IBM Center for The Business of Government

Optimizing Analytics for Policymaking and Governance

Dr. Jennifer Bachner
Johns Hopkins University

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FOREWORD

On behalf of the IBM Center for The Business of Government, we are pleased to present this report, *Optimizing Analytics for Policymaking and Governance,* by Jennifer Bachner of Johns Hopkins University.

DANIEL J. CHENOK

LEANNE HASELDEN

The federal government has long recognized the importance of deriving actionable insights from curated data to inform policy development, measure progress, and judge effectiveness of government programs. This approach is emphasized in legislation such as the Foundations for Evidence-Based Policymaking Act codified in January of 2019.

This legislation requires that federal agencies develop "learning agendas" that are tied to the strategic plan of the organization and demonstrate, through the use of data and data analytics or "evidence," that the mission programs are delivering results and the impact is as originally intended. In addition, the legislation also requires that a data analytics capability be established within the agency under the purview of a chief data officer to execute this responsibility.

As a supporting mechanism for the effective use of data within the federal government, the Office of Management and Budget released on June 4th, 2019, the Data Strategy Memorandum M-19-18, Federal Data Strategy—A Framework for Consistency, which provided a mission statement, principles, and practices to provide a governmentwide vision for how agencies should manage and use federal data by 2030. Federal agencies have since made progress against these goals and are still in the process of maturing their effective use of data analytics in policymaking and governance.

In this report, Jennifer Bachner has derived conclusions regarding agency progress based on a systematic review of these efforts. This review draws on a survey of professionals working in and with federal agencies to develop a more comprehensive understanding of how the government uses analytics, the outcomes of these efforts, and the challenges agencies face in their work to further develop analytical capabilities. The survey was first conducted in June of 2019 and again in August of 2021.

After each iteration, a forum with a panel of experts discussed the findings. The results show that the federal government has made substantial progress and the report highlights those successes and provides examples of effective implementations. The report also provides insight into the challenges ahead and key areas of focus and success factors necessary for continued improvement.

The timely release of this report coincides with the recent agency posting of their learning agendas Evaluation.gov. And the report builds on recent Center studies involving data and analytics, including Using Data and Analytics to Enhance Stakeholder Engagement in Environmental Decision-Making, Aligning Open Data, Open Source, and Hybrid Cloud Adoption in Government, Making Federal Agencies Learning-Based: The Key Role of Learning Agendas, and Silo Busting: The Challenges and Successes of Intergovernmental Data Sharing.

We hope that this report facilitates the continued conversation around the importance of data analytics in designing and measuring federal programs and ensuring these programs are delivering value and impact for American citizens.

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EXECUTIVE SUMMARY

Following the enactment of the Evidence-Based Policymaking Act of 2018 (Evidence Act), every federal government agency must now formulate and institute processes for collecting, analyzing, and sharing data to support evidence-based decision-making.

Several agencies have already made great strides toward developing effective data and analytics capabilities; some have enhanced their impact through increased reliance on data-driven policymaking. While individual examples of the use of analytics in the public sector are often instructive, there has not previously existed a systematic review these efforts. We therefore decided to conduct a survey of professionals working in and with federal agencies to develop a more comprehensive understanding how the government uses analytics, the outcomes of these efforts, and the challenges agencies face in their work to further develop analytical capabilities.

We conducted the survey first in June of 2019 and again in August of 2021. After each iteration, we held a forum and invited a panel of experts to discuss the findings. The results show that the federal government has made substantial progress. The communication and interpretation of findings is now a top area of focus for analysts, and the time analysts spend gathering and validating data has decreased. Further, there is a very high level of confidence in the quality of the data being collected and promulgated by agencies. And perhaps most importantly, data and analytics are creating measurable value for policymaking and governance. Going forward, many view self-service tools as a way to involve more agency staff and the public in analytical work and thereby increase efficiency, productivity, and accountability.

Nonetheless, challenges remain. Those working in government analytics believe that more investment is needed to propel the momentum built over the last few years. In particular, data and analytics teams are focused on recruiting and retaining high quality staff. Other key challenges include educating senior leadership about the value of analytics and managing the influence of politics.

Going forward, we offer several recommendations to support the advancement of evidence-based decision making. The survey results and conversations with leaders in the field suggest that each agency would benefit from developing an enterprisewide data strategy. A comprehensive and detailed roadmap would allow an agency to build a data-driven analytics organization that contributes in substantively meaningful ways to its mission. As part of this strategy, agencies should consider how they will implement self-service models, communicate their work and findings to agency staff and leadership, and initiate pilots that explore possible applications of artificial intelligence (AI) and machine learning (ML) tools.

INTRODUCTION

Since 2014, the Center for Advanced Governmental Studies at Johns Hopkins University has partnered with REI Systems to host a Government Analytics Breakfast (GAB) Forum.

The GAB Forum, which meets four to five times per year, is an opportunity for students, academics, and professionals to discuss how the public sector is tackling meaningful policy and governance challenges using analytics. The Forum has featured over forty speakers and panelists with hundreds of attendees participating onsite in Washington, D.C. and virtually via a livestream. Speakers have included leaders in government and industry, such as those in the positions of chief risk officer, chief data officer, chief technology officer, chief evaluation officer, and chief data officer. One of the hallmarks of the GAB Forum is the robust conversation between the audience members and speakers about the benefits and challenges associated with using analytics in government.

With the passage of the Evidence Act, and accompanying guidance issued by the Office of Management and Budget (OMB), every federal agency is now required to make data accessible to the public and to craft plans for developing evidence to inform policymaking. This legislation has accelerated the federal government's uptake of data-driven decision-making tools and approaches. Many agencies have established analytics teams and others are in the process of creating them.

The GAB Forum conversations, which have frequently focused on the impacts of the Evidence Act, have highlighted the absence of any systematic review of how the government is using analytics and to what end. To address this knowledge gap, we conducted a survey of professionals working in and with government agencies. This report presents key findings from the survey in the context of insights from leaders in the field of government analytics.

The report first provides an overview of the survey methodology and then summarizes the four key findings. The report then dives deeper into the results, first by describing the chief components of government analytics and then highlighting its successes. The next section identifies some of the tools and technologies that will be important for agencies to consider implementing in the coming years. The report then outlines the major challenges leaders face in their efforts to expand their organizations' analytic capacities and concludes by offering concrete recommendations for addressing these challenges.

Methodology

The Government Analytics Survey is a collaboration between the author (director of the Johns Hopkins University Data Analytics and Policy program), REI Systems, and the American Council for Technology-Industry Advisory Council (ACT-IAC, a forum for government and industry leaders to work together toward more effective government). The goal for this survey is two-fold:

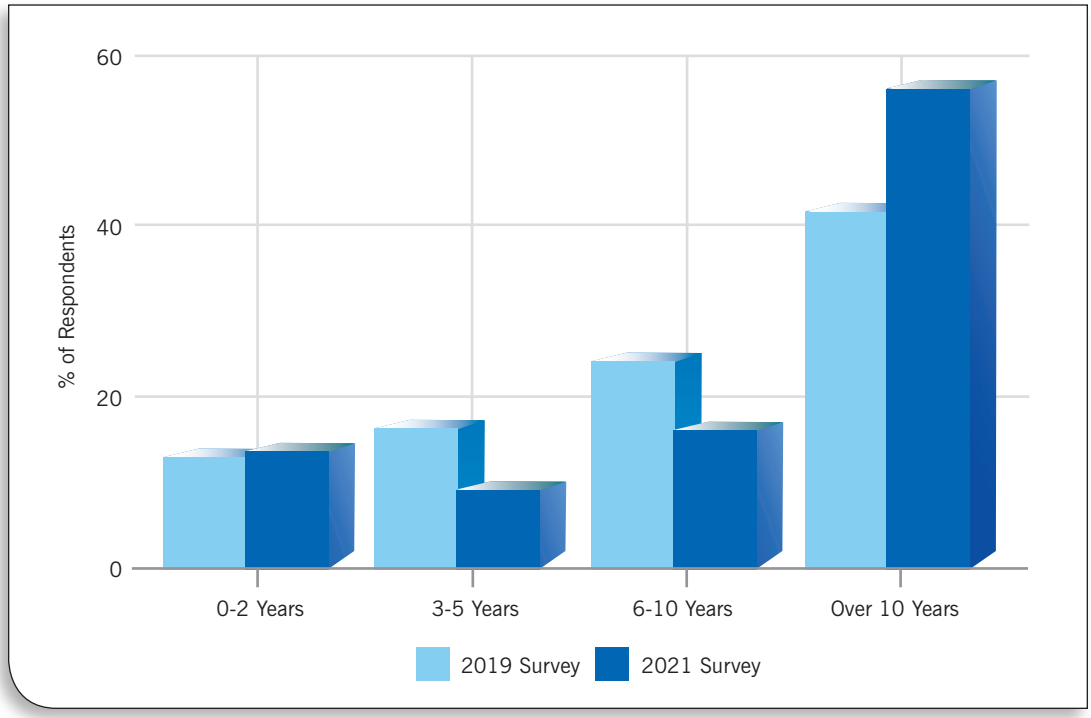
1. Describe how government is using analytics. Who uses analytics in government and for what purposes?

2. Describe the value obtained from the use of analytics in government. What is the impact of analytics on policymaking, program implementation and oversight, and risk management?

The first wave of the survey was conducted in June 2019 and the second in August 2021.[1] For both waves, we invited over 5,000 professionals in the government analytics community to participate in the online survey. The invitees included those who had attended a Government Analytics Breakfast forum event, students in the JHU Data Analytics and Policy program, ACT-IAC members, and relevant LinkedIn connections. Invitees were encouraged to share the survey with relevant colleagues. The responses were anonymous, though respondents could share their contact information if they were interested in answering follow-up questions.

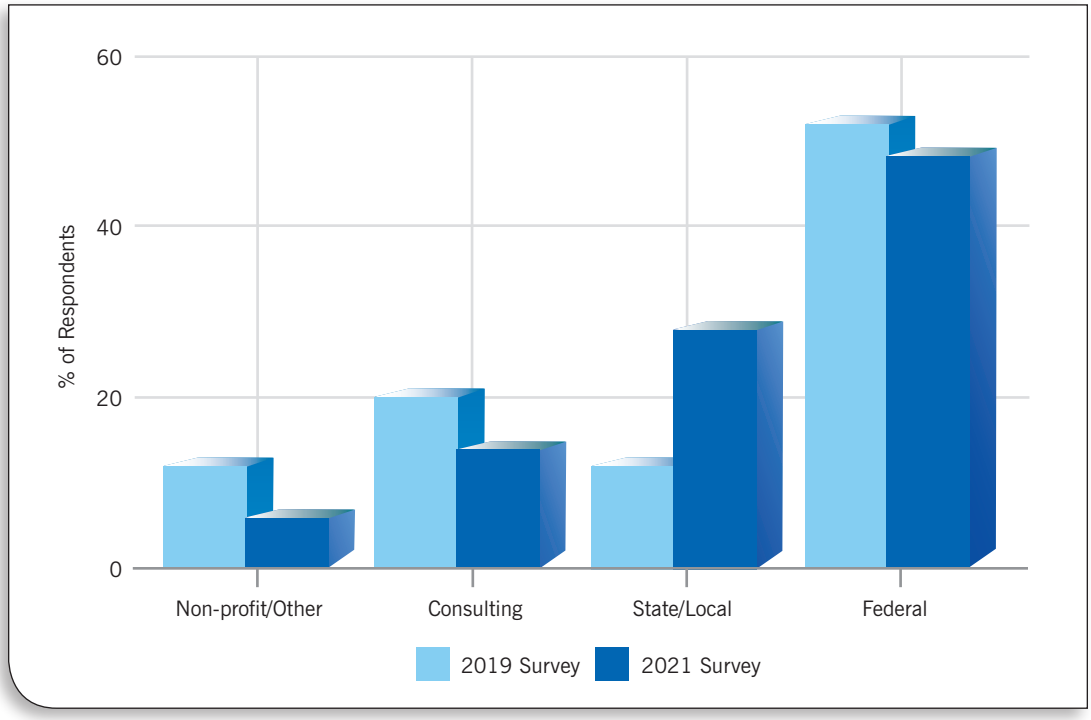
There were 106 completed responses for the first wave of the survey and 144 completed responses for the second. Figures 1 and 2 describe the amount of work experience and sector of employment for the two samples. In both waves, more than two-thirds of respondents possessed five or more years of experience and a substantial portion of respondents possessed over ten years of experience. In terms of sector of employment, approximately half of respondents in both waves worked for the federal government. Both samples also included a substantial percentage of respondents who worked for state and local governments or for private consulting organizations.

Figure 1: Work Experience in Government Analytics



1. Both surveys were pilot tested with a small group of analytics professionals approximately a month prior to administering the final product. The survey was administered using Qualtrics software.

Figure 2: Sector of Employment



Key Findings at a Glance

The results from the survey, and the accompanying panel discussions about the results at our GAB forums, revealed several key findings, summarized here. The subsequent sections of this report dive deeper into the survey results and relevant insights offered by leaders in the field.

- **Communicating and interpreting results now a top focus of analytic effort.** This is in contrast with the first iteration of survey, in which respondents indicated that their top activity was gathering and validating data. Today, those in government analytics are devoting much more emphasis to developing effective communication strategies, recognizing that results can only be acted upon if shared in accessible ways with decision-makers.
- **Data quality is high.** Survey respondents expressed a very high level of confidence in the data being collected and promulgated by their agencies. In short, the government has good data, and a lot of it. Agencies may therefore want to shift some of their focus away from data collection/validation and instead direct resources toward activities and staff that support data analysis and interpretation.
- **Analytics create value.** Both our survey results and discussions with leaders in government indicate that analytics are creating value through improved policymaking and governance. Survey respondents overwhelmingly report improvements in their organizations' mission achievement and performance owing to the use of analytics. Government leaders offer numerous examples of how analytics has added efficiencies and revealed actionable insights.
- **Self-service analytics is a trend that could increase the value of analytics.** As both data literacy and tools for interacting with data become more widespread, self-service models will likely expand. Under a self-service model, users can explore, visualize and analyze data using dashboards and cloud-based tools. With this approach, an organization's analytics team can support users across an agency rather than serving as the gatekeepers for analytics work.

Government Analytics

What is Government Analytics?

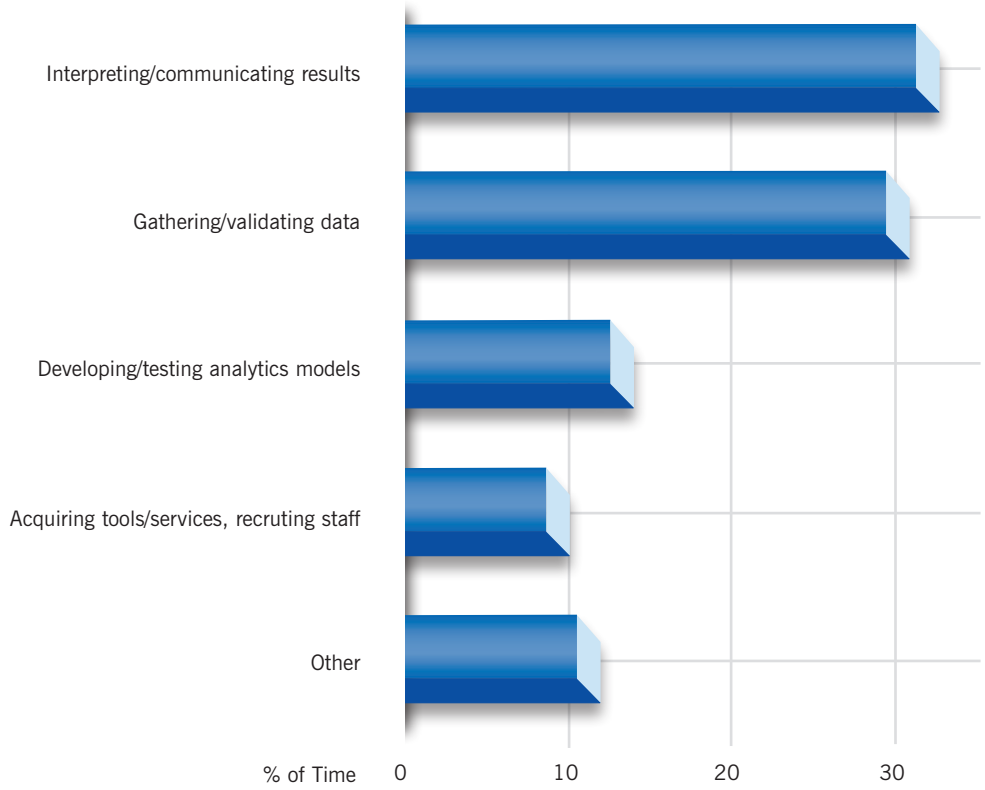
The Evidence Act requires government agencies to make data accessible to the public and to develop specific plans for building statistical evidence to inform policymaking. The law mandates that agencies rethink how they collect, manage, analyze, present, use, and store data. Since its passing (and the release of accompanying guidance from OMB), agencies have engaged both internal and external stakeholders to support implementation efforts.

At our GAB Forum, chief data officers and chief information officers (among other leaders) have highlighted various ways in which agencies use analytics to address meaningful public sector challenges. These examples have provided valuable insights into how agencies can achieve successes through the use of analytics, and they complement our survey's systematic overview of what analytics currently looks like in government.

Collecting Data, Communicating Data

Figure 3 displays the percentage of time respondents indicate that they spend on various analytic activities. Interpreting and communicating data emerged as the top activity, while gathering and validating data ranked a close second. This is a shift from our previous survey, in which gathering data was a clear standout as the most time-consuming activity.

Figure 3: Time Spent on Analytic Activities



Source: Data are from the 2021 Government Analytics Survey (N=144).

Leaders in the field suggest that one reason for this change is the increased automation of data collection. Automation is valuable both as a way to reduce time spent gathering data and also as a means of improving accuracy. Automation mitigates human error, which is very difficult to detect and correct with manual data entry. The Health Resources and Services Administration (HRSA), for example, is currently investigating the value of automated data collection from healthcare providers. Other agencies are likewise examining ways they can harness data that has been collected by existing systems rather than relying on surveys or forms of data collection that require manual data entry.

Beyond mitigating error, automation frees analysts' time, which they can then devote toward communication. Analysts increasingly recognize the importance of effective communication about data to agency staff and senior leaders. To generate real value from statistical findings, analysts need to use common sense language to discuss their real-world meaning and implications.

David Spett, chief data officer at the Bureau of Primary Health Care, explains, "If we're speaking in the same language that we use with other statisticians, it can be like speaking Greek to folks who don't have that same background." He emphasizes the need to become a "data storyteller," that is, someone who can create and present an engaging narrative based on statistical findings.

The shift in emphasis from data collection to communication has important implications for how agencies approach hiring. When developing job listings, we should expect to see a greater interest in attracting candidates with robust communication skills in addition to possessing a rigorous quantitative skill set. Further, we should expect to see this shift influence employee training programs and staff evaluations.

Purpose of Government Analytics

Federal government agencies are using analytics, but to what end? Our results show that *performance improvement* is the top aim of agencies' analytic programs. Over 70 percent of respondents indicated that "improv[ing] my organization's performance and its success achieving its mission" was a primary purpose. A majority of respondents also indicated that supporting major decisions (59 percent) and improving customer performance (65 percent) were top purposes. Reducing costs (41 percent) was the least-selected purpose. It therefore appears to be the case that the risk of an agency's budget being reduced (owing to efficiencies gained from analytics) is smaller than perceived by some leaders.

As a result, leaders who have been concerned about this should feel comfortable leaving aside this worry and focus their organizations' analytical efforts on performance improvement and mission achievement. To achieve these goals, leaders have noted the power of "backwards thinking." This means first identifying a challenge to be addressed or question to be answered and then thinking about what data needs to be gathered and which tools need to be used. A data strategy focused on the end goal has proven effective.

There are numerous examples of how agencies have implemented this model to achieve performance improvement and mission advancement. At HRSA, which is largely a grantmaking agency, analysts are evaluating the impact of predictive analytics for supporting their compliance efforts. The agency has conducted pilots to assess the ways in which predictive models can assist compliance officers with directing their resources toward the highest risk health centers, namely those most likely to require intervention by HRSA. Importantly, this is not a one-off effort. Analysts are continually evaluating their models to improve their accuracy and considering what data can best be used to produce actionable results.

At the Library of Congress, analysts have studied user data for the purpose of developing an organizational modernization strategy that will best serve the needs of Library patrons. Analysts obtained data on patrons' familiarity with different types of technology, their interest in different types of library materials and their satisfaction with services they used. This information was helpful for guiding the agency's next steps for performance improvement.

At the Consumer Financial Protection Bureau (CFPB), the data and analytics team has worked diligently to support performance improvement by making internal processes more efficient. For example, the team examined data collected by the IT services group, including their help desk. The goal of this effort was to reduce the amount of calls coming in by proactively providing more services and resources to agency staff. In addition, the team worked with analysts and auditors across the agency to provide them with tools to assist with report generation. By providing these tools, and training in how to use them, analysts and auditors can now spend less time creating reports and more time interpreting data and communicating the results to decision-makers.

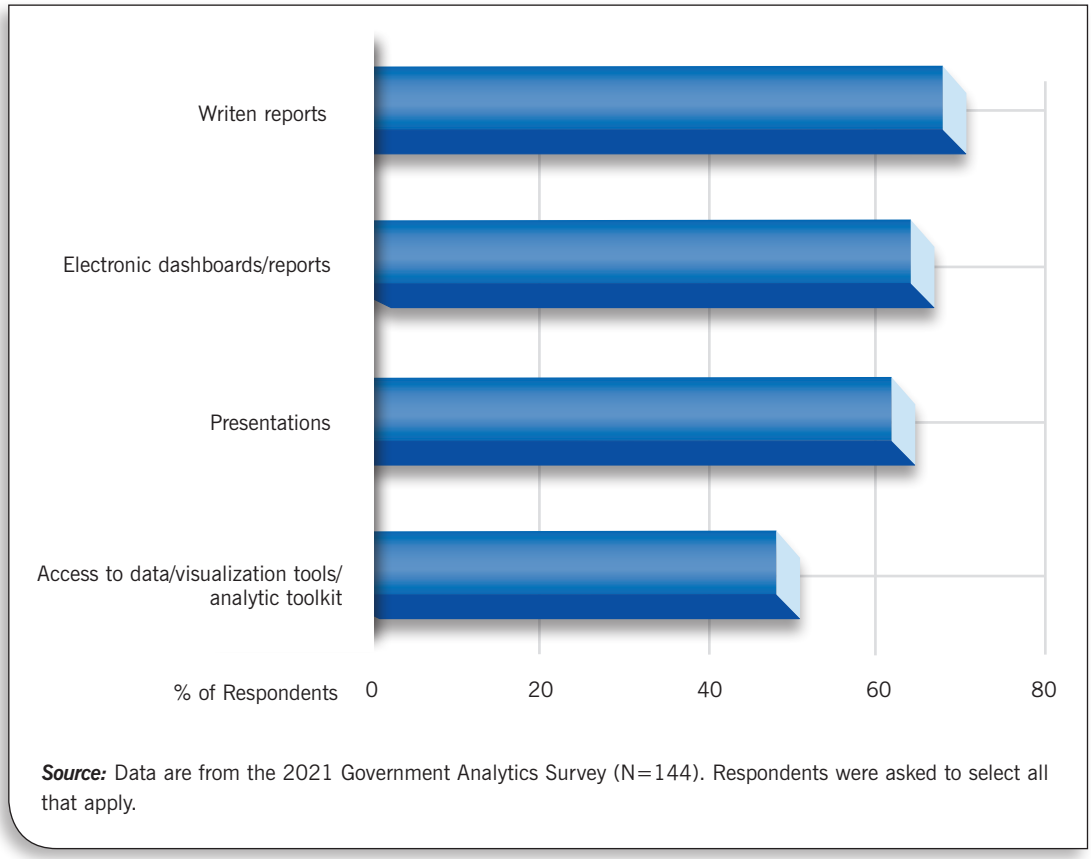
Consuming Government Analytics

Consideration of the ultimate "customer" is critical to achieve improvements in analytic capabilities. The results from our most recent survey show that most respondents (64 percent) view *other employees/colleagues* as the target audience for analytics undertaken at their agency.

This is a shift from our previous survey, in which an organization's *leadership* (either political or career leaders) emerged as the top audience. This finding is echoed in a recent talk by Shannon Files, director of Enterprise Data and Analytics at the CFPB, who explained that her organization largely serves as a centralized support unit for the various arms of the CFPB. She described the many ways in which her data and analytics group assists CFPB employees with gathering, analyzing and interpreting data for evidence-based policymaking. While the group has also developed a database for consumer use, supporting other CFPB employees is a top priority.

With regard to the *format* in which analytics is most often delivered, the top type selected in our survey was "written reports including text and quantified results" (70 percent), though electronic dashboards (67 percent) and presentations (65 percent) were not far behind (see Figure 4). Only 51 percent of respondents, however, indicated that they frequently share analytics via access to data or other tools that support "self-serve" analysis and visualization.

Figure 4: Format of Delivered Analytic Products



Source: Data are from the 2021 Government Analytics Survey (N=144). Respondents were asked to select all that apply.

Successes of Government Analytics

There is a growing interest in the government analytics community in developing self-service tools for agency staff. Data and analytics organizations within agencies have recently focused on provisioning business intelligence tools for widespread use, and on providing data literacy opportunities to educate staff on how to analyze, visualize, and interpret data. Some agencies have designed data science teams to serve as a centralized unit that is available to support staff in their analytic efforts throughout the agency. In this way, the data science team does not necessarily conduct or even oversee an analysis, but instead supports substantive experts with their own analytic work.

Over the past decade, investments in government analytics have yielded observable and meaningful successes. Today, it is clear that most in this community believe the government is promulgating high quality data, using that data to create value, and securing buy-in from those in career and political leadership positions that evidenced-based policymaking is a worthwhile goal.

Good Data

In our sample, 38 percent of respondents expressed a “high” level of confidence in the data promulgated by their agency, while an additional 43 percent expressed “some” confidence. Only 5 percent of respondents indicated “minimal” confidence in their agency’s data. This is a reassuring finding, as good data is essential to developing valid analyses and fostering trust among all stakeholders.

Having achieved this level of confidence in data quality, some wonder whether government agencies should now take a more discerning approach to data collection projects. The government (like some private entities) collects an enormous amount of data, but only has the need and capacity to analyze a small portion of this data. To be sure, there is additional, not-yet-collected data in the universe that would be valuable to have, but in many policy areas, the amount of data collected exceeds what is needed. Or, data has been collected in such a way that it does not have substantial long-term value. Christopher Chilbert, chief information officer at the CFPB, suggests that analytics teams address the following questions when considering a data collection project:

1. What is the value from the (proposed) dataset?
2. What is the feasibility of scaling the dataset?
3. What is the sustainability of the data collection project?

Mr. Chilbert explains that there are trade-offs to collecting more and more data. It takes an investment of resources, both in terms of time and technological infrastructure, to collect, store and manage data. There should be a clear goal for every data collection project with an end user in mind.

Further, data collection projects should be scalable. One-off projects rarely deliver the kind of value government agencies need to advance their missions. Relatedly, a data collection project should be sustainable, meaning it should continue over time. For both regulatory and nonregulatory agencies, data collected at just one point in time for a small sample yields far less value than data collection projects designed to create time series with large numbers of observations. Agencies should recognize the costs associated with data collection and therefore give careful thought to the value, feasibility, and sustainability of any proposed project prior to embarking on the gathering process.

Value Creation

Another success of government analytics has been the value added to policymaking and governance. According to our survey, 57 percent of respondents indicated that their agency's use of analytics improved its mission achievement (i.e., improved outcomes for service beneficiaries or improved regulatory outcomes) by more than 5 percent in the last twenty-four months, and 51 percent of respondents indicated that analytics improved their agency's performance (i.e., how well the organization is operating) by more than 5 percent in the last twenty-four months.

There are several ways in which analytics create value for federal agencies. First, they provide critical context for important decisions. Often this is context leaders did not have before the creation of an analytics team within an agency. Analytical results, in conjunction with qualitative information, empowers leaders to select the best course of action when presented with a decision point. In our survey, 80 percent of respondents indicated that "planning improvements" is among the most important type of success their office has achieved using analytics.

Agency leaders have started to take note of the successes experienced by other agencies through the use of analytics. Recognizing the value of analytics for informing strategic decisions, Michael Conlin, formerly the chief data officer for the Department of Defense, noted that the defense and intelligence communities are ripe areas for further exploring the use of analytics to guide decision making. And while data-sharing may run counter to the "loose lips sink ships" ethos, particularly in the defense space, broader collection and collaboration efforts have the potential to yield markedly better outcomes in this area.

Beyond supporting the decision-making process, analytics have produced important efficiencies. Automation tools help speed up data collection and analysis, and improve accuracy. Data scientists at the General Services Administration, for example, developed a machine learning algorithm to determine whether government requests for technology proposals comply with accessibility regulations. With thousands of solicitations active at any given time, it would be impossible to check each one for compliance manually. With less time spent on data "grunt work," analysts can devote more of their time to analysis, interpretation, and communication.

Some leaders have expressed concern that there is a risk that the use of analytics could be used against them. In particular, there is a fear that more efficient operations could lead to budget reductions with the idea that agencies operating more efficiently need fewer resources. In practice, however, this fear has proven to be unfounded. Mr. Chilbert has observed that, in fact, the opposite is true. In his experience, organizations that demonstrate that they are providing value to and advancing the mission of an agency are more likely to see an increased investment of resources, even if some of that value takes the form of improved efficiency.

Leadership Buy-In

Increased support from agency leadership has been another major area of success in government analytics. When senior leaders favor the expansion of a data and analytics organization at their agency, they are much more likely to help create the kind of cultural change needed for effective evidence-based policymaking. Experts in the field offer a number of suggestions for obtaining leadership buy-in:

- **Address the concerns and hesitations expressed by senior leaders.** It is part of human nature to be skeptical about change, and agency leaders are certainly not exempt from this inclination. To build trust, it is important to acknowledge that data is not going to solve every problem an agency faces. In other words, Mr. Chilbert explains, those in analytics should be mindful to avoid over-promising the value of data or to frame evidence-based policymaking as a complete 180 degree turn from a previous framework used for decision-making. Instead, analytical results should be framed as one of several important decision-making inputs that should be interpreted in context. Further, leaders should be encouraged to view analytical results with the same degree of skepticism they would apply to any piece of information that influences a key decision.
- **Deliver analytics in advance of when a decision must be made.** Like all decision-making inputs, analytics results are only useful if provided in a timely manner. Senior leaders need opportunities to receive data and analytics in advance of when they need to make

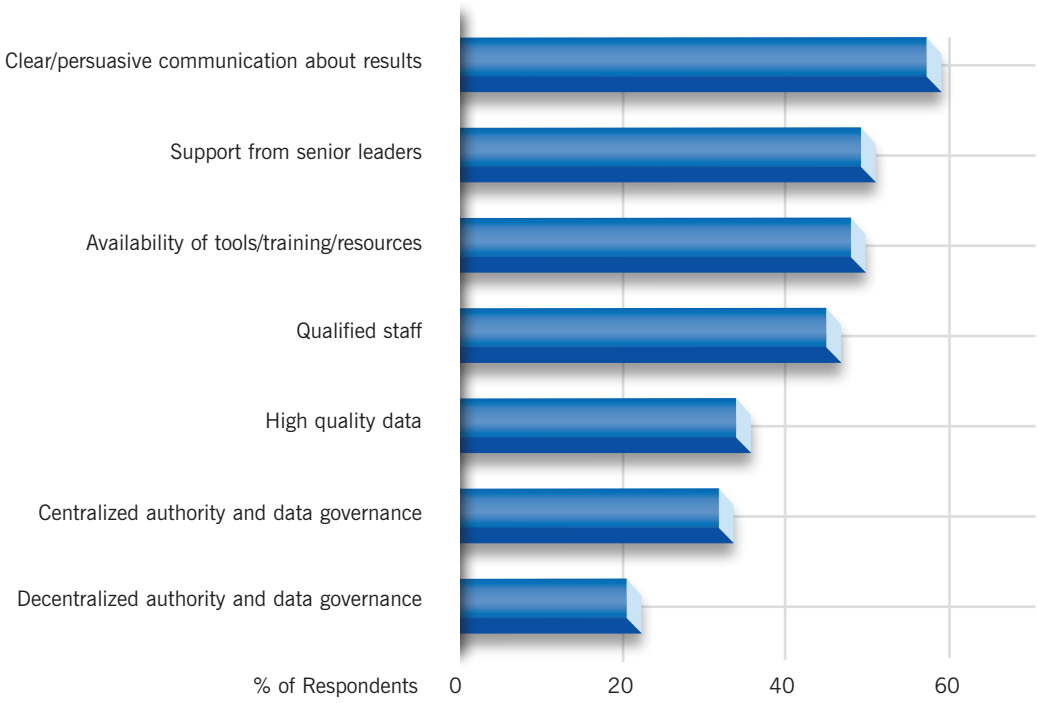
decisions. If analysts know that an important decision is on the horizon, the analysts should lay groundwork early for an evidence-based approach. Giving leaders time to digest analytics and apply the results to a decision helps forge the trust and comfort that feeds buy-in.

- **Build bridges between analysts and senior leaders.** One of the jobs of an analytics group leader is to build bridges between the leaders of an agency, who are tasked with policy-making responsibilities, and the junior analysts who have data skills and expertise. This needs to be a two-way relationship. Senior leaders are best positioned to identify upcoming decisions that will be important. This provides critical strategic guidance for analysts, so they can avoid using every possible technique on every possible dataset with no concrete goal in mind. In short, it prevents analysts from approaching their work with a "find something interesting" mindset and allows them to target their work toward addressing a specific issue or question.

Moving in the other direction, analysts can help senior leaders understand what is possible to learn with analytics. Analysts can support leaders in their effort to craft meaningful policy questions by showing them different ways of extracting insights from data. When leaders understand how data can be used, they can develop better questions for analysts to pursue.

In our survey, respondents indicated that the top two significant factors for success in government analytics are "clear/persuasive communication about the results of analyses" and "persistent, visible support from senior leaders" (see Figure 5). In both the public and private sectors, the availability of analytic resources and tools, as well as staff to use them, has improved markedly in the past few years. With this foundation in place, analytics groups are now able to focus more on communicating their results and building relationships with senior leaders that are key to long-term success.

Figure 5: Most Significant Factors for Success



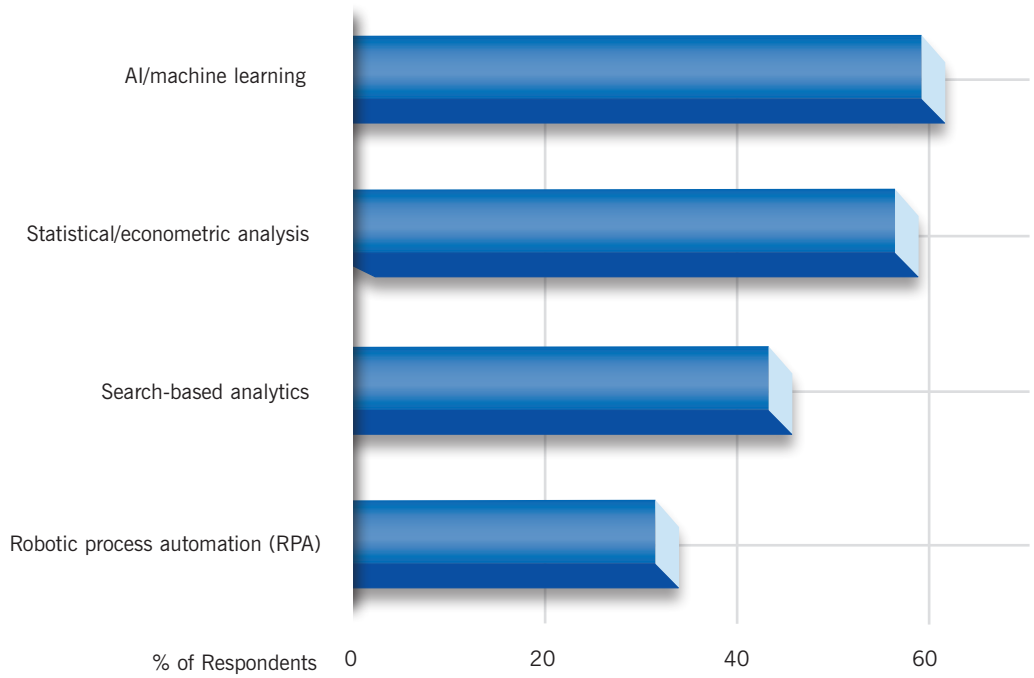
Source: Data are from the 2021 Government Analytics Survey (N=144). Respondents were asked to select their top three choices.

One way in which more leadership buy-in has bolstered government analytics is that it has facilitated better collaboration across agencies. For example, HRSA's Bureau of Primary Healthcare has been particularly focused on health centers' COVID-19 response and how they are treating Americans sickened with the disease. The Bureau has been able to obtain important data from the CDC that has allowed analysts to develop a clear understanding of what is happening at the health centers HRSA oversees and the communities served by the centers. Without a strong belief in the value of analytics among agency leaders, this kind of data sharing would be much more challenging.

Emerging Tools and Technologies in Government Analytics

Most of those in the field agree that artificial intelligence and machine learning (AI/ML) tools are at the forefront of government analytics. In our survey, AI/ML analyses emerged as the top choice among respondents when asked which area of analytics holds the most promise (see Figure 6). In the first wave of the survey a few years ago, "statistical analysis" was the top choice. Among those who report using AI/ML tools in the past six months, Python was the clear favorite (75 percent). Other tools, including Azure ML Studio (36 percent), R/RStudio (32 percent), AWS SageMaker (20 percent) and Databricks (9 percent), are being used as well, though to a far lesser extent.

Figure 6: Most Promising Emerging Technologies



Source: Data are from the 2021 Government Analytics Survey (N=144). Respondents were asked to select their top two choices.

Mr. Spett explains that, at the agencies where he has worked, the primary focus of analytics groups continues to be on descriptive statistics and some predictive modeling. There have been some relatively small pilots and proof-of-concept projects conducted as one-off efforts in the AI/ML space that have been undertaken by teams of skilled data scientists. These efforts have investigated ways in which AI/ML tools might be useful for advancing agencies' missions.

At HRSA, for example, AI/ML might be useful for collecting and analyzing patient-level data for the purpose of determining which patients might be most vulnerable to certain health conditions and therefore most likely to benefit from particular interventions, including medication. These tools would track patients anonymously using identifying numbers rather than names (or other de-anonymizing information) to protect individuals' privacy.

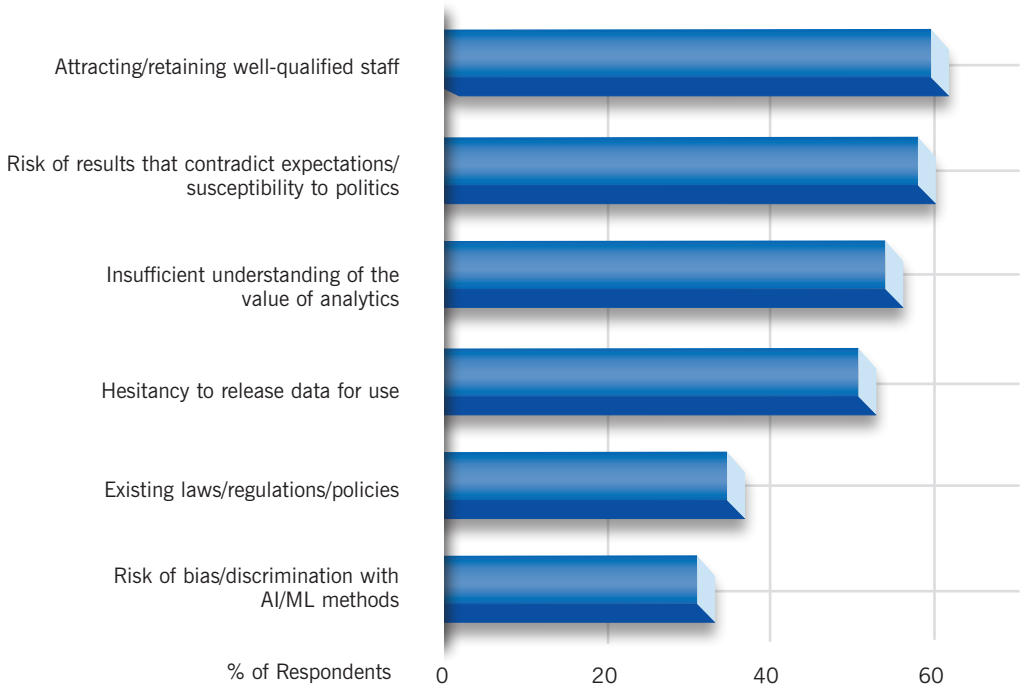
Mr. Spett notes, however, that it is important to view AI/ML tools as the logical extension of existing analytic efforts. He explains, "AI is an evolutionary piece, not a revolutionary piece, of a data strategy." This is a valuable perspective both to secure leadership buy-in and to ensure that an agency's data strategy remains focused on tackling the substantive issues at hand, rather than on using innovative tools for their own sake. The use of AI/ML methods should not be viewed as a paradigm shift, but instead as an expansion of tools available that might provide better insights in some circumstances.

There is significant variation in the specific tools and emerging technologies being used at government agencies today. As the amount of data being collected and analyzed grows, agencies are increasingly using cloud-based analytics platforms, such as Databricks and Snowflake. But any analytics group will need multiple tools and platforms, as different ones are better suited for different tasks, including conducting statistical analyses, developing visualization, and managing data. Moreover, analysts must adapt to the ever-changing technology landscape as new analytical tools are constantly being developed. Mr. Conlin reminds us, "the state-of-the-art advances every day."

Challenges Going Forward

Despite the evident, measurable progress in the field of government analytics, many challenges remain. Figure 7 shows the factors that survey respondents view as the most significant challenges currently facing government analytics. The results reveal a wide distribution; there is not a single challenge that stands out as the biggest. Instead, multiple issues need to be addressed to further advance the field.

Figure 7: Most Significant Challenges



Source: Data are from the 2021 Government Analytics Survey (N=144). Respondents were asked to select their top three choices.

Resource Investment

Figure 7 shows that a majority of respondents (56 percent) believe that, generally speaking, there is too little funding for government analytics across the federal government. This feeling also emerges when respondents are asked about their own organization's resource investment. Two-thirds of respondents indicated that their organization spends too few resources on analytics while nearly one-third believes their organization spends the right amount.

Public sector leaders offer three pieces of advice to those looking to increase investment in their analytic resources:

- **Demonstrate good stewardship.** Most importantly, analytics groups seeking more resources should demonstrate that they are responsible stewards. They should make a compelling argument for how they will use the additional resources to make wise investments in projects and tools that add value to the agency. This is a self-perpetuating achievement. If a team demonstrates that they are wise investors, more investment is likely to flow its way.

The importance of proving responsible stewardship is also an argument in favor of generating small wins. Analytics teams (particularly new ones) should look for ways to provide value on a small scale over short time periods rather than focusing solely on long-term projects.

Further, responsible stewardship means acknowledging failures (or less than desirable outcomes) and learning from them. Analytics teams that double down on a tool or approach that is not working are unlikely to be perceived as wise managers of scarce resources.

- **Conduct a gap analysis.** When requesting additional resources, it is beneficial to present leaders with a clear description of the gap between the current state of the analytics team and the vision for what that team could be. To accomplish this, it is useful to develop workload measurements, which quantify the amount of time it takes to complete particular tasks.

  The gap analysis should first identify the tasks the team needs to perform, the skills needed to accomplish these tasks and the infrastructure needed (i.e., hardware, software, cloud computing). The analysis can then demonstrate which of these human capital and infrastructure items the team needs to accomplish the tasks identified.

  Chief information officers (CIOs) and chief data officers (CDOs) report that this is much more effective approach than a general request for additional staff to build out a team. Instead, for example, a team might request two staff members who can use Python for natural language processing to undertake a project to develop a systematic understanding of the content expressed in public comments submitted to an agency regarding a proposed rule.

- **Communicate the value-add of new technology.** Related to the previous point, if a team would like investment in new technology, it must articulate how that technology will help an agency better advance its mission. Sometimes data scientists become enamored with a new tool or method simply because it is on the cutting edge of the field. While innovative ways of drawing insights from data are exciting to anyone who believes in data-driven decision-making, analysts need to draw clear connections between new technologies and outcomes of interest to convince leaders to make investments.

  Some argue that a singular focus on mission achievement is problematic, in that it precludes the possibility of identifying new goals worth pursuing. In the private sector, more "out of the box" thinking and experimentation is sometimes highly valued, particularly among venture capitalists. Rob Ness, general partner at Asymmetry Ventures (a Silicon Valley venture capital fund), explains that government is often hindered by its distaste for contrarian ideas and fear of failure. He suggests that agencies should devote a small portion of their funding toward innovative ideas that fall a bit outside the scope of its stated mission, with the hope of uncovering new ways to better serve agency stakeholders and beneficiaries. Further, he argues that agencies should create an environment conducive to innovation by tolerating some reasonable level of failure. In short, agencies should encourage some risk taking by supporting those who try, even if a project does not pan out as hoped.

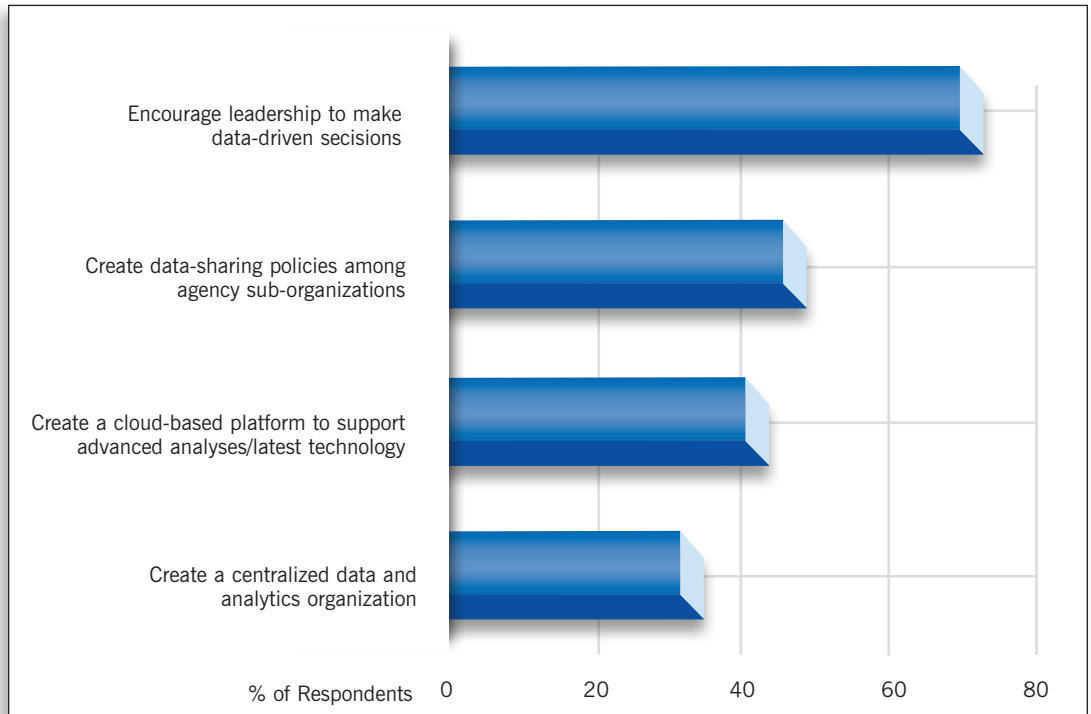
  Certainly not all agency leaders will be convinced of the value-add of contrarian thinking and risk taking by an analytics team. A team should consider what its agency's leaders view as contributing to the agency's success when developing an argument for investment in new technology.

Staff Recruitment and Retention

New technology is, of course, only useful to the extent there are staff who can harness its power. As noted in Figure 7, "attracting/retaining well-qualified analytics staff" emerged as the most significant challenge facing government analytics. Analytics team leaders should create a staffing plan that aligns with the interests of job seekers and needs of agencies. To improve recruitment, the plan should address the following questions that are likely to be top of mind for job applicants:

- **Does the agency have an analytics-friendly culture? Job seekers in analytics are interested in positions where their work will be valued by leadership.** One of the biggest reasons to work for a federal agency is that you care about its mission. Analysts want to help advance that mission through evidence-based policymaking, so it is important that agency leaders and other staff share this interest. As Figure 8 highlights, "encourage[ing] agency leadership to make data-driven decision" is the top approach, by a large margin, currently being taken to attract analytic talent.

Figure 8: Approaches Being Taken to Attract and Retain Talent



Source: Data are from the 2021 Government Analytics Survey (N=144). Respondents were asked to select their top two choices.

- **Will the agency provide an opportunity to use modern analytics tools? Analytics team leaders across the government emphasize that attracting talent requires "tooling up."** Analysts want to be able to use the latest software and cloud-based tools to collect, manage, analyze, visualize, and present data. Further, they are interested in opportunities to pilot innovative ideas, such as the application of AI/ML methods to intractable problems.

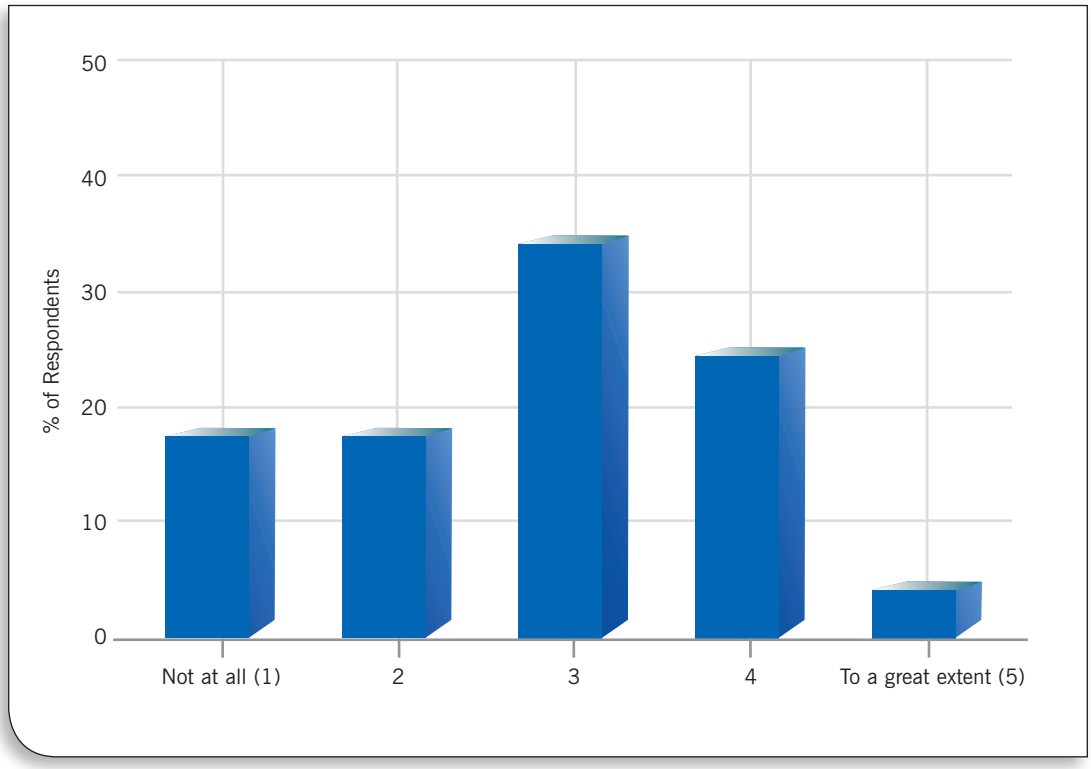
- **What are the opportunities for career growth? Job seekers want to be sure there is a path for advancement when considering an analytics position.** Most younger job seekers, however, do not envision a decades-long commitment to a particular organization (i.e., the kind of career path they have observed frequently among those in their parents' generation). Dr. Collin Paschall, senior lecturer in Data Analytics and Policy at Johns Hopkins, has noted that millennials expect to hold many different jobs over their careers. Agencies should foster a culture that encourages employees to expand their toolkits and even participate in rotations that allow them to experience a variety of roles within and possibly across agencies.

In sum, government agencies can successfully compete for talent by cultivating an analytics-friendly culture in which analysts are given opportunities both to use the best tools available and to advance their careers. These factors, combined with the ability to make a meaningful difference in peoples' lives, can ensure that agencies are able to attract and retain high quality analytics staff.

Staff and Leadership Knowledge

One of the biggest limiting factors in government analytics is the knowledge gap between leadership and junior analysts. When asked in our survey about the most important inhibiting factors to adopting emerging technologies, the most popular answer (49 percent) was limited knowledge among leadership. Further, only 18 percent of respondents indicated that their organization's executive leaders and managers use analytics "to a great extent." Figure 9 displays the distribution of responses to this question. There is significant variation across agencies, and there are many leaders who could increase the extent to which they rely on analytics as a key decision-making tool.

Figure 9: Perceived Use of Analytics among Organization Leaders



As noted earlier, there is a consensus in the field that building bridges between leaders and analysts is crucial for cultivating an analytics culture and ensuring that analytics are used effectively. Some have suggested that one way to accomplish this is through the implementation of "reverse mentoring," where senior officials are paired with new analysts, who can educate senior staff on emerging techniques.

Agencies may also want to consider expanding in-house educational opportunities for both leaders and analysts. Through workshops, leaders and analysts can engage in applied exercises that serve to both introduce leaders to new tools and methods and build relationships between leaders and junior analysts. This exercise can give participants an opportunity to tackle a real-world challenge using analytical techniques in a collaborative setting. These workshops can be developed and led by either in-house staff or external organizations.

Political Pressures

A final challenge highlighted by leaders in the field is politics. Senior leadership of federal agencies are comprised of at least one, but often several layers of political appointees. While many of these leaders have expertise in the policy areas they oversee, they are nonetheless part of the political leadership of an administration and play an important role in advancing that administration's agenda. As Figure 7 shows, 60 percent of the respondents in our survey indicated that the risk of analytics contradicting expectations and the susceptibility of analytics to politics constitute a significant challenge facing analytics groups.

Even leaders of independent agencies, whose authority enjoys greater insulation from executive power, are nonetheless subject to political influence. Many of these leaders, for example, hope to pursue careers beyond their tenure as political appointees. They are well aware that their likelihood of continued career success is usually improved by cultivating a positive, rather than contentious, relationship with the administration.

This is not to say that agency leaders disregard analytic evidence, but the political landscape is certainly among the factors considered as part of any significant policy or governance decision. Analysts should keep their focus on developing the best evidence possible to advance an agency's mission, but may find it helpful to stay aware of the political considerations that leaders must address as part of the decision-making process. This can assist with the communication of results and the framing of key findings.

Recommendations

Drawing from the lessons learned across the surveys and insights from senior public sector leaders, there are four "big picture" recommendations agencies should consider as they seek to develop robust and effective analytics teams.

Craft an Enterprise Analytics Strategy

It is essential that any organization interested in launching (or overhauling) an analytics group develop a strategy that covers analytics activities across the enterprise. This strategy should include the following components:

Alignment of organization goals and analytics objectives. It is important to define, with clarity and specificity, the goals of the organization and how the analytics group will support or contribute to the advancement of those goals. As part of this effort, it is helpful to develop a set of proposed projects or types of analysis that will help meet these goals**.**

- **Feasible and sustainable processes.** An enterprise analytics strategy should establish processes that work, in practice, and that can be repeated to meet incoming analytics queries and needs. Establishing these practices is aided by a number of factors, such as a good partnership between the chief data officer and chief information officer, a staff that possesses a strong analytics skill set and the ability to develop mission-relevant reports and analyses. Once a new analytics group has accrued some small successes, it can make the case that its practices work and it should be trusted with bigger, longer-term projects.
- **Cultural change.** The strategy should include efforts to cultivate a culture of evidence-based decision-making. This can be achieved, for example, by framing components of the Evidence Act as best practices rather than simply as matters of compliance. This means developing plans to ensure that data that is gathered is utilized, unnecessary data is not collected and analyses are mission-driven. Further, creating real cultural change requires leadership buy-in, which can be advanced by delivering relevant analytics in a timely manner and addressing concerns about an overreliance on analytics.
- **Centralized support.** Agencies, including the CFPB, have designed their analytics group to serve as a centralized support unit and found this to be a successful structure. In this arrangement, the analytics group offers support to all arms of the organization, assisting with data collection, data management, analysis and the presentation of results. The analytics group serves as an in-house consulting unit for the evidence-based decision-making taking place across the organization.

Who should do this? An agency's chief data officer is typically the person who takes the lead on developing this strategy, in consultation with other agency leaders and analytics staff. The strategy should be informed by the Federal Data Strategy issued by OMB, which provides a detailed framework.

Develop Self-Service Models

There is a strong interest in the governmental analytics community to promulgate self-service tools for both agency staff and the public. Mr. Chilbert explains that sharing more data with the public and enabling self-service (with appropriate privacy protections in place) will broaden what we learn from data. This will have the dual effect of helping agencies operate better and improving trust in government. Increased public and staff access to data and analytical tools improves transparency and accountability, both of which are crucial for sustaining a healthy democracy.

Who should do this? CDOs, with the assistance of data-focused officials in their organizations, should consider proposing these models to agency heads and other agency leaders whose offices use data, such as evaluation officers and performance improvement officers. After developing sufficient support for and interest in these models, CDOs can then initiate their development.

Focus on Communication

The ability to communicate results and their meaning is currently the most underappreciated analytic skill. Analytic teams should approach their hiring and staff training with this in mind. There is a growing appreciation that analysts need to be "data storytellers." They need to develop narratives that communicate the real-world meaning of analytic results, their implications and the limitations of the research. Further, these narratives should be accompanied by pictures (i.e., tables and graphs) that are easy to read and insightful.

Who should do this? CDOs should aim to create a data culture that emphasizes the value of communication. They should encourage their staff to develop their "storytelling" skills in the context of communicating statistical findings to other agency officials and the public.

Plan AI/ML Pilots

With a user-centric lens, analytics groups should identify valuable applications of new methods, including AI and ML tools. The objective, as always, should be to address end-user needs, but piloting the use of these tools and methods is also an opportunity for analysts to uncover their best value and increase awareness. Pilot projects illuminate the potential benefits of AI/ML approaches for various types of applications while also motivating an intellectually curious (and highly mobile) workforce.

Who should do this? Data analysts and data scientists can take the lead on proposing pilot ideas to organization and agency leadership. They should be sure to explain the substantive value of a proposed AI/ML pilot. As leadership develops a greater appreciation for the possible applications of AI/ML methods, they may then suggest ideas for analysts and data scientists to explore.

Spotlight: Creating an Analytics Organization at a "Startup" Agency

The Consumer Financial Protection Bureau was created by the Dodd-Frank Wall Street Reform and Consumer Protection Act (2010) with the mission of rooting out deceptive practices and protecting consumers in the financial space. The CFPB launched its operations in July of 2011, alongside the beginning of the modern data boom. The data and analytics team at CFPB consisted of three people when the agency launched, and today the group is composed of about twenty federal employees divided into five teams that support the Bureau with an enterprise approach.

Shannon Files, director of Enterprise Data and Analytics at CFPB, spoke at the Johns Hopkins Government Analytics Breakfast Forum about her effort to build a data and analytics organization at a "startup" government agency. Ms. Files emphasized that there was a commitment to data from the inception of the agency, and as a result, the organization did not have to struggle to obtain the necessary infrastructure, including hardware and software. Although the team wanted to jump to the top of the "data science hierarchy of needs pyramid" and immediately begin implementing AI and machine learning tools, Ms. Files quickly realized the need to establish a strong foundation focused on data gathering, cleaning and storage.

In 2012, about a year after its creation, the organization released its consumer complaint database, which serves as a direct line to the consumers the agency serves. In 2014, the organization developed a self-service business intelligence platform to make data and tools easily accessible to employees throughout the agency. In recent years, the organization has focused on implementing a cloud strategy and supporting efforts throughout the agency to use AI and machine learning methods to better protect financial consumers.

Ms. Files attributes the success of the organization's launch and development to several key factors, a number of which are echoed by respondents to the Government Analytics Survey:

- **Sharing data across agencies.** One of the first steps taken by the fledgling organization was to establish memoranda of understanding with several other regulatory agencies to facilitate data sharing. This allowed the organization to amass a large of quantity of data early on and move quickly into conducting analyses. From the start, the organization was prepared to manage big data in various formats.
- **Providing self-service tools.** The organization developed an enterprise platform it used to provide access to data and tools to support efforts throughout the agency. The organization tries to use open-source tools, such as R and Python, as much as possible while recognizing the diversity of users' skills sets across the bureau.
- **Supporting data literacy.** The organization worked hard to educate and support bureau employees at all levels of analytic expertise. For example, Ms. Files described how the organization has helped employees learn how to use relational databases (versus flat files) when a particular application calls for leveraging that data.
- **Marketing the organization's value.** A good analytics organization must tout its capabilities. A team of incredible data scientists can only help advance an agency's mission if its expertise is put to good use. Ms. Files's organization devotes substantial effort to communicating the various ways it can support agency staff.

The success of the data and analytics organization at the CFPB provides valuable lessons for other agencies working toward strengthening their analytics programs.

Spotlight: Communicating Risk to Government Leaders

The Transportation Security Administration (TSA) is tasked with regulating security across all modes of transportation in the U.S., including airports, buses, freight and passenger rail, mass transit, and pipelines. It is simply not possible to regulate every aspect of transportation at the same level at all times, so TSA employs an analytic framework to assess threats, vulnerabilities, and risks. The purpose of this framework is to leverage data to identify which vulnerabilities to address and with which mitigation measures.

Patricia Cogswell, former deputy administrator for the TSA, outlined this framework for attendees at the GAB Forum. The framework could be applied to any area in which mitigation measures are used to address risk, such as public health. The key concept is that the level of risk is determined by a combination of the threat level, vulnerability, and ultimate consequence. For example, if the expected consequence of a scenario in which there is a high threat level and high level of vulnerability is that five people are required to spend an extra two hours waiting for their transportation, it is reasonable to classify this as low risk. If, on the other hand, a scenario has medium threat level, low level of vulnerability, but the expected consequence is that thousands of people would lose their life, it might be classified as high risk. In practice, analysts develop these threat, vulnerability and consequence assessments using data and analytics.

Once the level of risk is determined, analysts then assess the expected impact of mitigation measures. Costly mitigations might have a minimal impact on risk levels, while a smaller or inexpensive mitigation might have a large impact. Analysts rely on the gathered data to drive their conclusions about the potential impacts of a proposed mitigation measure.

One important way the TSA gathers relevant data is through testing. There are three types of testing TSA undertakes: overt, covert, and double blind. With overt testing, both the tester and the system being tested are aware of the test taking place. With covert testing, the tester is intentionally trying to get an object or material through a system that is unaware of the specific test taking place. And with a double-blind test, both sides are unaware when a particular test takes place. Often these tests are focused on new threats (i.e., new materials or objects) to determine the extent to which systems designed to address known threats are capable of addressing new ones.

When possible, TSA conducts index testing. Under this approach, TSA conducts enough covert tests that they can quantify the vulnerability of its systems at multiple checkpoints as well as the end result. This approach helps detect the most useful points of intervention. For example, an index test might reveal that a system is 90 percent effective, and that reaching a 95 percent level of efficacy would require an incredibly expensive modification. Or, a test might show that a system is 40 percent effective and that implementing a relatively inexpensive modification would increase the effectiveness by 20-30 percentage points.

A measurement challenge associated with quantifying risk is calculating deterrence. Mitigation measures work by both stopping in-progress malicious activity and deterring bad actors. While index testing quantifies the first, measuring the second is very difficult. It is hard to determine the extent to which a mitigation measure changes the calculus of a bad actor such that they select a different target or abandon their plans altogether. Nonetheless, deterrence is a crucial risk reduction factor.

Spotlight: Communicating Risk to Government Leaders (cont.)

Of course, the level of risk that the public or oversight bodies can tolerate is hard to determine. A goal of 100 percent effectiveness in all places at all times is unattainable. But what is good enough? This is a policy question that analysts can help leaders answer by situating quantitative findings in the analytic risk framework described above. Ms. Cogswell draws an analogy between mitigation measures and prescription drugs. The Food and Drug Administration considers the improvement in patient health (benefit) and side effects (cost) when making a drug approval decision, recognizing that no drug works 100 percent of the time with no side effects. Likewise, good risk mitigation measures should improve outcomes with tolerable side effects.

In addition to quantifying risk, the TSA must also address how quickly a vulnerability or gap must be addressed in light of current intelligence. For example, in the face of an imminent attack, the TSA might need to implement a fast and effective mitigation measure that would deeply inconvenience many people. In contrast, if the intelligence does not suggest an attack is imminent, TSA might take more surgical efforts that take time to implement (such as installing new surveillance technology).

TSA leaders brief oversight bodies in both public hearings and private briefings. Communicating effectively about risk levels, mitigation priorities and budget requests in these arenas is critical but challenging. There is no objectively correct balance of risks and costs. Ms. Cogswell has found that using data to compare and contrast risk levels across different types of transportation or different locations helps oversight bodies understand TSA's resource allocation decisions. These comparisons provide a context for evaluating the merits of TSA's priorities and requests.

CONCLUSION

There has been tremendous progress in the field of government analytics over the last decade, and the next steps should focus on communication and coordination. Until very recently, federal agencies have acted independently in their analytical work and advancement. There has been experimentation and innovation, and several agencies have developed highly effective data and analytics organizations. The implementation of the Evidence Act is an opportunity for all agencies to take stock of their analytics needs and chart a path forward.

Beyond establishing an analytics infrastructure (including hiring staff and procuring tools), improving communication should be a top priority. Analysts must be able to communicate their findings to agency staff and leaders. They should be deliberate in their use of commonsense language to discuss statistical results and their implications. The COVID-19 pandemic has underscored the difficulty and importance of discussing statistical findings in a manner that is precise, contextualized, and accessible. The demand for analysts who can tell stories with data will continue to increase as the field advances.

A related need is better coordination within and across agencies. Increased data sharing across agencies will reduce duplicative data collection efforts and ensure that data that is collected is put to its full use. Datasets are frequently relevant to multiple areas of policy, and thus multiple agencies. Health data, for example, is pertinent to not only healthcare agencies but also education and environmental research. As data management systems continue to improve, agencies should focus on establishing processes and policies that decrease the administrative burdens associated with data sharing.

There have been great strides in the field of government analytics, and choosing the next steps wisely can position the field for even better results. There are many passionate and dedicated leaders and analysts in the field who are eager to help implement these steps to advance the field and better serve the citizenry.

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All opinions expressed and implied in this report are solely those of Dr. Bachner and do not represent or reflect the views of the Johns Hopkins University or the Johns Hopkins Health System.

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