GOVERNMENT WORKFORCE IN FOCUS:

CLOSING THE DATA & ANALYTICS SKILLS GAP

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of respondents said they believe they have a data skills gap at their agency.

THE FEDERAL WORKFORCE SKILLS GAP CHALLENGE

A survey of 283 public-sector professionals brings insights on the challenges in closing the data skills gap.

Standing between the federal government and improved delivery of services is the data skills gap. Federal managers worry that prospective employees entering the job market lack the analytical skills, statistical competencies and technical proficiency needed to understand the federal government's large and complex datasets.

The data skills gap comes at a time when federal government employees need to have a diverse set of abilities. They need to work across teams, communicate effectively and be prudent stewards of limited fiscal resources. Possibly most importantly, employees must have the analytical skills needed to capitalize on the volumes of data that agencies now collect.

"There is no question that a data skills gap is threatening America's future, and in particular, the workforce of the federal government," said Karen Terrell, Vice President, SAS Federal.

For this research brief, GovLoop partnered with SAS, the global leader in business analytics software and services, and surveyed 283 public-sector professionals. As it turns out, they agree with Terrell's assessment. A stunning 96 percent of respondents said they believe they have a data skills gap at their agency.

The survey responses provide insights on the unique nature of closing that gap in the public sector. The federal workforce clearly sees the opportunity to transform agencies through data, but too often those agencies face significant workforce hurdles to capitalize on their operational and performance data, our research found.

As the federal government continues to compete to attract top talent, there is no priority more important than building a skilled workforce capable of meeting the complex challenges of public-sector missions.

Our research brief will explore several aspects of this problem: why the data and analytics skills gap exists, how it affects government at a time when more and more agencies are using data to transform their decision-making, challenges in surmounting the gap, and options the federal government is exploring to close it.

We asked our community members how they think data can improve their operations. Here are their responses:

Data drives workforce efficiency.
"[Data can help] establish a set of key performance indicators, understand relationships amongst metrics within these indicators, and regularly review, report, and act on metric results."

Data improves the decision-making process.
"Better information always results in better decisions. It has been said that knowledge is power. The more knowledge you have about your business, the better you will be able to make decisions."

Data that is consolidated increases accessibility.
"The department benefits from having a single warehouse of data networked throughout and controlled by authors that are versed in funding constrains, duplicate spending and technical advancement."

Data gives insights for long-term program sustainability.
"We spend too much time looking at the data trees, and not enough time appreciating the information forest. We measure things because we can, not because they are key performance indicators. We would benefit from shifting our analysis away from reacting to the immediate past, and more toward long-term strategies and outcome-based-accountability."

Data can build predictive models.
"Better surveillance of regulated industries, including the ability to prioritize investigations and identify trouble areas in advance."

Data helps develop visuals to consume complex information.
"Communicating data visually might give decision makers a little ease with understanding how the data ties into to the mission of their office."

Data can be used to combat waste, fraud and abuse.
"Better data to identify fraud, best practices, outcome evaluation, and proof that the money is being used wisely and has positive outcomes."

Data can improve workforce productivity.
"Efficiency in workflow and business process can provide quick data analysis and faster policy decisions and implementation."

SURVEY FINDINGS: EXPLORING THE FEDERAL DATA SKILLS GAP

What is your main role in your organization?

46%	Expert/Analyst
28%	Other
19%	Management
5%	Senior Management
2%	Executive Management

What is your age group?

1%	18-24
18%	25-34
25%	35-44
29%	45-54
23%	55-64
4%	65+

In which area do you perform your duties?

49%	Mission-Oriented Services, Non-IT
21%	Administrative Services, Non-IT
17%	Other
13%	Information Technology

Our survey results show that the GovLoop community realizes the value of data, but believes it does not currently have the workforce skills to extract knowledge from information.

Terrell's experience supports this: "I recently spoke with a very young employee of mine here at SAS," Terrell said. "She graduated from college last year, and this is her first job beyond internships. We were discussing the kind of curriculum that she had in grade and high school. She explained there was a heavy emphasis on memorizing poetry and liberal arts programs and not enough of an emphasis on data analysis and statistics, engineering, information architecture and even just basics on business analysis and econometrics. There is a long list of skills that are needed that we are not equipping our workforce with."

Survey participants shared similar anecdotes. "My agency is still in the [D]ark [A]ges with technological advancements," one participant said, and another added, "[We have] no training in data analytics or business intelligence for employees who are not contractors."

Although participants said the workforce lacks the necessary skills to leverage data, 78 percent of respondents said that data is a significant component of their job. "[Data is used to] formulate the metrics that will be used to perform program evaluations," said a respondent. Additionally, 60 percent of those polled said that the extent to which they base business decisions on data is above average (36 percent) or great (24 percent). (See Figure 2: Exploring Data Adoption in Government.)

Those statistics show that government has embraced the data revolution, but 57 percent of respondents strongly agree that their agency still needs training in more advanced use of data and analytics. (See Figure 3: Understanding the Data Landscape in Federal Government.)

Additionally, most respondents said their agencies are either not very effective (22 percent) or only somewhat effective (44 percent) at understanding, analyzing and using data, while only 4 percent believe their agency is very effective in leveraging data. (See Figure 2.)

"There are multiple systems and platforms with the same information that is not shared, in addition to a lack of funds to integrate systems," a respondent said. "Management is not looking at all possible solutions to problems. They are not very open-minded and they have a lack of training for data analysis."

"[My agency needs to] understand what story the data tells us about outreach and service delivery to target audience," added another.

This data reaffirms the growing skills gap agencies face to create data-driven organizations. The survey also reveals that many employees believe they are not fully equipped to leverage information — they say they lack both the data skills and technical solutions to extract knowledge from data.
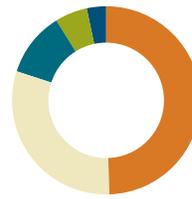
Respondents said the skill most lacking at their agency is having a better understanding of how to integrate data sources. (See Figure 4: What Analytical Skills Does Your Agency Need?)

From our survey, we have identified eight key ways that employees believe they can close the federal data skills gap:

1. **Learn how to build consensus among supervisors and decision-makers.**

2. **Develop expertise on how to leverage business intelligence (BI) tools.**

3. **Use effective critical thinking and problem solving skills.**

4. **Implement data management policies and strategies.**

5. **Understand how to connect data to mission needs.**

6. **Identify the appropriate training opportunities for staff.**

7. **Assess workforce and identify skills gaps.**

8. **Create data-driven performance metrics.**

Interestingly, the skills identified in our survey are a blend of soft and hard skills, indicating that exemplary leaders need to be trained in both technical and management competencies to properly leverage data.

Later in this report, though, we take a global perspective, learning some important lessons about the power of data from one international, intergovernmental agency.

CASE STUDY: USING DATA ANALYSIS TO SAVE LIVES

To demonstrate the value of having an analytically talented workforce, SAS' Terrell turned to a case study from the international community.

The International Organization of Migration (IOM) is an intergovernmental agency that provides humanitarian assistance to migrants in need and relies on a highly skilled data workforce to meet its mission. Through its work, IOM provides relief after natural disasters, managing and coordinating efforts for displaced citizens. This includes managing temporary shelters, schools and evacuation centers.

In November 2013, IOM was an essential part of the relief efforts as Super Typhoon Haiyan barreled through the Philippines. "[During Typhoon Haiyan] one of the IOM's jobs was to focus vital resources for first responders," Terrell said. "One division of IOM was using spreadsheets, intuition and human analysis to take a look at where they should be sending their resources to fix the problem."

IOM had to manage thousands of data points — from tracking clusters of individuals and water and sanitation needs to collecting information from government and non-governmental organizations partners, such as the Philippine Department of Health, World Health Organization and UNICEF.

To share the SAS analyses effectively, IOM used its Displacement Tracking Matrix (DTM), a management tool that tracks relief efforts and assesses individuals' needs. "By adopting easy-to-use technology, combined with intuition and knowledge that workers had, they were able to get actionable data and trends within 30 seconds," Terrell said. Through DTM, IOM workers knew where services were needed and provided.

One area Haiyan hit particularly hard was the city of Guiuan, which has a population of roughly 50,000. Using an SAS text mining analysis tool, more than 10,000 tweets were analyzed, providing important details about the relief efforts' current status. The social data also told IOM workers that the Red Cross and an Australian emergency medical team were in Guiuan already providing support. Finally, the tool provided information about what resources, such as antibiotics and generators, were most desperately needed.

> "This information would have been unavailable to IOM if they did not have a way to look at social media in a way that was useful and actionable to them," Terrell said. "So in this case, they were able to pivot and send resources where they were most needed."

The IOM case study shows how the combination of cutting-edge technology and talented teams who understand data can make a real impact on service delivery — and save lives in the process.

Figure 2: Exploring Data Adoption in Government

In which ways are you involved with data?

- Using data to make decisions **78%**
- Data analysis **78%**
- Data management **54%**
- Other **14%**
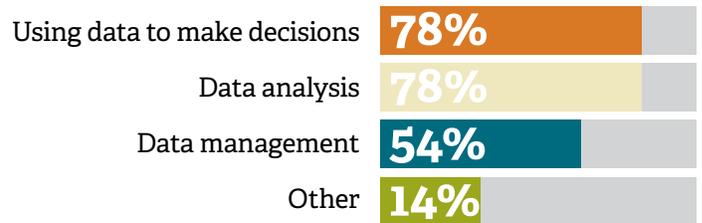
Do you use data or perform analytics as a significant component of your job?

- 78% Yes
- 22% No
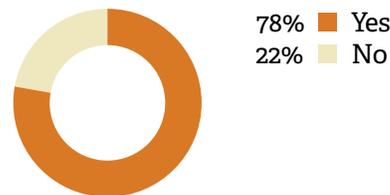
To what extent are your business decisions based on data or analytics?

- 36% Above Average
- 25% Moderate
- 24% A Great Extent
- 14% Some
- 1% Little to Zero
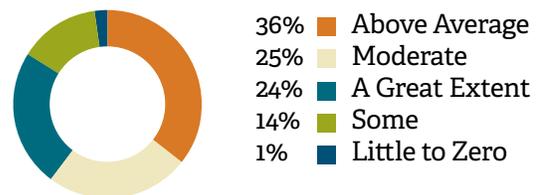
In your opinion, how effective is your agency in understanding, analyzing and using data?

- 44% Somewhat Effective
- 22% Very Effective
- 22% Not Very Effective
- 5% Not At All Effective
- 4% Extremely Effective
- 3% Unsure/Do Not Know
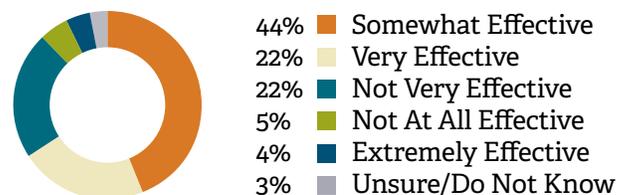
Please indicate your level of agreement with the following statements:

I feel well prepared to make use of my agency's data and information.	My agency's management places a high priority on the use of data to make decisions.	Employees at my agency have access to the training they need to become more analytically proficient.
24%	28%	5%
47%	38%	17%
14%	16%	26%
14%	15%	31%
1%	3%	19%
		2%

Strongly Agree: ▮   Niether Agree/Disagree: ▮   Strongly Disagree: ▮
Agree: ▮   Disagree: ▮   N/A: ▮
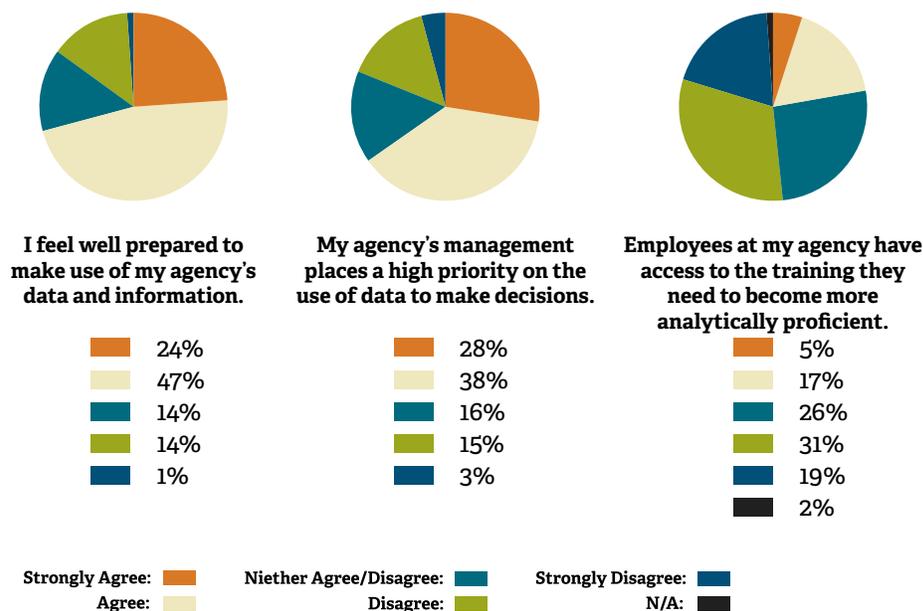
FOUR CHALLENGES IN CLOSING THE DATA SKILLS GAP

Unfortunately, most federal agencies do not have the skilled data workforce IOM has. Our survey respondents talk about four overarching obstacles that are currently impeding the government's attempt to build a skilled data workforce.

1. Lack of Adequate Training

One of the hardest challenges in closing the data skills gap is that the education system does not provide future employees with the right training. Although 72 percent of educational institutions believe that recent graduates possess the necessary skills to excel in the workforce, only 42 percent of employers agree, according to a McKinsey study.

In our GovLoop survey, many participants acknowledged that analysts at their agency have not been properly trained. (See Figure 4: What Analytical Skills Does Your Agency Need?)

"The cost, monetarily and temporally, in staying current with data is the biggest barrier," said one survey respondent. "An agency must have significant personnel and technology resources for gathering, sorting, and analyzing the volume and complexity of data available and then further significant resources to put the data analysis to use in any meaningful way. Knowing what the data is actually saying is one thing. Creating programs and processes that effectively capitalize on that knowledge is an entirely different, time-consuming, complex task."

"Specialists and analysts have not received effective training or any training to support using data and analytics in our organization," another respondent said.

Many noted their agencies do not provide training in data analytics or BI, and instead often outsource work in those areas to contractors.

"A barrier is training employees how to use the data in their daily responsibilities. It does no good to have easier access to data and integrate into decision-making processes if the employees don't understand why the data is important and how to use it," said a survey participant.

"Lack of technical skill [is a problem]," said another respondent. "My co-workers need me to show them what information is available at their fingertips, how it could be useful, as well as training them how to access various reports."

2. Changing Cultural Norms

Using data requires organizations to think differently about processes, workflows and job responsibilities. These changes introduce leadership challenges for the agency. In some cases, people have been doing a task or process the same way for decades, and breaking the cycle can be difficult. One survey respondent calls this obstacle the "[teaching the] old dog new tricks syndrome."

My agency has the skills it needs to make good use of our data and information.

- 9%
- 31%
- 23%
- 25%
- 12%
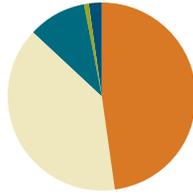
More advanced knowledge of data and analytics would help me make better business decisions.

- 48%
- 39%
- 10%
- 1%
- 2%
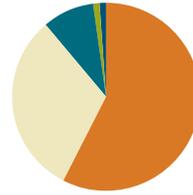
My agency would benefit greatly from more advanced use of data and analytics.

- 57%
- 31%
- 9%
- 2%
- 1%
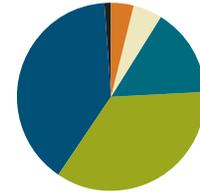
Analysis of data and information for decision-making is a skill I do not have.

- 4%
- 5%
- 15%
- 35%
- 39%
- 2%

Strongly Agree: ▮ Niether Agree/Disagree: ▮ Strongly Disagree: ▮
Agree: ▮ Disagree: ▮ N/A: ▮

Our community also identified the barriers they face that prevent people from actively sharing data across an agency. "Our information technology directorate 'owns' the data and is protective of access to people outside of IT," said a survey respondent. "We need to break this barrier and allow any and all people to have access to the data, run whatever report necessary and interpret for his/her needs as appropriate."

To overcome cultural challenges, agency leaders must show the business need to adopt data-driven practices, assess workforce skills, and then identify and fill knowledge gaps. This will require leaders to invest significant time to understand how data can transform their business models, which ultimately may lead to a more efficient workforce. "Most managers and staff do not think they have the time to learn how to access or analyze data, but don't realize that taking the time to learn will help them in completing other tasks more quickly after they learn," noted a survey respondent.

But the cultural challenges are only one obstacle facing government. Even with a skilled analytics team in place, data is not always accessible.

3. Data Access

Eliminating accessibility and interoperability challenges is essential in overcoming the data skills gap. Our survey respondents noted how difficult it often is to access information, either because systems do not integrate, data is not standardized, or they simply lack the right hardware or software to access information.

"Data is spread out in several locations and doesn't talk to each other. Also, the tools to access the data are different, depending on [the] program and there are no tools built to pull data from one program and merge [it] with data from another program to show a more robust picture of what is truly happening," said a survey respondent.

Respondents also noted the challenges of data trapped in spreadsheets. "We do not have a quick and easy way to access and clean the data needed for tasks. We need better and easier ways to pull data from spreadsheets into analytical software," a respondent said.

Technology itself can be a barrier. Organizations must be able to equip teams with the right kinds of solutions to extract value from data.

"Our databases are poorly designed so it is hard to get data out of them. Also, there are multiple data systems that don't connect to each other, so it's hard to know if you are actually getting all of the data when you search for information," said a respondent.

4. Lack of Budgets & Funding

Respondents noted that their agencies have a hard time identifying funding to modernize IT solutions and invest in training, specifically around data. Without the necessary funding available, challenges will remain. But as the federal government continues to adopt data-driven practices, officials will see cost savings by cutting waste, fraud and abuse. Ideally, this will enable them to divert more funding to modernization and training efforts.

These challenges present a real problem, and in addressing the skills gap, agencies continue to face an uphill battle — if they are addressing it at all. According to our survey, 55 percent of respondents weren't sure their agencies were.

Our next section explores how the federal government is responding to the skills gap and what your agency can do.

In which of the following areas are analytical skills needed most in your agency?

Area	Percentage
Better integration of data sources	**74%**
Increased data-informed decision-making	**63%**
Ability to use data powered software/tools	**62%**
Wider data use across agency	**59%**
Faster processing/analysis of data	**50%**
Other	**9%**

HOW THE FEDERAL GOVERNMENT HAS RESPONDED TO THE DATA SKILLS GAP

In this section, we explore some steps the federal government has made to address the skills gap. We also discuss the importance of the Chief Data Officer (CDO), and how they can help your agency capitalize on data.

The federal government recognizes the importance in closing the data skills gap, and many agencies have started to create initiatives to better understand how it will affect their agency. One example comes from the departments of Education and Energy, which have taken an innovative approach to attract and retain top science, technology, engineering and mathematics (STEM) talent.

Energy's STEM Mentoring Café is a pilot program that connects teachers and students with federal STEM professionals in Washington, D.C. In May 2014, Education hosted a café event. A press release states:

"Thirty female STEM professionals from 16 different government agencies arrived with their 'tools of their trade,' ready to interact with 18 teachers and 38 5th-8th grade students to share their passion for their STEM careers. The participants assimilated quickly to the 'speed-dating' format, with STEM professionals moving from table to table during the five rounds of 10-minute intervals, enabling students and teachers to ask questions and learn about STEM professions during each roundtable discussion."

This type of program is a great way to encourage students to pursue STEM positions for public service. But finding and attracting top STEM talent is an urgent problem.

That's why the Office of Personnel Management recently announced five data products that will help managers hire qualified STEM job applicants. These tools are designed to expedite the hiring process and help the federal government become more competitive with the private sector. "White House Fact Sheet: Celebrating Careers and Contributions of the Federal Science and Technology Workforce" explains more about each product:

▲ **Hiring Manager's Portal**
"A web-based portal that will help hiring managers better identify quality STEM applicants and tailor job announcements to desired skills and qualifications of prospective applicants based on OPM data resources. The portal will be available through OPM to Federal hiring managers to facilitate job/skills linkages."

▲ **Data Science Ladders**
"A central, online resource that will provide employees the opportunity to build [science and technology (S&T)] skills. OPM is collaborating with other Federal agencies to make this resource available to all Federal employees through an easily accessible online platform."

▲ **STEM Employee Directory**
"An online resource that will allow agency hiring managers to find employees with STEM skills already within the Federal government, along with other Federal employees with extensive S&T skills and experience. OPM is currently developing this tool, which would be made available to hiring managers as well as other interested stakeholders in the Federal community."

▲ **STEM Data Catalog**
"A data community and catalog that will allow interested parties to analyze information related to S&T applicants and better understand the challenges of including these candidates in the Federal workforce. OPM is working to make this and other workforce-data visualization tools available to the Federal community."

In your opinion, where are the biggest skill gaps in your agency's use of data and analytics? [Select up to three answers.]

Abilities to turn data insights into action	**45%**
Software or technology expertise	**39%**
Data management and integration abilities	**37%**
Data interpretation and application abilities	**34%**
Deep reasoning or critical analytical skills	**28%**
Data presentation and communication skills	**26%**
Statistics, math and quantitative skills	**21%**
We have no real analytical skills gaps	**4%**
Other	**4%**

⚠ **STEM Applicant Dashboard**

"A tool to help hiring managers visualize at what stages they may be losing high-potential STEM-job candidates. This dashboard will empower users with a data-driven tool to answer questions and hone strategies related to STEM applicant pools. OPM is working to provide this tool as an analytical resource for hiring managers."

Another important development is the movement for more competitive pay for STEM professionals. In a recent memo to federal agencies, OPM Director Katherine Archuleta reminded chief human capital officers that federal agencies "have substantial discretionary authority to provide additional direct compensation in certain circumstances to support their recruitment and retention efforts for the STEM workforce." This pay flexibility is designed to help the government compete with the private sector to recruit and retain top STEM talent. If a STEM position qualifies as critical, the department can increase pay above the typical rate.

Another critical development to closing the data skills gap is several agencies' addition of the chief data officer (CDO) job to the C-suite.

The CDO position is one that many federal agencies are considering to not only help close the skills gap, but also implement data strategies. The Federal Communications Commission hired a CDO in 2010, and since then so have the Federal Reserve, National Institute of Standards and Technology, and National

Institutes of Health. Additionally, in July 2014, the Commerce Department announced it was hiring a CDO.

"The CDO can help plan and implement an agency's enterprise data strategy. The strategy would consider how data can improve and advance the agency's mission in service to the citizens of our country. The CDO would look at specifics like maintaining data quality, pulling together data silos and data acquisition as well as integration and dissemination." SAS' Terrell said.

"In the federal government, there is already an overwhelming amount of data available. A CDO would help their agency to understand the myriad of possibilities for that data and, together with the chief human capital officer, guide the agency towards more deliberate applications for that data, all in service to their agency priorities," she added.

But before an agency starts to consider hiring a CDO, it must assess its current workforce's skills and its ability to meet its mission. This process starts by gathering the right information. Try thinking through these 10 questions:

1. **Have we considered hiring a CDO?**

2. **How do we collect, store and manage our information?**

3. **Who has access to data we collect and what data is confidential?**

4. **How is data being used to help us meet our mission?**

5. **What competencies does our agency lack?**

6. **How can we fill our agency's knowledge gaps?**

7. **What kind of continuing education and training are available?**

8. **How do we balance institutional knowledge against the need to modernize?**

9. **What kinds of analytics solutions would be most beneficial to staff?**

10. **What's the return on investment of our data programs, and how are we proving value?**

These questions will help you begin to frame a workforce strategy.

HOW SAS CAN HELP

SAS is helping governments around the world address their skills gap, and drive data-driven decisions.

SAS is helping government agencies uncover the power in their data and supporting STEM education programs. "SAS is a company that doesn't just invest time and effort in the technology we are building, but we are also addressing the STEM and analytics skills gap issues," Terrell said. "That's because the best technology in the world is not useful unless there are skilled people deploying the solutions."

To help bolster the STEM talent pipeline, SAS has focuses its philanthropic efforts on closing the skills gap. Earlier this year, SAS launched Analytics U, a broad academic initiative that includes free software, university partnerships and engaging user communities that support the next generation of analytics professionals. "SAS supports numerous analytics and data science degrees around the world." Terrell said. "SAS helped create the first Master of Science in Analytics at North Carolina State University in 2007. All 75 graduates of NCSU's 2014 who were looking for jobs had one by the time they graduated. 90% had at least two offers. "

SAS also supports degree programs at Texas A&M, Louisiana State University, University of South Carolina, Lehigh University, Northwestern University, Stevens Institute of Technology, Oklahoma State University, University of Cincinnati and others, and has partnered with colleges to create more than 50 certificate programs around the world.

Our research finds that a failure to close the skills gap can have long-standing effects on the public sector's ability to serve constituents. More specifically, organizations will not be able to effectively leverage large and complex datasets to cut waste, fraud and abuse or to reform service delivery and share data.

It's clear that data is changing the way public institutions operate. But without a skilled workforce able to take on the challenges, organizations will fail to capitalize on the opportunity. With more training, funding of programs and stronger metrics to assess the workforce, agencies will be able to recruit and retain the necessary talent to re-imagine their operations.

Figure 5: Addressing the Data Skills Gap

How are you or your agency addressing the data skills gap?

I'm not sure if we are currently doing anything — **55%**

Contractors — **26%**

Hiring analytically-skilled workers — **23%**

Professional development programs (internal and external) — **20%**

Leveraging knowledge/resource of other federal agencies — **11%**

Other — **6%**
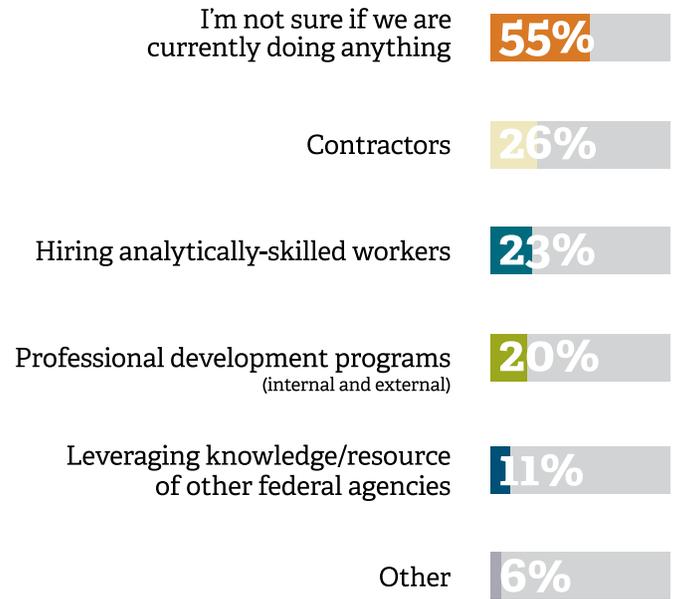
How do you or your agency acquire data/analytics talent?

Internal staff — **55%**

Contractors — **42%**

Recent graduates/universities — **30%**

Hire from the public sector — **27%**

Other — **13%**
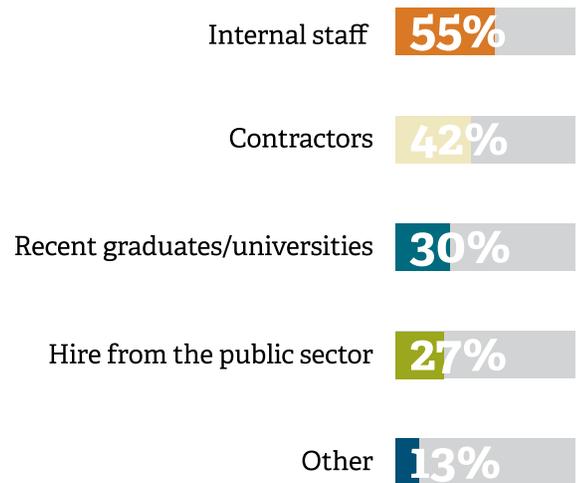
ABOUT SAS

As the leader in business analytics software and services, SAS transforms large amounts of data into insights that give you a fresh perspective on your organization. You can identify what's working, fix what isn't and discover new opportunities. SAS has more than 70,000 customers around the world andhas provided innovative solutions targeting the unique analytic needs of the federal government for more than three decades. All 15 US federal departments use SAS software's analytic and predictive capabilities for critical initiatives such as performance management, budgeting, logistics, cyberdefense, combating fraud and improper payments, and threat assessment.

Learn more at http://www.sas.com/en_us/industry/government.html

ABOUT GOVLOOP

GovLoop's mission is to "connect government to improve government." We aim to inspire public-sector professionals by serving as the knowledge network for government. GovLoop connects more than 140,000 members, fostering cross-government collaboration, solving common problems and advancing government careers. GovLoop is headquartered in Washington, D.C., with a team of dedicated professionals who share a commitment to connect and improve government.

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