CHAPTER SIXTEEN

The Future of Data and Analytics

Shelley H. Metzenbaum

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THE FUTURE OF DATA AND ANALYTICS

By Shelley H. Metzenbaum

How should federal, state, and local governments use and communicate data and analytics in the future to improve government performance across multiple dimensions—including impact, return on spending, fairness, interaction quality, trust and understanding? What needs to be done to get from where we are now to where we want to be?

Data and Analytics Are Key to Better Government Performance and Community Outcomes

Government needs to collect data and use analytics to enable citizens, policy makers, and citizens to answer a common set of questions:

- What problems need attention, how important are they relative to other problems, and what causes them?
  - Which causal factors can government influence?
  - What characteristics might affect how quickly, successfully, cost-effectively, and fairly the problems can be addressed?
- Are there promising practices for addressing the problems that seem to work well, and can they be successfully replicated?
  - Do they work well for everyone, and, if so, how can they be refined to work better and at a lower cost—and how can broader adoption be effectively and quickly promoted?
  - If not, where do they work well and where don't they? What else should be tried and assessed?
  - Are unwanted side effects associated with the practices, and how can they be prevented or reduced?
- How can we best pursue opportunities for discovery and growth?
- What future risks and advances should government anticipate and plan for?

Government has long collected and shared data, or mandated its collection, starting with the Constitution's requirement for a decennial census. Congress quickly called for the collection of additional categories of data as well, such as censuses of manufacturers and agriculture, and counts of schools,

and other groups of interest (which at the time included the insane, mentally retarded, and illiterates).[1] Despite this long history of data collection, federal agencies unfortunately too often failed to collect "policy relevant data," or they published relevant data with "excruciating delays,"[2] impeding governments' and others' ability to use data to inform action.

Other times, however, as with traffic fatalities and morbidity and mortality data, government got it right. It put in place administrative frameworks and governance processes that regularly collect, analyze, and share data, resulting in continuous outcome improvements over decades,[3] albeit not without occasional problems.[4]

Dramatic technology advances over the last few decades in business analytics and visualization software now make it possible for federal, state, and local governments, and those they fund or otherwise influence to collect, analyze, and share data in increasingly relevant and timely ways. These technology advances enable far greater functionality and significantly lower cost for data collection, analyses, and sharing. An increasing number of governments in the U.S. and around the world have opened government data sets and invited others to analyze their content and apply the insights of those analyses as they choose.[5] Some also routinely share performance and spending data and their analyses,[6] visualize problems and progress or enable their visualization,[7] and support the generation and dissemination of the findings of well-designed measured trials.[8] In addition, government and others, such as Code for America and the Bloomberg Foundation, have begun boosting the analytic capacity of people working in or with government[9] and strengthening networks to enable government employees to learn and apply insights from their own and others' data-informed decision-making experience.[10]

Despite government's long history and recent progress with using and communicating data and analytics, as well as technological developments that have increased data processing power and cut data handling costs, current government data and analytic practices are nowhere near as sophisticated as they could and should be. Many government data systems remain clunky and hard to use, while government's analytic and evaluation capacity is woefully scarce.

A VISION FOR 2040

It is tempting to project how new technologies, such as remote sensing and mobile access, and new techniques, such as machine learning and blockchain, will strengthen government data handling and analytics in the future. However, much of what needs to happen twenty years from now could come to fruition with today's technology with the right governance structures and incentive systems, as suggested by the following vignettes about two data-savvy private sector companies, UPS and Amazon.com. Both companies

routinely integrate data, analytics, and measured trials into their strategic decisions, daily operations, and internal and external communications today.

To achieve greater beneficial impact, operational efficiency, fairness, understanding, and trust, government should learn from and adapt the data-handling and analytic lessons that these two cases offer. Governments of the future should also learn from past government efforts, both successful and unsuccessful, when using and communicating data.

Specifically, by 2040, all levels of government should:

- Fuel the front line with timely user-tailored analytics and research findings
- Obsess on mission, continuously innovating to improve critical processes
- Use visualization and other communication tools to show problems, progress, causal factors, and likely effects of corrective action in context
- Count and characterize events and conditions to inform continual improvement

FUEL THE FRONT LINE WITH TIMELY USER-TAILORED ANALYTICS AND RESEARCH FINDINGS

UPS, a delivery company, uses and communicates data, analytics, and measured trials in ways that enable front-line drivers to deliver packages quickly, affordably, courteously, and in good condition. Data and analytics teams translate data gathered from every aspect of the delivery process into actionable insights that front-line drivers can use to know when and where to deliver a package; decide the order and routing of deliveries; and avoid dangerous dogs and other risks along the way.

UPS mobile devices collect and transmit data ***from*** drivers and analytical insights ***to*** drivers in timely and easily applied ways. Analytics help truck loaders decide which packages to place where. Measured trials test door designs and key fobs to find ones that work faster, easier, and more safely at a reasonable and lower cost. Drivers go to safety school to learn techniques and rules such as “right turn only, no left turns” based on analyses of the costs and causes of past problems. In short, UPS intensely collects, analyzes, and communicates data to enable front-line UPS workers to do their jobs better, in addition to asking and answering central office questions about issues such as revenues, costs, and market conditions.

Who does the equivalent in government? Certainly, the military supports front-line soldiers, sailors, marines, and airmen, but how many non-military agencies support the front line in their own operations and that of their delivery partners with user-tailored insights gleaned from data, analytics, and well-designed measured trials? For example:

- How are analytic and research findings packaged to make it easy for front-

line educators, comprising nearly 11 million state and local employees, 8 million of them in elementary and secondary education,[11] to understand how to help the next generation grow, learn, and thrive?
- Who reviews and packages analytics, and the findings of well-designed pilots, so the second largest group of government workers—those working in hospitals and health care—can learn from their own and others' experience how to improve health and reduce health-system-acquired illness and injury?
- Who helps front-line Social Security, Veterans Administration, and social workers in every level of government learn from data, analytics, and measured trials so that they can provide continually better services and benefits?

A 2018 article in *Analytics Magazine* underscored the importance of using data to support workers on the front line:

> Who is the ultimate stakeholder? In most enterprises, there are many proximate stakeholders: analytics leaders, company executives, IT group, etc. However, the ultimate stakeholder—the front-line manager—is often discounted. Ideally, your front-line managers must be the loudest voice in key conversations. But in reality, in most cases they don't even have a seat at the table. Effective synergy among analytics, executives, IT and front-line managers is the cornerstone of outcome mindset.[12]

Twenty years from now, governments should routinely support their front line with relevant information packaged and delivered in a timely way that helps the front line deliver more successfully, courteously, efficiently, and fairly while simultaneously facilitating the front line's ability to share and learn from their own and others' experience.

What Will It Look Like in 2040?

Government will have identified the front-line workers focusing on the government's priority mission objectives, and given them ready access to the information they need to do their jobs well and continue to improve. If these workers need more or different information, government will be working with them to figure out what they need to know and the best way to provide that information on a timely basis.[13] Government will also proactively determine how burdensome field-based reporting is and, if needed, work on ways to reduce the burden and enhance the value.

OBSESS ON MISSION, CONTINUOUSLY INNOVATING TO IMPROVE CRITICAL PROCESSES

Amazon.com, also a delivery company when it started in 1994, quickly expanded beyond its initial focus on books to deliver, or broker the delivery of, approximately the same number of physical items (5 billion annually) just to its Prime members that UPS, started ninety years earlier, delivers to all of its customers today.[14] In addition, Amazon delivers a vast array of electronic services.

How did Amazon accomplish its astounding rate of growth in just over twenty years? It did it by obsessing on its mission: "to be Earth's most customer-centric company."[15] In addition, as Amazon CEO Jeff Bezos wrote in his 2017 annual letter, Amazon pairs its "unrelenting customer obsession" with "ingenuity and commitment to operational excellence".[16] To woo, win, and keep its customers, Amazon continually works to find better ways to support its customers in product search, order placement, fulfillment, delivery, and returns, whether through its website or with new tools such as Alexa and Echo.

Amazon's commitment to operational excellence led it, almost accidentally, to accelerate lagging application development time.[17] "Everyone was building their own resources for an individual project, with no thought to scale or reuse." To tackle this problem, Amazon decided to build "common infrastructure services everyone could access without reinventing the wheel every time." Because of its commitment to ingenuity and operational excellence, Amazon solved its own problem, simultaneously creating a product it realized others would find useful.

In addition to using data and analytics to advance its mission and improve its creation processes, Amazon communicates data and analytics in ways that help the interested public make better-informed decisions and, sometimes, even resolve product-related problems. Crowd-sourced, curated online customer ratings, comments, and FAQs help customers find products best-suited to personal needs and tastes, get answers before and after they buy, and find "workarounds" that minimize product weaknesses.

Government similarly needs to obsess on mission while innovating to master delivery processes owned by multiple lines of business, tap external expertise and effort, and inform individual choice. It is not unusual for government agencies to innovate, but this is usually done by individual agencies at the project and program level. It is seldom done at the agency, and even less frequently at the cross-agency, level. In May 2018, for example, the Transportation Security Agency (TSA) put out a call for smarter luggage scanners,[18] while the Internal Revenue Service (IRS) requested analytic services to detect tax fraud across all levels of government.[19] Government seldom, however, seeks synergies and opportunities to scale and reuse innovations across programs.

By 2040, government must figure out how to:

- support continuous learning and improvement, discovery, and testing to improve critical government processes undertaken by multiple programs. These processes might include, for example: benefits processing; regulatory permissions and compliance; harmful incident prevention, response, recovery, and remediation; and research and development.[20]
- support continuous learning and improvement, discovery, and testing across organizations and levels of government with shared missions.
- communicate data and analytics to inform individual and organizational choices about priorities, strategies, and tactics, and to enlist external expertise and effort to solve public problems and advance opportunities at the local, state, and national level.

What Will It Look Like in 2040?

Government will extensively use analytic and visualization tools that support, enlist, and motivate local action. It will do this while providing context for local priority-setting, problem-solving, opportunity advancement, and precision treatment design. Government will also have enhanced its use of analytic and visualization tools to support learning from and cooperation with others, inform individual and organizational choice, and enlist external expertise and effort.

USE VISUALIZATION AND OTHER COMMUNICATION TOOLS TO SHOW PROBLEMS, PROGRESS, AND CAUSAL FACTORS IN CONTEXT

The public and not-for-profit sectors also offer examples that suggest a vision for powerful data and analytics in the future. Consider, for example, Hans Rosling's brilliant visualization of life expectancy, child mortality, and economic trends across time, across countries, and within countries.[21] Rosling's not-to-be-missed TED talk (on video) debunks myths about presumed problems that no longer exist, and reveals overlooked progress that has been made. In addition, he spotlights areas still in need of attention, as well as variations in historic paths to progress that can inform future action.

Rosling's video animation provides a vivid vision for the way every government should analyze and communicate data in 2040. This analytic approach—using scatter diagrams and bubbles linked to country size to display performance trends for multiple outcome indicators over time in multiple locations, together with drill-downs showing who is faring well and who is not, and easy identification of positive and negative outliers—supports priority-set-

ting, learning, motivation, continual improvement, understanding, and trust.

Rosling appreciated that he was able to undertake his stunning analyses because a government agency, the U.S. Agency for International Development (USAID), launched the international Demographic Health Survey and chose to make the data both public and free.[22] In so doing, USAID embraced practices the public health field, with its remarkable progress,[23] considers critical: "special methods of information gathering" and "corporate arrangements to act upon significant findings and put them into practice."[24]

While recent technological developments undoubtedly enable faster, broader, and more accurate interpretation and application of analytic insights, the will and skill to analyze outcomes in context is far more essential to progress than technology, as Dr. John Snow dramatically demonstrated in London a century and a half ago when he mapped the location of houses with cholera and drinking water wells. His analytic approach allowed discovery of the contaminating pump and removal of its handle, slashing the number of cholera cases.[25]

What Will It Look Like in 2040?

Government will have made it easier to find and see governments' objectives (within and across governments), trends on those objectives, where progress is being made, and where it is not. At the federal level, government will have created visualization tools that agencies and cross-agency teams routinely use to present mission-focused goals and objectives in the context of national and sub-national goals, historic data trends, relevant international comparisons, and other contextual information that enable causal factor identification and fair comparison. In addition, in 2040, governments will routinely collect and broadly share timely outcome data in easy-to-access affordable formats, as USAID did in the 2010s. Governments will have also made it easier for front-line practitioners and the many who support them to find relevant research findings in easily understood and accurately interpreted formats, in locations that successfully catch their attention when they need the information, and not locked behind proprietary firewalls.

COUNT AND CHARACTERIZE EVENTS AND CONDITIONS TO INFORM CONTINUAL IMPROVEMENT

William Haddon, the first leader of what became the National Highway Traffic Safety Administration, appreciated what the public health field understood: the need for special methods for information-gathering and governance

structures that assure ongoing data analyses and translation of analytic findings into effective action. Using an injury epidemiology framework, Haddon created a matrix that still guides collection of traffic fatality data today. For every traffic fatality, twelve categories of information are collected: operator, equipment, environmental, and socio-political characteristics (the columns in Haddon's matrix) before, during, and after each event (the matrix rows).

These data points enable policy makers in Washington D.C., in statehouses, and at the local level to understand fatality trends, the riskiest and safest drivers, the riskiest and safest vehicles and equipment, and the most dangerous locations. Policy makers use this knowledge to design increasingly precise, effective, and cost-effective actions that have successfully reduced traffic fatalities for decades, until the past few years. Analytics of routinely collected data are paired with well-designed measured trials to discover effective ways to address emerging or still intractable problems, such as drivers[26] and pedestrians distracted by their smart phones. In the words of Ralph Nader, Haddon brought the subject of traffic safety "from one of hunch and surmise to one of rigorous safety analyses."[27]

By 2040, all parts of government similarly need to evolve from "hunch and surmise" to rigorous analyses. They need to figure out the "special methods" they will use to gather information that helps them understand changes in outcomes and other dimensions of performance they seek to influence. They also need to put in place governance structures that ensure continued analysis and application of analytic insights.

New technologies make it more possible and affordable than ever to collect data that points to likely causes or enables more informed action or investigation. By time-stamping and geo-coding our whereabouts as gleaned from our smart phones, for example, Google can tell us which times of the day and days of the week state departments of motor vehicles and Social Security offices are likely to be less crowded, allowing individuals to adjust when they want to visit. Similarly, by time stamping its violation data, a Coast Guard office was able to see that most of its violations happened in the wee hours of the morning while all of its inspections took place during the day. Changing inspections to the hours when violations occurred sliced the number of violations.

Most government agencies should time-stamp and geo-code data. In addition, as Haddon did for traffic fatalities, they need to figure out how to count and characterize key attributes of the information they collect about outcomes and other dimensions of performance and process, causal factors, and unwanted side effects to improve on multiple dimensions.

What Will It Look Like in 2040?

For common processes that governments perform—such as benefits and permit processing, fleet management, and cybersecurity—governments will have created and shared default suites of metrics and analytics that all governments adopt, adapting as needed. This will help them improve outcomes and communicate more meaningfully with citizens. In addition, organizations that try to advance the same or similar outcome objectives will create continuous-learning-and-improvement communities to develop common outcome and other indicators, analytic methods, and data standards, share platforms and principles, and learn from their own and others' experience

Steps to Achieve the Vision of 2040

What follows are specific steps to speed the journey to get to where we want to be in 2040.

- **Support Front Line Use of Data:** Identify front-line workers for each government agency and cross-agency priority mission-focused goal. Work with the front line to determine if they have ready access to the information they need, and, if not, figure out how to get it to them on a timely, easily used, accurately understood basis. At the same time, reduce the burden and enhance the value of data sharing.

- **Create analytic and visualization capacity:** Launch Presidential (and Governor/Mayor/County Executive) Analytic Fellows programs to beef up government's analytic and visualization capacity. Create analytic personnel exchanges with data-savvy private sector companies for the same purpose. Build online educational tools to beef up government capacity in these areas.

- **Build process mastery and innovation teams:** Identify three problematic government processes that would benefit from "common infrastructure services everyone could access without reinventing the wheel every time," as Amazon did to speed application development. Launch operational excellence scrums in these areas to learn how to speed process improvements. Support these process improvements with the governance structures they need to sustain continued progress. Based on lessons learned, expand to other critical processes. In the federal government, strategically manage common processes such as credit, benefits, grants, and fleet management by identifying and establishing common infrastructures that advance operational excellence and speed cross-program learning and innovation.

- **Identify priority areas for improvement:** Publish, annually, trends for key outcome indicators in ways that are easy to find and accurately interpret, with peer comparisons providing context when fair comparisons are feasible. Spotlight trends moving in the wrong direction previously trending in the right direction, and pockets of excellence or weakness compared to peers. Use this

information to inform priority goal and strategy selection—and build intergovernmental and intersectoral governance alliances to advance the goals. The U.S. federal government, specifically, should pilot at least three mission-focused Cross-Agency Priority Goals in areas where federal trends have been moving in the wrong direction (e.g., mortality and morbidity, traffic fatalities) and two where the U.S. does significantly worse than peers (e.g., infant mortality, life expectancy), naming goal leaders and establishing a cross-agency, intergovernmental, inter-sectoral governance structure and teams that work to close these performance gaps.

- **Invest in cross-boundary information collection, sharing, and use:** Figure out the "special methods" needed to gather useful information that informs the design of effective actions. Geo-code, time-stamp, and tag causal factors linked to outcome indicators. Identify and adopt other data standards to facilitate user-centered, place-based problem-solving and opportunity advancement, with appropriate privacy and security protections. Two good places to start are:

  – government programs that try to prevent bad things from happening and keep costs low when they do. Variations on the Haddon Matrix, for example, could be adapted to learn from harmful past incidents, not just for outcomes such as transportation accidents and oil spills, but also for process problems such as fraud and significant processing delays and errors.

  – benefits/permits/loans/insurance. Government programs that receive applications and confirm continuing eligibility are all likely to benefit, for example, from tracking not just the number of incoming, outgoing, and pending applications, but also by comparing to the same period in prior years and by tallying total time in the system, sorted by complexity.

  Standard-setting organizations such as the Governmental Accounting Standards Board or the Federal Accounting Standards Advisory Board, or intergovernmental networks such as the International City/County Management Association, could develop some of these standards, as could intergovernmental communities of practice such as the What Works Cities network[28] and Mid-Atlantic StatNet. So could federal agencies working with their state and local delivery partners or networks of front-line providers.[29] Complementing this effort, governments and others should experiment with development of shared data warehousing platforms to find ways to cut the costs and facilitate learning and cooperation across programs, while providing needed privacy and security protections.[30]

- **Establish standards for data governance, provenance, and ethics:** Establish one or more intergovernmental bodies to sort out and establish standards for data governance (e.g., who owns, who gets access), data provenance, and ethical issues related to data generation and use. Develop standards that ensure proprietary interests do not interfere with government's ability to learn from experience and undertake iterative trials to discover ways to improve on multiple dimensions.

Shelley Metzenbaum *works on variety of projects to encourage a better world through better government. She is also a Senior Fellow at the Volcker Alliance and formerly served as Associate Director for Performance and Personnel Management at the Office of Management and Budget. She was the founding president of The Volcker Alliance and has held positions at the U.S. Environmental Protection Agency, the Commonwealth of Massachusetts, the City of Boston, the State of Arkansas, the University of Massachusetts, the University of Maryland, and the Harvard Kennedy School.*

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