should find out what matters to the organization by talking to managers and asking questions—do they care about operational bottlenecks, public complaints, efficiency, fraud, or the quality of location-based services? You can't know the priorities of your customers and what's going on in the organization without asking. At the start of her job, HHS OIG CDO Caryl Brzymialkiewicz went to every Deputy Inspector General, met with them one-on-one, and shared her vision of what the CDO role could be. She then asked, "What are your biggest concerns and where do you need help?" Similarly, USAID CDO Brandon Pustejovsky advises, "A new CDO should expend significant energy reaching out to learn about the business of the organization. We simply cannot succeed without listening to the needs of our partners." A listening tour also helps identify those who will become your internal champions and advisors. In developing their data-heavy Wellbeing Index, the city of Santa Monica used their listening tour to establish a team of project advisors who became one of the keys to the project's success.
- **Identify the problems that matter to your organization.** The most important starting point for data exploration is a puzzling public policy problem. As one CDO said, "don't sell your value by communicating the role of the CDO, instead work on solving mission critical problems and bring your data expertise to the table. Then let the data be the enabler of the solution." EPA CDO Robin Thottungal said "Don't come in talking about technology; you have to sit with the program offices and understand their problem and their mission so they see that you are working to solve their problems not that you are giving them a tool and saying to use it."

## Recommendation Four: CDOs Should Create a Skilled and Diverse Team

**Action: Create a team with diverse and complementary skills.**

- **Create a diverse team and enable their capacity.** Public sector data teams need a variety of skills—the ability to listen to customers and understand their problems, the ability to dissect problems and find root causes, data management and analysis skills, data visualization, communication, and presentation skills. No one staff member will possess all the

needed skills. USAID CDO Brandon Pustejovsky offers the following advice on building a team, "Once you admit you're not an expert in everything, then surround yourself with good people—because if you're not an expert, you need someone who understands your vision and can advise you in areas where you're not an expert." In a similar vein, one CDO says, "My single most-important piece of advice would be to hire smart people." Enabling capacity means making sure the team has the resources they need and can access training and professional development opportunities. Successful CDOs are often not spotlight-grabbers themselves, but rather give their staff the chance to shine, providing their teams with opportunities to brief the senior political appointees so that junior staff feel valued and get to develop their skills. As one former data leader said, "the number one priority is to invest in talent."

- **Remember, it's a team sport.** Sports analogies abound in articles about data analytics in government—"it's a marathon not a sprint" or it's a "relay" or a "triathlon." Regardless of the analogy, a joint blog post by GSA CDO Kris Rowley and EPA CDO Robin Thottungal said that data science is a "team sport."[40] They clearly see that no one team member can succeed alone. Team sports demand that each player knows the role and how it relates to the rest of the team—and they have to know the plays in the playbook.

**Action: Don't underestimate the importance of people skills.**

- Hire staff with strong people and communication skills. Data analytics staff should listen carefully to business users and understand their problems, because "even a killer algorithm is worthless if it is not used." It must address a real problem or be based on customer input, or they won't use it. According to a Gartner survey of IT professionals, of IT projects that fail, only one percent is due to "mostly technical skills."[41] Far more of the failures of IT projects lay at the hands of insufficient knowledge of the operations and the true needs of end users. A good CDO will either have solid business process analysis skills or will seek this strength in building a team.

**Action: Use creative hiring strategies.**

- Use a variety of tools and methods to find the right talent. Successful federal CDOs have been creative in their hiring strategies. For example, both DOT CDO Dan Morgan and HHS OIG CDO Caryl Brzymialkiewicz have leveraged fellowship programs, and FAA CDO Natesh Manikoth has made use of staff on detail to fill out his team. The first movers had to be creative because, in the early days, there were no job classifications in federal government for data scientists and big data analysts. One CDO reports consulting with the Office of Personnel Management and being advised it could take as long as three years to create a data scientist job classification. One CDO initially used the "social science research" job classification to make quick hires, searching within the organization and then aggressively hiring ambitious statisticians, policy analysts, and mathematicians from the outside. Other CDOs have used the statistician and operations research job titles to hire data scientists. EPA CDO Robin Thottungal recommends starting with internal hires by "finding people who are willing to work with you to change the way the organization is using data. I strongly believe there are people in your organization who are already data scientists but not being called that—maybe they are called statisticians or mathematicians. Start with internal people and you'll save time."

40. Robin A. Thottungal and Kris Rowley, "Open data democratizes innovation, 18F, June 2016, https://18f.gsa.gov/2016/06/02/open-data-democratizes-innovation/.
41. Svetlana Sicular, "Big Data Analytics Failures and How to Prevent Them," *Gartner,* August 2014, https://www.gartner.com/doc/3108918/big-data-analytics-failures-prevent.

## Recommendation Five: CDOs Should Strive to Create a Culture of Data and Innovation

**Action: Be a data evangelist and advocate for data-driven government across the organization.**

- **Communicate widely about the value of data.** One trait common to successful CDOs in federal, state and local government is that they communicate well and often about their work and the value it delivers. They are communicators as well as doers. One CDO describes himself as being a "salesperson for the agency every day." The ability to motivate and to pull people together depends on good communication skills and a bit of marketing. GSA CDO Kris Rowley says it well when he sums up the CDO role, "Data's not the beginning or the end of the conversation. It's just part of the conversation, and I'm just trying to insert it within the conversation as much as possible."
- **Celebrate data and analytics successes.** When government managers see their peers getting internal accolades or getting positive press for results achieved through their analytics efforts, it helps garner momentum for data-driven government and helps build credibility internally for the work of a CDO. As one CDO suggested, taking credit when a project fails and giving credit to others when it succeeds is a good way to build a "trust bridge" that can help turn data antagonists into data evangelists.
- **Create a data community.** A new CDO should find the super users of data and enterprise systems in his or her agency and should connect with them regularly in formal and informal ways. Kris Rowley, CDO at GSA, provides a great example in this area. He became a "Pied Piper of data" by gathering what had been an informal network of data professionals from across GSA into regular peer sharing sessions. GSA holds not only in-person trainings, but also informal brown bag lunch discussions to continue to grow the data community. EPA CDO Robin Thottungal also identified super users early on. When his team created a self-service data visualization platform, they identified the early adopters and asked them to test out the platform and provide feedback. These early adopters used the platform and developed applications on it and then become the proponents who encouraged others by example. There are now 2,500 users and 5,000 applications for this platform.

**Action: Build data culture throughout the organization.**

- **Build data literacy into culture change.** As one CDO said, across federal government, "We desperately need to advance data literacy" and to help leaders understand how to use data to make decisions. Many CDOs are already working on building staff data skills. The GSA not only makes data training available to their own staff, the training materials are all available publicly to others as well. The importance of training for culture change cannot be overstated. While analyst skill training is becoming common, a major gap remains at the manager and senior executive level. In some cases, senior managers may be uncomfortable with the growing expectation that they manage "by the numbers," given that they may not have training in emerging practices and tools. As one CDO said, "the leaders in my agency are not data people." Asking leaders to make decisions based on complex algorithms without providing basic data literacy training is a setup for failure. Growing the comfort level of senior leaders opens the opportunity for greater use of analytics throughout the enterprise.

**Action: Create a culture of innovation in your team.**

- **Allow your team the "freedom to fail."** As one CDO said, "in science, failure is the best teacher ever." Fostering a spirit of experimentation and risk-taking means tolerating a certain level of failure, or even expecting failure. A "freedom to fail" often is the springboard to succeed with new ideas, when staff have a safe place for "sandbox" thinking.

## Recommendation Six: CDOs Need to Deliver on Analytics by Getting the Basics Right and Providing Data Stewardship

**Action: Get the basics right first—data stewardship is a necessary precursor to analytics.**

- **Lay the foundation first.** Data stewardship—comprising data governance and data infrastructure—lays the foundation on which analytics is built and, whether these activities are part of the CDO operation or not, they are essential to the success of any analytics program. A CDO who does not have responsibility for data quality, data standards, privacy and security needs to work closely with those who are responsible. The saying "garbage in, garbage out" certainly applies to data analytics, so a CDO must assure the quality of data inputs, either by taking responsibility directly or by assuring that another person does.

**Action: Solve the problems that matter most to your internal customers.**

- **Clearly define and stay focused on the policy outcome of an analytics project.** Asking good questions matters, and clearly defining how the analytics effort will generate public value is important. As one CDO said, "you might be Lord Algorithm but if you don't stop to understand the problem, you will never succeed in making government better." Connecting analytics projects to concrete results may seem obvious, but there is the danger of being led into "analysis paralysis" or continual loops of perfecting an algorithm and being distracted from solving the policy problem for the customer. As one former data leader warned, it's easy to lose focus on the core problem and "spin our wheels solving problems we don't have."

- **Foster curiosity.** Curiosity and a willingness to go where the data leads is essential. NTIS Director Avi Bender noted that, to be exceptional, a CDO needs "insatiable curiosity—a desire to know the why, who, when, where and how." Coupled with empathy and storytelling, these are the three keys to success according to Bender—and it starts with curiosity. Likewise, HHS OIG CDO Caryl Brzymialkiewicz emphasized the importance of curiosity for her team in looking at patterns and trends in data, saying, "'What if' and 'why not' are my favorite questions." EPA CDO Robin Thottungal put it well when he framed the need for curiosity: "Come in with the mentality of a kid, because there are a lot of things you have to learn."

- **Be flexible in approach, keeping mission in mind.** Solving complex public problems with data requires flexibility to adapt the approach when necessary. HHS OIG CDO Caryl Brzymialkiewicz recognizes that she and her team need to continually iterate their methods to keep ahead of the fraudsters. "Solving fraud has no definitive end. When one problem is solved, fraud goes somewhere else. We're developing new approaches to identify unknown, undetected, and emerging patterns. We want to stay one step ahead of the fraudsters and not be stuck in a whack-a-mole approach."

**Action: Deliver timely, useful results in a customer-friendly format.**

- **Don't let the perfect be the enemy of the good.** One data leader warned against the temptation to overcomplicate things, encouraging the use of the least complex model that delivers results, the equivalent of a "minimum viable product" in technology development. After all, a complex model can later be built from a simple one, once it is proven to work. In taking on advanced analytics projects, some CDOs are tempted to not call the project complete until it's perfect. This is a natural outgrowth of the data science mindset of precision. However, it is often at odds with the important public goals of just making government better than it currently is, even if the solution is not perfect.

- **Document and share results achieved.** CDOs gain significant credibility and momentum when the value of their work is seen by government managers as a way to advance their mission and to achieve greater value for the same or fewer resources. Internally, the com-

munications of CDOs can be powerful accelerants to the adoption of data-driven government. Externally, being available to the various press requests and to sharing results via publications and conferences helps advance the general state of knowledge and speeds adoption of successful ideas in government.

- **Present results in an accessible format.** When results are presented in an overly complex manner, the message can be lost—especially if the audience are not data experts (which describes most managers). One data leader advised "talk about the policy value of your results, not about your Bayesian network model." Former CMS CDO Niall Brennan said "you have to make your analyses tangible and relevant to the powers that be. You could have the greatest analysis in the world that could put someone to sleep in five minutes. You need to make sure it's relevant to the challenges the organization's leaders are facing."

**Action: Improve data quality via regular intergovernmental data dialog.**

- **Federal CDOs should reach out to their state and local counterparts to discuss data standards and data reporting protocols.** Intergovernmental dialog should happen both across levels of government and across the agencies of federal government. With its transit and smart technology innovation programs, U.S. DOT CDO Dan Morgan has actively engaged with state and local government. The EPA has engaged with local communities in their Smart City Air Challenge. Other agencies have not been as aggressive, but could benefit from this level of engagement with the field. There are many ways that the federal government can foster inter-governmental dialog on data, and both formal and informal methods should be pursued.

**Action: Leverage existing tools and resources.**

- **Make use of existing platforms and programs.** A wide range of tools and resources are available to federal CDOs, so a good first step for a new CDO is to scan the environment for appropriate existing resources. A good starting point is GSA, which hosts the D2D analytics platform and makes its data literacy training materials available on its GitHub site. The technology and data consulting services provided by 18F are also part of GSA. In addition, the Data Science Corps, an effort of the National Science Foundation, will soon place volunteers—including data science professionals and data science students—into federal agencies on a temporary volunteer basis to offer assistance on data science problems and to provide data science training. Another interesting partnership is The Opportunity Project (https://opportunity.census.gov/) which brings an entrepreneurial approach to engaging with the private sector on digital and data innovation projects. Partnering with the private sector can be streamlined with the Joint Venture Partnership or with a Cooperative Research and Development Agreement (CRADA).

- **Leverage innovative procurement tools like the Joint Venture Partnership (JVP).** The National Technical Information Service (NTIS) offers several valuable resources for federal agencies. It manages the historical document repository of the Data Cabinet and hosts an annual Federal Data Meeting—perhaps most importantly, NTIS uses a power granted to it by Congress to enter into JVPs. The JVPs enable faster time to solutions for federal agencies for data analytics, machine learning, and artificial intelligence projects. Using a competitive process, NTIS pre-qualified 35 companies, nonprofits, and research groups who can now compete for projects defined by federal partners. NTIS manages the relationship between the federal agency and the JVP partner. The JVP allows problem-based procurement where the government can engage in a dialog with the potential partner to explore questions and provide clarity on goals. Because the JVP Program uses pre-approved vendors who have blanket contracts already in place, the process can move quickly, with project start dates as soon as 90 days from the initial conversation between the agency and NTIS. If this capacity is leveraged by more federal agencies, it could deliver significant value to the public via innovations that save effort and reduce cost.

# CONCLUSION

## While the challenges are many, the outlook remains bright. A small number of highly talented, dedicated data leaders in federal agencies are making tremendous progress in bringing their agencies into the modern age of analytics and data-driven decision-making.

CDOs at companies like Amazon and Netflix generate revenue by analyzing our data and presenting it to us in ways that make our lives easy. Just like that, we buy the next movie or book that's suggested to us—our decisions are made easy with data analytics.

A government CDO can do something much more powerful than suggest a movie—he or she can analyze data and present it in a way that lets a policy maker see new insights and make better decisions for the public good. A CDO can use data to help government better set and define priorities, and can make it easy to digest the data with maps and visualizations. In government, we're making decisions about resource allocation—improved safety, more economic growth and prosperity, and better targeting of resources to combat problems like poverty, natural disasters, or opioid addiction. CDOs in government are positioned to make a lasting difference in our lives.

CDOs are becoming culture change agents in moving their organizations toward data-driven decision making. A great deal has been accomplished, and there is momentum toward greater success in the future. But challenges await the emerging class of data leaders in government. Digital tools are creating machine-readable data at an ever-increasing pace, and the concomitant need to manage, store and optimize that data looms large. Data privacy and security will continue to need the attention of our data leaders. As more digital natives enter the workforce, data leaders will need to respond in kind with tools for them, and with data literacy training for their supervisors and leaders. Data leaders need to engage actively in the important emerging debate about algorithmic bias and the potential for unintended harm.

While CDOs are few in number they are mighty in their accomplishments and their ability to deliver results for taxpayers. As stated well by USAID CDO Brandon Pustejovsky, "We're listening; we're iterating; we're moving forward. There is still so much left to do, but these are exciting times and the best days are ahead of us."

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# APPENDICES

## Appendix 1: Research Methods

The research methods applied for this report include the following:

- **Horizon scan:** The first phase of work was a horizon scan to identify information already in the public domain on the existence and accomplishments of CDOs (and those who perform similar duties) in the federal government. The scan included government websites, national and specialty news sources, peer reviewed academic journals, and corporate sources. Phone calls were also made to press contacts at federal agencies and email requests sent for information regarding the existence of a "chief data officer."
- **Interviews:** More than 20 interviews were conducted in person and via phone with thought leaders and experts in data analytics, governance, and innovation, and with CDOs and other data and analytics leaders in federal government. At the request of the interviewee, some interviews were conducted on the record and others were conducted on background. Interviews informed the selection of case studies and the development of the conceptual framework. Several individuals contacted with requests for interviews declined to participate.
- **Case studies:** Case studies were developed based on interviews with leading CDOs, and the case studies highlight how data was used to make transformational and lasting improvements in government in a diverse set of circumstances. The five case studies provided demonstrate the range of ways in which federal CDOs excel.

The methodology for collecting the data on federal CDOs in the largest 10 agencies was as follows:

- First, a search on the department websites for "chief data officer" was performed to see if the name of a CDO could be found. The search term "data analytics" was also used.
- Second, a review of the organizational structure of the department (based on material on the department web site) was completed to determine if a CDO existed or if a similar role existed within the offices of any chief information officer, innovation office, evaluation office, performance office, or research and data office of the department or the office of the secretary. Where a title that included data, research or innovation was found, a search was done to identify the name of the person holding that office. When one was found, they were sent an email inquiry requesting information about the existence of a CDO and about data leadership generally in the agency.
- Third, if no public information on the website made obvious whether there was a CDO, an inquiry was sent to the press office of the agency asking for the name of the CDO or other data leader. When several emails remained unanswered, a phone call was made when phone contact information was available. For each department, a minimum of three contacts were made using a variety of contact formats. One press officer responded via phone that the agency did not have a CDO and that "that sounds like something from the private sector. We definitely don't do that sort of thing."
- Finally, an internet search using the department name and the term "chief data officer" and the term "CDO" was conducted.

# Appendix 2: States with CDOs

| State | Organizational structure | Reports to | Year CDO role created |
|---|---|---|---|
| Alabama | Designated within the Office of Information Technology | IT | |
| Arkansas | Designated by the director, serves in the Department of Information Systems under H.B. 1793 (2017) | IT | 2017 |
| California | Appointed by the governor, housed within the Government Operations Agency | Operations | |
| Colorado | Designated within the Governor's Office of Information Technology | IT/Gov | |
| Connecticut | Appointed by the governor, housed in the Office of Policy and Management per Executive Order No. 39 (2014) | Policy and Management | 2014 |
| Delaware | Appointed by the governor to chair the Open Data Council, housed within the Department of Technology per Executive Order No. 57 (2016) | IT | 2016 |
| Florida | Appointed by the chief information officer, housed within the Agency for State Technology under S.B. 2500 (2017) | IT | 2017 |
| Illinois | Designated within the Department of Innovation and Technology | IT | |
| Indiana | Appointed by the governor, serves as the executive head of the state's Management Performance Hub under H.B. 1470 (2017) | Management Performance | 2017 |
| Louisiana | Designated within the Division of Administration - Office of Technology Services | IT/Admin | |
| New Jersey | Appointed by chief technology officer, housed in the Office of Information Technology under S.B. 727 (2017) | OIT | 2017 |
| New York | Designated within the Office of Information Technology Services | IT | |
| North Carolina | Designated within the data division, serves as deputy state chief information officer | IT | |
| Oregon | Appointed by the chief information officer, housed within the Office of the State Chief Information Officer under H.B. 3361 (2017) | CIO | 2017 |
| Tennessee | Designated within the Strategic Technology Solutions department | IT | |
| Texas | Housed in the Department of Information Resources under H.B. 1912 (2015) | IT | 2015 |
| Utah | Housed in Department of Technology Services under S.B. 70 (2014) | IT | 2014 |
| Vermont | Designated by state chief information officer with Governor's approval, housed under data management division in the Agency of Digital Services per Executive Order No. 06-17 (2017) | Agency of Digital Services | 2017 |

# Appendix 3: CDOs in the 10 Largest Cities

| Of the top 10 cities by population 8 have a data leader and 5 have the CDO title | |
|---|---|
| **City** | **CDO or equivalent role** |
| New York | ✓ |
| Los Angeles | ✓ |
| Chicago | ✓ |
| Houston | ✓ |
| Phoenix | |
| Philadelphia | ✓ |
| San Antonio | ✓ |
| San Diego | ✓ |
| Dallas | |
| San Jose | ✓ |

***Source:*** U.S. Census for city population data, CDO data via email and interviews by the author

## Appendix 4: City CDOs—Quick Facts

The table below includes summary information for cities whose CDOs who have participated in meetings of the Civic Analytics Network. Data is current as of August, 2018.

| City | Name | Title | Reports to | Year Position Created | FTE |
|---|---|---|---|---|---|
| Allegheny Co, PA | Erin Dalton | Deputy Director, Data Analysis, Research, and Evaluation | Department of Human Services Director | 2007 | 42 |
| Baltimore, MD | Tracy McKee | Chief Data Officer | Chief Information Officer | 2018 | 9 |
| Boston, MA | Stefanie Costa Leabo | Interim Chief Data Officer | Chief Information Officer | 2016 | 22 |
| Chicago, IL | Vacant | Chief Data Officer, Department of Innovation and Technology | Chief Information Officer | 2011 | 13 |
| Cincinnati, OH | Brandon Crowley | Chief Data Officer | Chief Performance Officer | 2014 | 1 |
| Denver, CO | David Edinger | Chief Information Officer | CDO function is divided among Chief of Staff, CIO, and City Attorney | N/A | N/A |
| Kansas City, KS | Alan Howze | Chief Knowledge Officer | Assistant County Administrator | 2016 | 5 |
| Kansas City, MO | Eric Roche | Chief Data Officer | Chief Performance officer | 2015 | 6 |
| Los Angeles, CA | Sari Ladin-Sienne | Chief Data Officer, Director of Mayor's Data Team | Deputy Mayor - Office of Budget and Innovation | 2013 | 3 |
| Louisville, KY | Michael Schnuerle | Data Officer, Performance Improvement and Innovation | Chief of Civic Innovation | 2016 | 2 |
| Minneapolis, MN | Eero M. Kilkson | Director of Business Intelligence and Data Services | Chief Information Officer | 2015 | 5 |

| City | Name | Title | Reports to | Year Position Created | FTE |
|---|---|---|---|---|---|
| New Orleans, LA | Melissa Schigoda | Director, Office of Performance and Accountability | 1st Deputy Mayor, New Orleans Chief Administrative Officer | 2010 | 6 |
| New York, NY | Vacant | Chief Analytics Officer, Director of Mayor's Office of Data Analytics | Director of Operations | 2013 | 8 |
| Philadelphia, PA | Tim Wisniewski | Chief Data Officer | Chief Administrative Officer | 2012 | 10 |
| Pittsburgh, PA | Laura Meixell | Analytics and Strategy Manager, Department of Innovation and Performance | Chief Innovation & Performance Officer | 2014 | 15 |
| San Diego, CA | Maksim Pecherskiy | Chief Data Officer, Performance & Analytics Department | Director of Performance and Analytics | 2014 | 2 |
| San Francisco, CA | Vacant | Chief Data Officer | Mayor | 2013 | 7 |
| San Jose, CA | Erica Garaffo | Data Analytics Lead, Office of Innovation and Digital Strategy | Deputy City Manager, Office of Civic Innovation and Digital Strategy | 2016 | 11 |
| Seattle, WA | Richard Todd | Analytics Lead | Innovation and Performance Director | 2016 | 8 |
| South Bend, IN | Santiago Garces | Chief Innovation Officer | Mayor | 2014 | 30 |
| Syracuse, NY | Sam Edelstein | Chief Data Officer | Office of Accountability, Performance and Innovation | 2016 | 2 |
| Washington, DC | Barney Krucoff | Chief Data Officer, Office of the Chief Technology Officer | Chief Technology Officer | 2016 | 19 |

# REFERENCES

## Articles

Bean, R. "Organizational Alignment is Key to Big Data Success." *Sloan Management Review.* Massachusetts Institute of Technology, January 2013.

Booz Allen Hamilton, *The Role of Data and Analytics Catalysts: Agents of Culture Change,* Booz Allen Hamilton, October 2017.

Brennan, Naill, Allison Oelschlaeger, Christine Cox, and Marilyn Tavenner. "Leveraging The Big-Data Revolution: CMS Is Expanding Capabilities To Spur Health System Transformation." *Health Affairs* 33, 7. Project HOPE: The People-to-People Health Foundation, July 2014.

CIO Council. *State of Federal Information Technology.* CIO Council, January 2017.

Commission on Evidence-Based Policymaking. *The Promise of Evidence-Based Policymaking: Report of the Commission on Evidence-Based Policymaking.* Commission on Evidence-Based Policymaking, September 2017.

Desouza, Kevin C. *Delivering Artificial Intelligence in Government: Challenges and Opportunities.* IBM Center for The Business of Government, 2018.

Doar, Robert and Linda Gibbs. *Unleashing the Power of Administrative Data: A Guide for Federal, State, and Local Policymakers.* Results for America and American Enterprise Institute, October 2017.

Eggers, William D. and Steve Hurst. *Delivering the digital state: What if state government services worked like Amazon?* Deloitte, 2017.

Max Galka. "How an open data blogger proved the NYPD issued parking tickets in error." *The Guardian,* July 26, 2016.

Harrison, Teresa, and Theresa A. Pardo, Mila Gasco, Donna S. Canestraro. *The Salience and Urgency of Enterprise Data Management in the Public Sector.* Proceedings of the 51st Hawaii International Conference on System Sciences, 2018.

Heller, Nathan. "The Digital Republic: Has a tiny post-Soviet nation solved the problems of twenty-first century America?" *The New Yorker,* December 18 and 25, 2017.

Henke, Nicolaus, Ari Libarikian, and Bill Wiseman. "Straight Talk About Big Data." *McKinsey Quarterly.* McKinsey & Company, October 2016.

Konkel, Frank. "Better Data Just Saved Taxpayers $900 Million in Medicare Fraud." *NextGov.* Government Executive Media Group, June 23, 2016.

Lee, Yang, Stuart Madnick, Richard Wang, Forea Wang, and Hongyun Zhang. *A Cubic Framework for the Chief Data Officer: Succeeding in a World of Big Data.* Massachusetts Institute of Technology, March 2014.

Manyika, James, Michael Chui, Diana Farrell, Steve Van Kuiken, Peter Groves, and Elizabeth Almasi Doshi. "Open data: Unlocking innovation and performance with liquid information." *McKinsey Quarterly.* McKinsey & Company, October 2013.

McKinsey. *The Need to Lead in Data and Analytics.* McKinsey & Company, April 2016.

MeriTalk. *Calling the Plays: The Evolving Role of the CDO and Federal Big Data.* MeriTalk, December 2016.

Moghe, Sonia. "Patients give horror stories as cancer doctor gets 45 years." *CNN,* July 11, 2015.

National Technical Information Service. *Federal Data Meeting: Summary Report.* U.S. Department of Commerce, 2017.

Newcombe, Tod. "Big Data or Big Hype? Has data analytics delivered on its radical promise?" *Public CIO Special Report.* Center for Digital Government, 2018.

Nir, Sarah Maslin. "Bus Lane Blocked, He Trained His Computer to Catch Scofflaws." *The New York Times,* March 15, 2018.

Norton, Michael, and Ryan W Buell. "Think Customers Hate Waiting? Not So Fast…" *Harvard Business Review.* Harvard Business Publishing, May 2011.

Partnership for Public Service and the IBM Center for the Business of Government. *The Future Has Begun: Using Artificial Intelligence to Transform Government.* Partnership for Public Service, 2018.

Pew Charitable Trusts. *How States Use Data to Inform Decisions: A national review of the use of administrative data to improve state decision-making.* Pew Charitable Trusts, February 2018.

PwC. *Data-driven: Big decisions in the intelligence age.* PwC, 2016.

Sicular, Svetlana. *Big Data Analytics Failures and How to Prevent Them.* Gartner, August 2014.

U.S. Agency for International Development. *Open Government Plan v 4.0.* U.S. Agency for International Development, September 2016.

U.S. Agency for International Development. "ADS Chapter 579." *USAID Development Data.* U.S. Agency for International Development, March 2015.

U.S. Government Accountability Office. *Emerging Opportunities and Challenges: Data and Analytics Innovation, Highlights of a Forum Convened by the Comptroller General of the United States, Report to Congressional Addressees.* GAO-16-659SP, September 2016.

U.S. Government Accountability Office. *Data Analytics to Address Fraud and Improper Payments,* Highlights of a Forum Convened by the Comptroller General of the United States, GAO-17-339SP, March 2017.

U.S. Government Accountability Office. *Internet of Things: Communities Deploy Projects by Combining Federal Support with Other Funds and Expertise.* GAO-17-570, July 2017.

U.S. Department of Health and Human Services, Office of Inspector General. Justification of Estimates for Appropriations Committees. Fiscal Year 2019.

U.S. Social Security Administration. Fiscal Year 2016, Bipartisan Budget Act of 2015 Section 845(a) Report

The White House Data Cabinet. *The Federal Government Data Maturity Model.* The White House, 2016.

The White House. *President's Management Agenda.* The White House, March 2018.

Wilkinson, Alec. "The Serial-killer Detector: How an algorithm is discovering new links between unsolved murders." *The New Yorker,* November 27, 2017.

Wiseman, Jane. "Discovering the True Value of City Data Experts." *Data-Smart City Solutions.* Ash Center at Harvard Kennedy School, November 2017.

Wiseman, Jane. "Analytics Excellence Roadmap: A Four-Stage Maturity Model for Data-Driven Government," *Data-Smart City Solutions.* Ash Center at Harvard Kennedy School, July 2016.

Wiseman, Jane. "Customer Driven Government: How to Listen, Learn, and Leverage Data for Service Delivery Improvement." *Data-Smart City Solutions.* Ash Center at Harvard Kennedy School, August 2015.

The World Bank Group. *Big innovation challenge: Pioneering approaches to data-driven development.* The World Bank Group, 2016.

## Presentations

Brzymialkiewicz, Caryl, Ph.D., Assistant Inspector General and CDO, U.S. Department of Health and Human Services, Office of Inspector General. "Using Analytics to Reduce Healthcare Fraud, Waste and Abuse." February 17, 2016.

Brzymialkiewicz, Caryl, Ed Slevin, and Kelly Tshibaka, "Organizational Readiness for a Data Analytics Program," 2017 *Data Analytics Forum.* June 2017.

Brzymialkiewicz, Caryl. "Predictive Analytics at HHS OIG." April 4, 2017.

Kraemer, Michael, Federal Reserve Board, CDO. "Federal Reserve Board Mission and Priorities." June 2017.

Powell, Linda, CDO, Office of Financial Research, U.S. Department of the Treasury. GS1 *Global Forum 2014.* February 18, 2014. Brussels, Belgium.

Powell, Linda, CDO, Consumer Financial Protection Bureau. *ATARC conference.* December 13, 2016. Washington, DC.

Rowley, Kris, "Mobilizing Self-Service Data Analytics," *ATARC Conference.* December 5, 2017.

## Interviews

**Note:** All interviews conducted and noted by Jane Wiseman.

Bender, Avi, Director, National Technical Information Service. February 1, 2018.

Brennan, Niall, former CDO, Centers for Medicare and Medicaid Services. January 25, 2018.

Brzymialkiewicz, Caryl, Ph.D., Assistant Inspector General and CDO, U.S. Department of Health and Human Services, Office of Inspector General. March 23, 2018.

Campbell, Ray, Executive Director, Commonwealth of Massachusetts Center for Health Information and Analysis, June 26, 2018.

Danzig, Lisa, Deloitte Consulting, former Associate Director for Personnel and Performance Management, United States Office of Management and Budget. March 6, 2018.

Franklin-Hodge, Jascha, former Chief Information Officer, City of Boston, May 25, 2018.

Kearns, Ed, CDO, National Oceanic and Atmospheric Administration (NOAA). May 4, 2018.

Kleykamp, Tyler, CDO, State of Connecticut. May 7, 2018.

Manikoth, Natesh, CDO, Federal Aviation Administration. February 2, 2018.

Morgan, Dan, CDO, Untied States Department of Transportation. May 25, 2018.

Persons, Timothy, PhD. Chief Scientist at U.S. Government Accountability Office. February 15, 2018.

Pustejovsky, Brandon, CDO, United States Agency for International Development. February 15, 2018.

Rowley, Kris, CDO, General Services Administration. March 13, 2018.

Thottungal, Robin, Chief Data Scientist, Environmental Protection Agency. May 29, 2018.

Zachary, Drew, The Opportunity Project, United States Department of Commerce. March 6, 2018.

# ABOUT THE AUTHOR

**Jane Wiseman is a Senior Fellow at the Ash Center for Democratic Governance and Innovation at the Harvard Kennedy School. She has served as an appointed official in government and as a financial advisor and consultant to government.**

JANE M. WISEMAN

The focus of her current consulting, research, and writing is government innovation, data-driven decision making, and operational efficiency in government. With the Harvard Ash Center, she helps a national network of urban CDOs to accelerate the use of analytics in local government. Also with Harvard Ash Center, she created an open platform for government access to the best examples of government operational efficiency approaches, with case studies showing successful implementation. She has advised the U.S. cities funded by the Bloomberg Philanthropies Mayors Challenge competition. She has written on customer-centric government, data-driven decision making in government, pretrial justice, and 311 for a variety of audiences.

Her prior consulting work has included organizational strategy, performance management, and eGovernment strategy work for Accenture and Price Waterhouse. Selected clients include the National Governor's Association, the United States Department of Veterans Affairs, the National Criminal Justice Association, the Commonwealth of Massachusetts, the United States Postal Service, the State of Michigan, the United States Department of Housing and Urban Development, and the United States Department of Commerce.

Ms. Wiseman has served as Assistant Secretary for the Massachusetts Executive Office of Public Safety and as Assistant to the Director for Strategic Planning for the National Institute of Justice in the United States Department of Justice. Ms. Wiseman also represented the Justice Department on detail as a Staff Assistant for the U.S. House of Representatives Appropriations Committee. Ms. Wiseman holds a Bachelor of Arts in Government from Smith College and a Master of Public Policy from the Harvard Kennedy School.

# KEY CONTACT INFORMATION

## To contact the author:

**JANE WISEMAN**

Senior Fellow, Ash Center for Democratic Governance and Innovation
Harvard Kennedy School

124 Mt. Auburn Street

Cambridge, MA 02138

Jane.Wiseman@gmail.com

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**For more information:**
**Daniel J. Chenok**
Executive Director
IBM Center for The Business of Government

600 14th Street NW
Second Floor
Washington, DC 20005
202-551-9342

website: www.businessofgovernment.org
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