DATA ANALYTICS: PROMISE AND LESSONS

Lessons from urban analytics pioneers, and a roadmap for excellence in delivering public value with data and digital innovation

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Civic Data Analytics
Lessons from Urban Analytics Pioneers
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Executive Summary

This paper describes the advances in use of data to improve efficiency of local government operations and the quality of customer service since the appointment of pioneering city chief data officers (CDOs) over a decade ago and reflects on the factors that accelerate or impede progress.

The pandemic arrived just as many urban chief data officers were hitting their stride, with some having spent years building organizations and data infrastructure to transform government operations by unleashing the power of vast troves of previously siloed administrative data. Data came into the spotlight during the pandemic, when daily counts of COVID-19 cases, test positivity rates, hospitalizations and deaths became not just leading news, but also key factors in government decision-making.

City data leaders demonstrated during the crisis and response phases of the pandemic that government has tremendous power to achieve better results for the public. For example, in Boston, a multi-year citywide data warehouse project meant Chief Data Officer Stefanie Costa Leabo was able to provide her mayor with a real-time integrated COVID-19 dashboard in a matter of days.[1]

A tremendous amount of innovation happened in city government at the start of the pandemic – when city halls closed cities didn't stop picking up trash and issuing permits or recording births and deaths – they just had to do it in new ways that adapted to COVID protocols. In some cases, processes had to be reinvented on the fly to reflect the danger of in-person contact in the early stages of the pandemic.

The pandemic also forced government to divert attention from long-term transformation projects into immediate crisis response activities. Much of the initial response to the pandemic focused on migrating in person service delivery to digital services, often without streamlining existing, often complex processes. In the rush to put citizen service online, many cities simply "paved the cow path" and, as one data innovator noted, "If you automate a crappy process, you have an automated crappy process." The long-term goal is, as another data innovator said, "We don't just want to digitize the bureaucracy, we want to make the process simpler."

CDOs have a difficult and increasingly complex job. Policy issues such as equity, data bias, data privacy, sustainability and crumbling infrastructure are increasingly getting the attention of mayors as well as their data leaders. Rapid technological advances in recent years have some

data leaders and their information technology (IT) counterparts feeling overwhelmed by the speed of change. Amid a growing portfolio of policy and technology issues to pay attention to, there are a few recommendations that may help CDOs and other data innovators navigate the next few years:

- **Recommendation #1: Create a strategy and roadmap.** As the saying goes, if you don't know where you are going, you might end up somewhere else. Many CDOs feel spread too thin across too many priorities. One former CDO noted that the city's data focus had become "splintered" in the current environment due to the many emerging trends and needs. As Jim Collins famously said, "If you have more than three priorities, you don't have any." There is no magic number of top priorities, but without a written strategy that is known to all, any team is likely to bounce from one urgent problem to another without making progress on long-term goals. With the immediate pandemic response phase over and the federal stimulus investments coming, this is the ideal time for a new or updated data strategy that addresses the urgency of integrating data analytics and digital services, addresses the influx of new priorities, and realistically describes what can be done by when. Ambitious goals are important as are timelines and plans to help make the goals achievable. Clear definition of roles should be a key part of the strategy to avoid turf issues or duplication of effort.
- **Recommendation #2: Lead citywide data governance.** Many emerging policy issues require citywide data governance, which can successfully be orchestrated by a CDO or other data leader. Without standards and policies in place, some data analysts are hesitant to collect and use certain data. As one data leader said, "People are afraid to use the data on dockless bikes because of data privacy." An important part of data governance is improving data quality and data quality will continue to be in the spotlight with increasing awareness of the damage that can result from bias in data sources, data gaps and data quality issues. Further, with democratization of data analysis tools at lower cost to purchase and lower skill levels needed to deploy, agencies can easily develop independent capacity which may not align with citywide standards. Such siloed procurement can lead to additional cost and duplication of existing city data infrastructure, and as one former CDO said "Every sensor company will try to sell you their data storage rather than let you use the city servers." Data governance should include policies around what tools will be used so that there is a reduction in cost. For example, in New York City the Mayor's Office of Data Analytics is standardizing the procurement of third-party data so that whether it be housing data, credit card transaction data, or job listing data, there are not separate contracts in each city agency but rather a shared purchase which can reduce duplication of cost.
- **Recommendation #3: Become a visible and vocal data evangelist.** As more services migrate to digital, and as an increasing number of IoT devices come online, the volume of data available to cities for analysis will continue to grow. Alongside that growth there is a need for greater data literacy among managers, greater skill among data staff, and greater understanding among the public of the value created by administrative data in government. The urgency of improving data awareness only grows with the policy issues of the day that expose gaps in data about equity issues and infrastructure

vulnerabilities – and these problems can only be addressed with accurate data and an ability to interpret meaning. A CDO is well positioned to be the data evangelist who advances the goals of data literacy, data skill, and appreciation of the value of data. As an example, the data team in San Jose views its mandate as encompassing data analytics, community engagement, and storytelling, three legs of the same stool of performance improvement.

There is a great deal of work to be done to modernize the data capacity of government and to revisit data strategies and plans put in place before the pandemic. The entrepreneurial innovation that kicked in during the adrenaline-filled early days of the pandemic demonstrated that data leaders and their counterparts in city government are capable of making tremendous progress in a very short time. Bringing some of this spirit forward into the recovery phase, particularly if fueled by stimulus dollars, holds great promise for a data and digital government of the future.

This is an opportune time for such investment and effort, with significant stimulus funding flowing to cities. As one data leader noted, “With cities having this amount of money to spend, that's kind of, in some ways overwhelming, because it just has not been around before.” Further, federal stimulus funding specifically calls out advancing “Effective Service Delivery” as an allowable use of funds, along with “capacity building resources to support using data and evidence[2].” Successfully leveraged, this federal investment can create new cultures of government data innovation that can sustain for generations to come.

Introduction

In addition to chief data officers and digital officers, there are a growing number of innovation roles in government. A survey by Bloomberg Associates of 30 leading cities across the globe found that titles for government innovators are as unique as the cities themselves, with 82 variations on titles ranging from the more common chief information officer and chief data officer to the less common chief marketing officer and head of transformation, and technology advisor to the mayor.[3] The survey found the average number of individuals in roles such as these was two point seven in the global sample and four per city in the US cities.

Note, the terms data innovator, data leader, and chief data officer are used in this paper for simplicity, recognizing that there are myriad variations. The Civic Analytics Network (CAN), a Harvard network of city and county chief data officers, includes those who go by titles such as chief analytics officer, chief of performance and innovation, and chief data and geographic officer. In some cities, the participants in CAN have roles that overlap with or encompass other functions such as digital services, innovation, performance stat programs, smart city and the like.

The earliest CDOs were primarily focused on open data programs, mapping of open data, and data analytics, with some also responsible for performance stat programs. The role has evolved and today, urban CDOs have a difficult and increasingly complex job. As one former city CDO said, “There are a lot of emerging policy issues to pay attention to, and the technology is evolving almost daily, so it’s hard to keep up.”

To demonstrate the scale of change in the role, the charts below describe the span of responsibility of CDOs five years ago, and the policy and technology issues that have emerged or become higher priorities for urban CDOs in the past year.

Responsibilities and Issues of Concern for Urban CDOs in 2017
• Open data portals, open data programs, public access to data • Data strategy • Data quality across data portals • GIS mapping of data and presentation of spatial data • Dashboards and data visualization • Data analytics for insight on program operations • Data standards and data governance • Data storage, data warehousing, data architecture, etc. • Communities of practice for data analysts across government • Performance data for department level operations

Responsibilities and Issues of Concern for Urban CDOs in 2022	
Policy issues	**Technology issues**
• Data privacy concerns regarding the sharing of individual level data of members of the public • Ability to measure equity gaps with high quality and readily available data that is current or frequently updated • Lack of standard methodology for data analysis on equity gaps • Public concern over security of government data • Inconsistent citywide standards for procurement of technology, and data services including third party data • Need to assess potential for bias in algorithms, machine learning, and artificial intelligence deployed both in central CDO office and citywide • Policymaker curiosity about use of emerging technologies and need to be informed on government use of blockchain, etc. • Need for standards across city in procurement of new technologies, such as IoT sensors • Urgency of spending stimulus funding and need to balance with rigorous data collection on outputs and outcomes • Micromobility data and need for mobility policy alongside mobility data policy • Rideshare data policy for capture of data and use in setting policy • Short term rental data policy standards for collection and policymaking • Curb management data collection and ability to inform policy • Working toward equal access for the public to digital services	• Citywide data platforms capable of ingesting increasingly large amounts of data as analog services migrate to digital channels • Data analytics tools and training of staff to use new tools for data analysis • Integrating IoT data from the increasing number of sensors into city data stores • Data storage for vastly increasing amounts of data, including video and audio data • Security and privacy risks for large stores of data about members of the public and the services they receive and protection of data from hacking and ransomware attacks • Digital civic engagement tool selection, management and monitoring • Procurement of third party data from sources such as credit card companies, mobility companies, real estate and job market trends • Broadband expansion to serve historically underserved communities and ability to map and document areas of greatest need • Digital service creation and development of digital infrastructure to enable rapid deployment of new services • Digital literacy among the public as an enabler of increased adoption of digital channels for government services

As cities embark on ambitious programs of data and digital innovation and as they tackle the most strategic way to manage the massive influx of stimulus dollars, among the most pressing issues of the day in urban areas are closing equity gaps and modernizing infrastructure, and each of these is informed by proactive civic input. This paper highlights selected recent examples of innovative work by CDOs in the following areas: Digital Service Delivery, Equity, and Civic Engagement.

Digital Service Delivery

Years of overlooked ideas and plans for digital services came to life in weeks or months when the pandemic closed city halls across the country. While digital government has gotten a great deal of "buzz" over the past few years, it is still an emerging area without clear definitions. Ask any five people to define digital government and you will get five answers. There are only a few dozen officially named city digital officers, yet most cities do at least some this work, without using this term. As one data leader said, "If you talk to anyone in the city, they wouldn't say we have a digital services team, yet we are building digital tools - we just focus on the problem we're going to solve and don't worry about the titles."

What does digital government mean? These terms can be inherently murky and sometimes they morph over time – from providing the front end of a city website and providing mobile apps for transactions to thinking about broadband access and equity of availability and cost. For clarity, the terms "digital" "digital services" and "digital access" are used as defined below.

What does "digital" mean?	
Term	**Definition**
Digital	The use of electronic means, preferably mobile-friendly, for providing information or service delivery to customers, and sometimes also the customer's ability to access the information or service
Digital services	Government services available anytime, anywhere via computer or mobile device, often via an app (application)
Digital access	The ability of the public to use digital services, which requires both a device and connection that is affordable, reliable, and robust

Digital government services are efficient because they take what would otherwise involve travel to city hall, paper processing time, and in-person interaction and make it instant - no waiting in line at a government building or visiting multiple offices. They are convenient because they allow the public to access information and services at any time and from any location without being confined to the business hours and location of a government agency. Digital services also allow for personalization and user-centric experience if data is captured from one transaction and saved for the next one.

Digital transactions are faster and easier, and not every situation needs the advice or assistance of a staff member. When Code for America helped California create a user-friendly app for food stamps, they cut time to apply by 75 percent. The result: 11 percent more people applied in the counties that used the app than in those that didn't. Code for America also built portals to help low-income individuals claim the child tax credit and generated $400 million in benefit for those who used the tools.[4]

Yet, for all the benefit that can be achieved, digital government remains at an early stage with few cities having published digital services strategies or roadmaps. And as pointed out by

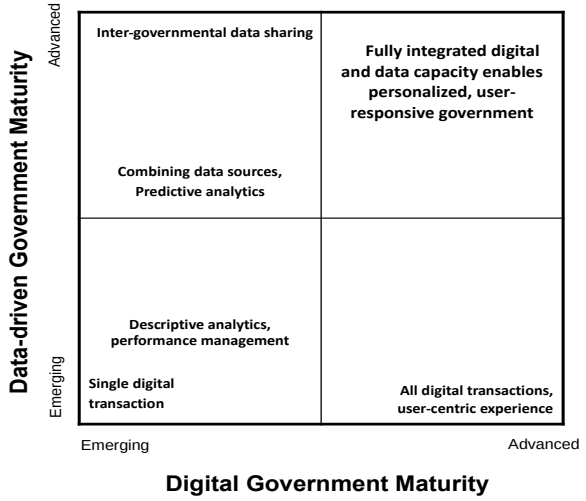
digital government scholar David Eaves, **"**For all the promise of digital government, it has done very little in the Western world to fundamentally alter the structure or processes of the state."

What might a mature stage of digital government look like? If government data systems could easily link to one another, if data was seamlessly connected across all of government, public sector employees could do their work without paging through paper documents and toggling back and forth among different sources of records in various formats, stored across departments. Error checks could be automated, making mistakes virtually nonexistent, saving time, money, and frustration. Customers would receive timely accurate information, transactions would be streamlined, efficient, and simplified. For example:

> *A couple walks into city hall to get a marriage license. The city clerk's office scans the barcode on their driver's licenses and instantly has accurate name and address data for each. The clerk issues a digital marriage license which is automatically routed to city and state vital records offices. The clerk then asks a few more questions. Would the couple like the city to automatically process a last name change for either party? If so, it can be automatically sent to city, state, and federal government agencies, saving the couple time and complication with the name change. Address change? Same simple process. New driver's license with the updated information? Click, click, it's on its way. Change in tax filing status? Also done with one mouse click. Enjoy the honeymoon!*

In this scenario, government could make this happy occasion a little better by taking out the paperwork. This future vision of personalized, customer-centric digital government may not be immediately realized, but it can serve as a long-term vision. This vision is described in the diagram below, with the upper right quadrant depicting a virtuous cycle of digital services gathering data that can be analyzed to improve service quality and increase personalization.

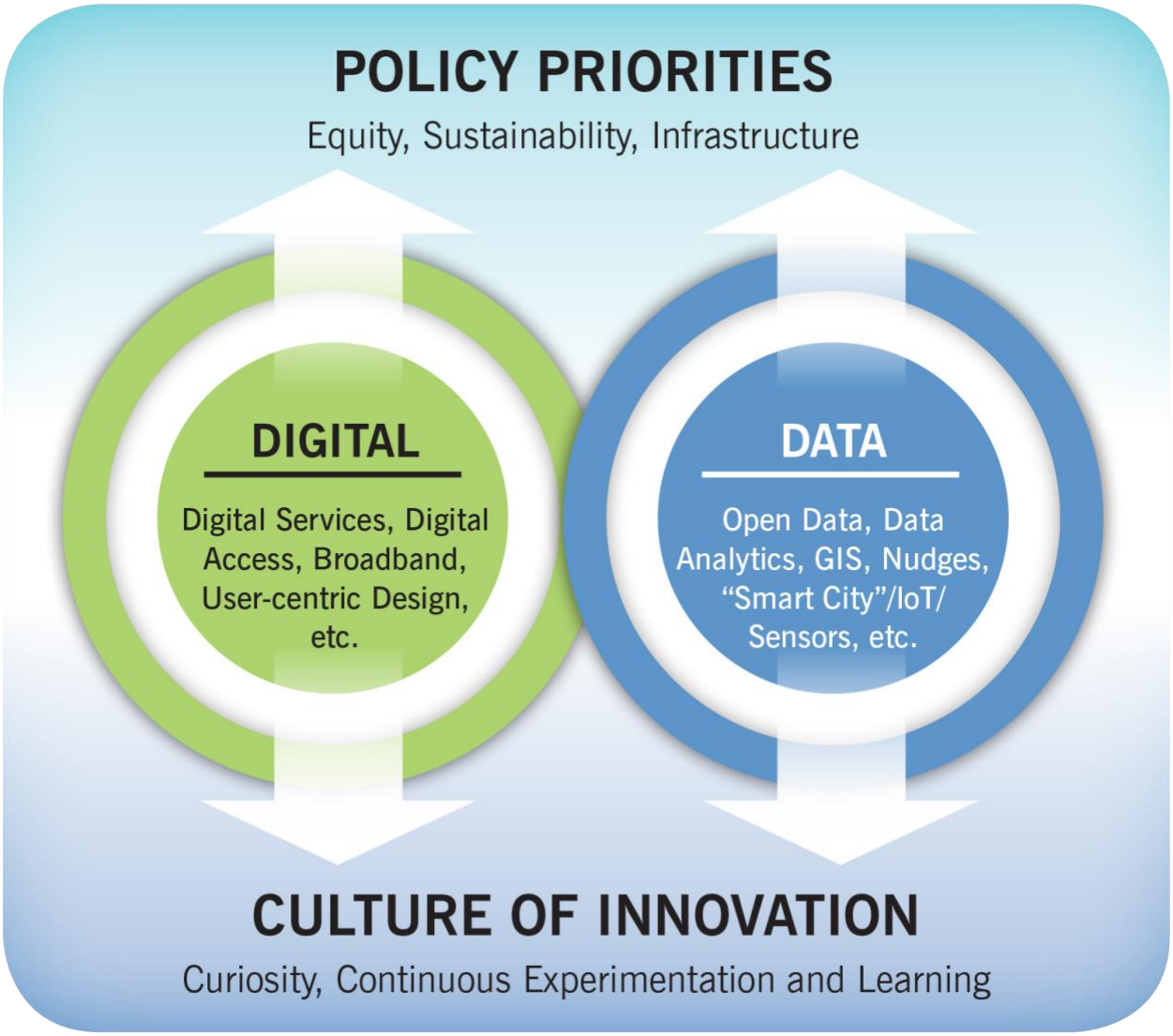
While many governments excel at data use or digital services, few yet excel at both



Integrating across digital and data is beginning in the state of California, where Statewide Chief Data Officer Joy Bonaguro announced in late 2022 that the state's data team, CalData, merged with the state's Office of Digital Innovation to become the Office of Data and Innovation which will work to bring these functions into greater alignment for increased power to transform government operations to better serve the public. This joining of functions is happening already, at least informally in some places. South Bend is a city small enough that staffers must be nimble, roles are fluid, and team members are used to wearing multiple hats. South Bend Chief Innovation Officer Denise Riedl notes that, "Digital, data, technology – it's all about how well we're delivering on the goals of citizens. Without technology it's hard to collect data, and without digital it's hard to know what the public wants. When we work with city departments, even if there isn't someone in the room with innovation in their title, you'll surface the people who informally are the innovators."

One example of how government digital services can leverage user centric design and mine the data gathered by the app for analytics insight is the Salt Lake City mobile app, SLC Mobile. This civic engagement app was useful when the city weathered an earthquake and major windstorm which brought down 3,200 trees. The city's previously established sensor network had captured data on windspeed by location. Using info input into SLC Mobile, the city was able to collect detailed data on the destruction – the type of tree, the type of building it fell on (house, apartment, commercial, etc.), and the location. This allowed triage of the trees that posed the greatest safety risk and allowed more efficient deployment of city mitigation resources. It also enabled a single system for capturing data about trees that had been removed so that there was no duplication of effort in the remediation process. Then, when the public put in requests via SLC Mobile saying "this tree landed on my house" much of the data had already been captured by the city. When the tree was removed, city workers documented their completed work using the app.

Data and digital are tools that can be applied across policy areas to more effectively achieve goals, including the new goals developed in collaboration with newly created innovation roles such as equity officers and infrastructure coordinators, as shown in the diagram below. Regardless of how organizations are structured, the functions of data and digital capacity are enhanced when built on a foundation of innovation culture and can drive success in a mayor's top policy priorities.



Source: Wiseman, IBM Center for The Business of Government, 2022.

For government to best serve the public, they need fresh ideas that better connect data sources across disciplines, and that better connect data and digital services to create responsive and customer-centric services. Innovation, data and digital efforts pursued individually are powerful, but when pursued together they can be truly transformational for government. Often but not always, these initiatives are led by a CDO. Regardless of who leads, the key is to use data as an engine of innovation and service.

Equity

Among the most pressing issues for urban leaders today is closing the equity gaps laid bare by the pandemic. Many cities struggle to even document the size and characteristics of their equity challenges given overlapping and inconsistent data across city departments, and large gaps in data completeness. For example, while the nation clamors for racial justice and greater equity, the nature and scope of the problem eludes precise description due to data inconsistencies, gaps, and time lags - at all levels of government. Many government records do not include any racial or ethnic data, while in systems that do include this data, the field is often left empty or is completed inaccurately. A Harvard Law School study of racial disparity in the Massachusetts criminal justice system found a great deal of inconsistent data and much that was simply missing – 24 percent of race data was missing along with 65 percent of ethnicity data.[5]

Gathering, improving the accuracy and completeness of, and then analyzing data is key to understanding and addressing equity gaps in access to opportunity for wellbeing and in receiving necessary government services to succeed. Cities taking a lead in bring data to their equity efforts include San Diego and San Jose.

San Diego was among the first cities to appoint a leader to focus on racial equity. When Kim Desmond was initially named as the city's first chief race and equity officer, she had no staff and instead relied on the city's data team for an initial project, examining equity and equal opportunity among city employees and San Diego's hiring practices.

The city started with an employee pay equity study that put a spotlight on racial and gender gaps for employees on city payroll. The 165-page report showed that women were paid 17.6 percent less than men and that people of color were paid 20.8 percent less than their white peers. The largest single factor was the occupation – while males and white people are overrepresented in higher paid occupations, females and people of color were more likely to be in lower paid occupations. Occupation explained two-thirds of the gender pay gap and 80 percent of the racial pay gap. Other contributors to the gap include a "parenthood penalty" that is greater for women and people of color than white people, and access to overtime, which was greater for males and white people than for females and people of color[6].

Having a definition of equity was important, and as Chief Data Officer Andrell Bower noted, "In the past, equity meant doing the same number of things in each council district. Now there's a deliberate effort to make sure that access to opportunity is equal for all city residents, not just by responding to requests for service by those who are motivated to interact with the government, which could come from privileged or overserved areas of the city."

Now well into her tenure, Desmond has developed a framework for assuring that equity is at the forefront as the city spends its stimulus funding[7]. This framework includes structured and ongoing collaboration between Desmond's team and the city data team to continuously

measure progress, using data visualization and mapping to show how the city is using the funds, and continuous checking for bias in data and in spending.

San Jose is known for technology innovation and entrepreneurship, qualities also embodied by the city data team, and the bold approach the data team took to addressing equity. That work is documented in detail in a case study previously published. To address the equity challenge exacerbated by the pandemic in his city, Mayor Sam Liccardo tasked his Mayor's Office of Technology and Innovation (MOTI) to use data to define and address equity gaps and to deliver city services with a greater focus on equity for all residents. Few cities have tied their equity efforts so closely to their data work. The MOTI team felt it was important to create a durable framework and a structured process for engaging with city departments and programs around equity, rather than using an ad hoc or customized approach for each project or department. A framework that was adaptable and scalable facilitates a repeatable, high-quality approach that can endure across the years and mayoral administrations. The Data Equity Framework has three distinct stages:

1. **Equity Objective:** Defining the what -- "What is an equitable outcome for the department and programs?"
2. **Equity Metric:** Establishing the how **– "**How will we measure success?"
3. **Monitoring and Evaluation:** Reviewing the outcomes – "How do we ensure this long term?"

In using the data equity framework with departments, the MOTI team mostly uses internal city administrative data, rather than external sources such as survey and census data. The main reason to focus on city administrative data is that other sources of data collection have inherent bias in who is not counted. With city administrative data, the limitations are better understood, and the amount of available data is enormous.

The process for equity engagements spanned eight weeks, with a different task each week. Each project begins with a project launch to align on goals and project scope. The next step is data exploration which helps set the tone for defining the equity objective, a process that is facilitated by MOTI using a structured process and guided by a facilitation worksheet. Half of the eight-week schedule for data equity engagements is devoted to change management, recognizing the challenge of implementation is generally a lot harder than idea generation.

Data was analyzed not in a vacuum, but in close consultation with the owners of the data -- the staff with the knowledge that comes with longtime program management. These staff have the most intimate understanding of service delivery details, and often also have novel ideas on how to improve programs. The MOTI team viewed their role as facilitators of the insights that could be found in the data, discussed with the program managers, and turned into actionable insight. Several of their tools were made public either in the case study, or in blog posts created by the team about their work, and listed at the end of the case study.

The San Jose data team achieved a great deal in a short time by fusing a passion for public service with a creativity and fresh perspective that comes from being a diverse team with nontraditional backgrounds, and by relying on standardized frameworks and structured processes. Addressing the importance of brining data to equity policy, the mayor declared in his budget vision the need to "squarely confront data, rather than pointing at anecdotes."[8]

Civic Engagement

Voices from outside government help make service delivery more customer-focused, more responsive to user needs, and more relevant to and impactful for historically underrepresented groups. Gathering the perspectives of residents, advocates, academics, and private sector leaders brings fresh ideas to government – all the more important at a time that demands bold ideas.[9] Technology makes it far easier than ever before to gather stakeholder input and to maintain ongoing engagement in the planning process, as well as providing customer satisfaction feedback.

Digital tools open new methods for civic engagement, like online town halls and mobile comment site. More members of the public can voice their opinions online than can be at a public meeting at a specific data and time. Further digital civic engagement is permanent – if you go to a community meeting and voice an opinion, you have no way to know if your comment will make it into meeting minutes, but if you record it in a digital tool, you can see that it has been noted. City employees can easily capture and store a wide variety of inputs via digital media.

Typically, in-person community meetings are attended by a small but vocal minority.[10] New virtual platforms, particularly if they allow asynchronous contributions, significantly increase the public's input. Participatory budgeting, virtual town halls, customer feedback surveys, online suggestion boxes and many other digital forms of engagement offer templates for getting public input on stimulus spending plans. Reaching even beyond digital engagement, artificial intelligence is now enabling those who are less comfortable with written input to participate in moderated community conversations that can then be digitized and analyzed for more manageable review by policymakers.[11]

Civic engagement grew in variety and intensity during the pandemic. For example, in an experiment among 18 cites in CAN, social media sentiment mining led to the identification of micro-influencers in communities with low vaccination rates and enabled mayors to target messaging to those most likely to need protection from the virus and least likely to get vaccinated, via leveraging trusted community influencers.[12] This effort helped combat vaccine disinformation and helped speed the inoculation of historically disadvantaged communities. In another example, San Diego uses an anonymous survey of the public to generate insights for improving policing on a near real time basis.[13] With no national data on public trust in the police and with a long delay in the publication of crime statistics, this provides the city with ongoing feedback about how the police are perceived and how well they are doing their job, on

a neighborhood basis. Other ambitious programs of civic engagement can be found in Salt Lake City, Syracuse, San Jose, and Los Angeles County as outlined below.

Salt Lake City is making civic engagement easier and more impactful, with several apps designed to get the public more engaged in civic participation. Chief Data and Geographic Officer Nick Kryger created a 3D way for the public, city council and the mayor's office to literally "see" how proposed projects will fit into the city. A civic engagement app gives the public a view into the process of funding capital improvement projects. Interactive maps allow users to see capital improvement requests by location, along with related data such as total population by racial and ethnic group, household income, housing type by racial and ethnic group, health outcomes, education levels, internet access, and employment. The tool is used to help the city to build out broadband fiber in the areas where need is greatest and where it will close gaps for historically underserved communities. Another civic engagement app is an interactive redistricting map that will allow the public to pull census block data into and out of council district boundaries to essentially role play at doing the redistricting themselves. The app also allows the public to provide comments to the city council on how they feel about various redistricting plans.

In Syracuse, New York, Mayor Ben Walsh tasked his data and innovation team with developing a data-driven method for managing stimulus funded projects and creating a public facing dashboard showing spending priorities, funded projects, and progress toward output indicators.[14] The dashboard lets any member of the public explore not only what is planned but how progress is going, and to drill down by category (jobs and economic recovery, children and families, government response and resilience, and infrastructure and public places). The page provides status updates for all projects indicating if they are in the planning stage, in progress, or completed and for funding purposes indicates if the project is budgeted, authorized, and if the funds are spent. The public is invited to provide feedback on the stimulus funding with a link to email the mayor directly with comments during the five-month public input period.

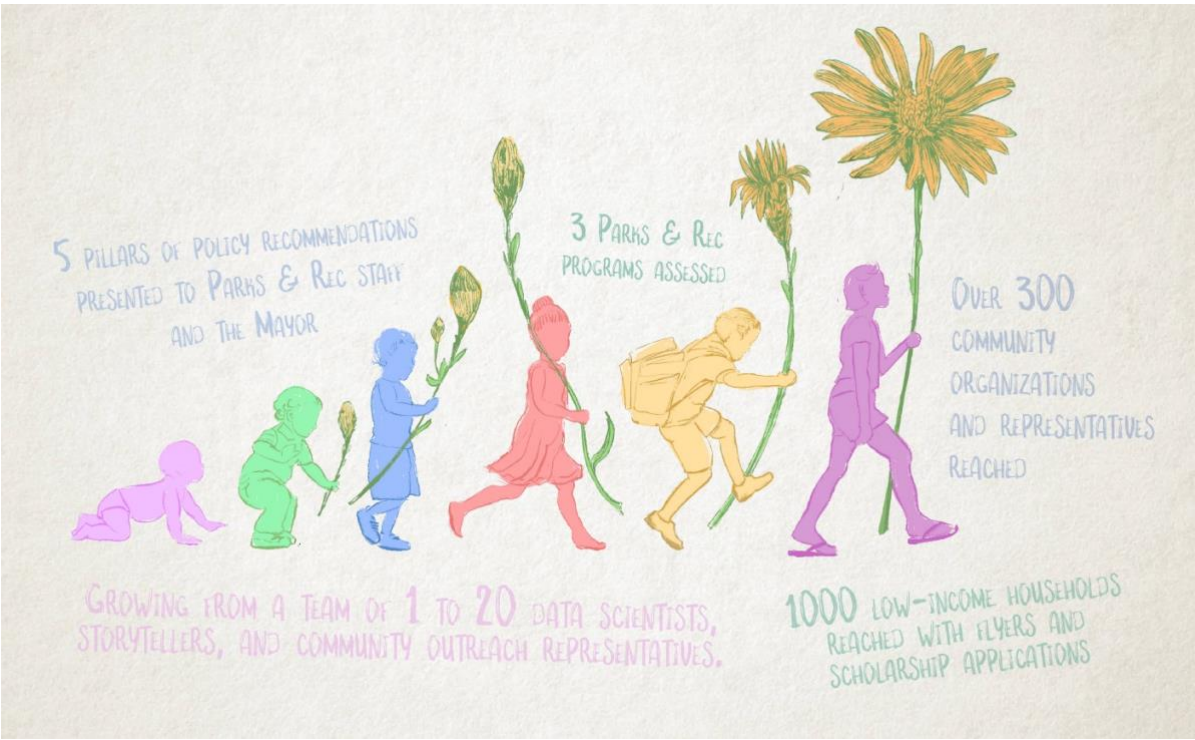
The city also sought public input when the police department considered using license plate readers, seeking to understand how the public would feel about the privacy and safety tradeoffs.[15] This is part of a broader mayoral initiative on police reform that inspired a surveillance technology working group made up of city employees and community stakeholders and is charged with creating an inventory of surveillance technologies used in the city and making recommendations on deployment of such technologies.[16]

San Jose has used innovative methods in their civic engagement efforts, and have helpfully documented their approach in a handful of blog posts. When city staff from the data team began working with city departments to measure equity gaps and to develop policy solutions for key city services, they decided to proactively engage members of the public who either were receiving services, or who should be but weren't yet reached. San Jose's Beatriz Aldereguia, Christopher Maximos, and Insha Momin led the civic engagement effort, guided by the maxim, "No amount of program data can compensate for the perspectives of community members," and inspired by the realization that "the voices of residents who rely on city services most are

not always represented in City Hall." This team distilled their lessons from this effort and described their process in a blog post with sufficient detail to give other cities a head start on launching their own community engagement efforts.[17]

One of the first steps was to scan other fields for best practices, and this came naturally to the community engagement team, as they were from many disciplines, including strategic communications, education policy, social impact, and data analysis. The community engagement process relied on a structured approach and repeatable tools that could easily be used by new members of the team after a brief onboarding process and relied heavily on listening and facilitation rather than solution-building. The effort was successful and on just one project identified 16 tangible policy proposals and actionable solutions generated by community stakeholders – ideas that were valuable to the city because they reflect the needs of those for whom the program was designed but who had been challenged to access them.

An effort to provide more low-income families with access to child care subsidies included reaching over 300 community stakeholders via 50 meetings, three 90-minute virtual roundtables with more than 20 key community stakeholders at each session, and door-to-door distribution of a survey about childcare needs to 1,200 households in six languages (Spanish, Vietnamese, Traditional Chinese, Punjabi, and Korean). A local artist created the graphic below to demonstrate the advancing maturity stages of their efforts to reach community members for this recreation center based program.



Source: *Illustration by Taylor Dubose, San José-based designer and illustrator*, San Jose MOTI blog post.[18]

To help low-income families access city scholarships for programming at their local recreation centers, the community engagement team translated what data analysis found into actionable information. This data storytelling effort was key to engaging community members with insights that could help them in concrete ways – not scholarly publications but ground-level information that could improve access. For example, the data team found that there was unequal allocation of scholarship funds based on family size, neighborhood, and income level. Engaging with the community to share these insights, and to reach neighborhoods that were underserved by the programs increased access for those most in need but not previously reached by the programs. The community engagement effort ended up hearing about a wide range of concerns, such as literacy barriers, reform of the scholarship application process, and transportation to city recreation centers.

In neighborhoods with high concentrations of low-income families who might benefit from the program but were not yet participating, community engagement fellows reached out to every single organization that supports children and families -- from school superintendents to boys and girls club leaders, to faith-based organizations, and so on.

In total, the engagement effort took several weeks and started with an intensive period of identifying key stakeholders who supported diverse communities but were not already in city contact lists, including non-traditional sources such as culturally based community organizations and houses of worship. Recognizing that the community organization leaders they reached out to were busy they asked for only 10-15 minutes of their time and found this approach successful in securing initial meetings to explain their reason for reaching out and goals.

Having a dedicated community engagement team gather structured bi-directional feedback helped in ways not anticipated, as well. One example that came from the listening sessions with stakeholders for the childcare scholarships was that in some neighborhoods, parents weren't accessing the scholarships for the recreation center programs because kids had to be picked up at five o'clock, but the parents worked until later. So, while these parents may have very much needed the help with their children, the structure of the program didn't respond to their needs. Without this feedback loop, that need would never have been flagged.

The Los Angeles County Citizen Redistricting Commission (CRC) innovated on how they gather public input on an issue of critical importance – the redistricting of the county based on the most recent decennial census. While most state and local governments entrust elected officials with redistricting responsibility, LA County entrusted this task to the CRC. But, during a pandemic and with public trust in government at all-time lows, how would the CRC inspire the public to provide input?[19] The CRC overcame public mistrust and was successful in engaging the public, receiving testimony from hundreds of members of the public, thousands of their written comments in the form of emails or letters or emails from residents, and 113 maps with proposed redrawn district lines.[20]

This success came from applying a variety of approaches and aggressively seeking to meet the public where they were – whether it be YouTube or a virtual community meeting. And they did it in the language preferred by their residents-- in addition to having much of their material translated into other languages, the CRC also held a public meeting in Spanish with translation into English rather than the other way around, honoring the many residents who speak Spanish as their primary language and creating a more welcoming environment. Further, to make sure that those without reliable internet access could participate in virtual meetings, CRC worked with community groups to host virtual meetings in community centers, in one case pairing it with a potluck dinner.

During an interview with Data-Smart City Solutions writer Matt Leger, Executive Director of the LA County CRC Gayla Kraetsch-Hartsough noted, "Public engagement should not be a 'check-the-box' activity in local government, but that is unfortunately how engagement is often treated."[21] Reflecting on the process, she pointed out that "Many of the communities we heard from were communities who have felt disenfranchised...who felt like they have never been heard from before. Not only registered voters but noncitizen immigrants who came forward to present their needs and helped us shape the future of the county."

The key was to create two-way communication and to really listen to and act on the input provided by the public – otherwise they would lose trust and attention. Among the creative tools used the CRC to gather public input included emails, newsletters, online community chat boards, and both county and stakeholder social media pages to post messages, advertise public meetings, and gather comments and feedback from residents. Residents were also given access to cloud-based maps and were trained on how to make suggestions to modify the proposed district maps, both in English and in Spanish.[22]

The CRC held public meetings in places people might already frequent, instead of just city buildings, including libraries and community colleges. In addition to hosting the live stream on the government website, the team created a YouTube channel to live broadcast the meetings, and play recordings of the sessions. Given the research indicating that participants in government open meetings have historically been skewed toward the older, more educated and more affluent residents who have the resources to commit to attending long meetings, this approach allowed participation from those whose work, childcare or transportation needs did not allow in person meetings, or who preferred during the pandemic to not be in public meetings. To help build bridges to the community, the CRC also reached out to organizations that had credibility on the ground, to help them forge new pathways to community members who may feel they are not represented in government or may not be listened to.

Drivers of Success for Data and Innovation Teams

CDOs and other data innovators have shown that government has tremendous power to achieve better results for the public by finding efficiencies and by making service more customer oriented. The COVID-19 pandemic demonstrated the value of being able to access and share data quickly and seamlessly - not just across the various levels and agencies of government but also with external partners such as hospitals, testing and vaccine supply chains, and transportation providers. Residents have seen both impressive successes and instances where information flows were painfully slow or flawed, yet the one constant is the demand for accurate and timely data sharing and public dissemination of reliable information.

Looking across the leading innovators, several themes emerge about what makes these teams successful, and the pitfalls they identified that others should avoid.

Drivers of success include:

- **Executive attention and support.** In cities that are successful with their data, digital or innovation efforts, they have the full support of their chief executive, and get the resources they need. In Boston, Mayor Michelle Wu was herself once an intern in the city's innovation office and has placed a heavy focus on data and innovation in her pursuit of equity and improved access to opportunity. Another example where data is tightly integrated into the policymaking process is in Syracuse, where the mayor relies heavily on the data team to guide and evaluate stimulus funding decisions. Using data and digital tools to change the status quo is hard because change threatens comfortable habits and routines and can cause fear of losing power or status. Support from a chief executive is critical, and as Grace Simrall, Louisville chief of civic innovation and technology, says, "I have seen colleagues struggle because they don't get buy-in or support from the chief executive. My mayor empowers me and then stays out of the way. And he gives cover when I need it."
- **Problem-focused.** Anyone can get distracted by the "shiny new toy" of a technology innovation, especially when a vendor sales pitch is slick. This can lead to solution-first thinking where we believe the new technology will solve the problem. The best data innovators start with a clear definition of the problem before getting to the solution stage. Jim Anderson, head of Government Innovation at Bloomberg Philanthropies, echoes this sentiment, "Public-service transformation never begins with the technology. It starts with a clear-eyed, people-centered understanding of the problem at hand — and working outward from there."[23] This focus on problem solving means that teams need to be staffed with creative thinkers. For example, veteran innovator and former Seattle Director of Innovation and Performance Tina Walha described her previous team as, "an interdisciplinary innovation team, and all-time offense problem solvers."
- **Results-oriented.** Every data analytics project should begin with a clear definition of the outcome; what public value will be created, what service will be improved, or what customer service will be revamped. As Keung in San Jose pointed out, her team's goal is to measure and improve city performance on specific services and programs for the public.

Her team is organized around performance improvement, and she said “At the end of the day, the goal isn't some academic paper or some intellectual analysis, because that's not really what government is for. Our job is to translate data into improvements to the program and to make sure that's measured.”

- **Focus on strategy and goals.** Public service often means dealing with the most urgent problem or the highest priority of the elected leader, which can distract from long term strategy and goals. For Melissa Schigoda, director of the office of performance and accountability in New Orleans, the biggest challenge is “to keep the long term up and running without getting sucked into crisis after crisis.” The most effective data innovators are those who have a strategic plan and a vision and can keep their staff motivated toward the big picture and not get distracted by the crisis of the moment. California crafted an elegant data strategy,[24] and the city of Athens has an excellent Digital Services Roadmap.[25] These documents can help keep focus when distractions arise. Another example is Syracuse, where Mayor Walsh personally invested his and his senior staff’s time in developing a long-term strategy for stimulus funding, with an offsite retreat covering multiple days. As he pointed out, "We want to invest, number one, where we may not have resources to typically invest or where we can move the needle on some more of our significant challenges, like gun crime or climate change, but also want to make sure we're not investing in areas that will require ongoing investment."
- **Creative staffing.** University partnerships and private sector resources can be powerful tools for hiring and leveraging talent on a part time or short-term basis. While some cities have great track records, these resources and partnerships are often underleveraged in the government data innovation field. Further, in some cases, it is the local university rather than city hall driving a research agenda and programming. Hiring and importantly, retaining staff with in-demand skills can be challenging, particularly in cities with residency requirements or salary caps. Some governments have solved this problem with allowing such roles to bypass collective bargaining, by using contracted labor, or allowing remote work, yet the challenge remains for many. Cities should build on initiatives to bring outside ideas into government, such as fellowships, internships, executives on loan and interagency personnel agreements.
- **Work across boundaries.** The best data innovators work across boundaries because the more interesting and complex problems in government are cross-departmental; for example, the question of how blighted properties and violent crime intersect. A heatmap that shows geographically how they are connected would need data from the police department as well as from code enforcement. Layering on data about complaints from the public would mean adding 311 data. Is that a project for an innovation team, a digital team or a data team? Any one of those teams could take on such a task, and in one city this very task was done with a combination of data and innovation team staff along with GIS staff. Collaboration across silos is an area with perennial opportunity for improvement. As one data innovator said, “As a taxpayer I assume people are on the same page working together, but from the inside I can say that there isn’t as much collaboration as we’d all like.”
- **Form alliances for collaboration, with clear delineation of roles.** Reflecting on how Denver integrates its data, technology and innovation work, Paul Kresser, Denver’s chief data

officer notes, “To be successful you have to encourage strong collaboration and empower people at the same time. It’s important to be clear about roles as there can be issues around who has what authority that just leads to unnecessary delays.” In New Orleans, Schigoda believes that collaboration and cooperation across organizational lines is key to success with data and innovation. Having worked under multiple mayors and the various organizational alignments of her performance and analytics team, her perspective on getting things done in city government is, “What matters is the people and personalities, not where you are on the org chart.”

- **Customer-focus.** Data innovators should listen to their customers across government and build relationships of trust by listening. Once that trust is established, it should be nurtured, along with a connection to citywide bureaucracy. As one city leader said, “You want to be warmly invited in not thrust upon an agency because the elected sees something wrong.” And beyond government itself are the ultimate customers who need to be heard – the public. As Santiago Garces, Boston’s chief information officer notes, “We’re the one company that can never turn anyone away. Everyone is our customer.”
- **Start small and let success build.** Reflecting on the lessons learned from her state’s data-informed response to the opioid crisis, Josie Fasoldt, senior director of engagement and analytics with the Indiana Management Performance Hub (MPH) advises others to “start small – don’t try to solve the world all at once.” She notes that MPH started with one dashboard and built from there, after establishing credibility and the power to add value and insight. Beginning with laboratory information for state police, they then added death data from the state vital records office, and then added incrementally from there. As she said, “Once the value of the data is shown, people are appreciative, and it snowballs from there.”
- **“Walk the walk.”** Innovators can’t just tell others to innovate, they need to be able to do it in their own teams too. Clearly “walking the walk” of innovation in Louisville, Simrall intentionally creates a culture of constant improvement for her team as a way to set the example for what they are trying to help the city do – improve every day, every month, and every year. As she says, “It’s so easy to rest on your laurels and coast on successes for the rest of your tenure in local government. But I challenge the team to repeat their best performance over and over again. As they say on the Sopranos, ‘You’re only as good as your last envelope.’ For our team, yesterday’s performance is yesterday’s news, we’re always pushing for more.” Simrall thinks outside her box and challenges others to do so as well. For example, she pushes the city’s IT team to not just consider doing business with the vendors who proactively sell to the city, but to also look at platforms and solutions and technologies from companies that typically only sell to the private sector.

Pitfalls to avoid include:

- **Soloists.** Sometimes, a new innovator is appointed and celebrated, but not given much more than a title and a direct line to the mayor or governor. Without authority or a team, these solo actors struggle to establish enduring achievements. Like a soloist in a choir, they contribute beautifully, but briefly. An example of this is Kansas City, among the first cities to appoint a Chief Innovation Officer, in 2013. After brief tenures of three

different Chief Innovation Officers, the city did not rehire for the position after the mayoral turnover. This function was in the mayor's office but was not staffed with the depth to serve citywide, which decreased its impact.

- **Dual-hat leaders.** In some state and local governments, the rush to name someone as a chief for data, innovation, or digital has meant that someone has both roles, a so-called dual hat. In most cases, one person doing two jobs is not a good idea. For executives tempted to appoint one person to two roles, it is helpful to remember that Clark Kent and Superman never did the same job *at the same time*. If one individual is going to be given two roles, they should have sufficient resources to perform both functions, and must have clear delineation of roles with strong leaders at the helm of each team.
- **Overemphasis on tools.** New tools, for data analytics or for data visualization, often cause excitement. Yet sometimes there is an overemphasis on the tools at the expense of true problem solving. One data scientist, when confronted with a straightforward request to help allocate costs at their city airport, was excited to do random forest model because the team had just done their first successful project using this tool – but a far more complex tool was needed in the case. As the saying goes, "When you have a hammer, everything looks like a nail." Sometimes, it's not the data team but the customer that is overly focused on the tool. For example, data teams often complain that they are bogged down by requests for both internal and public dashboards, with one city leader noting, "We're building dashboards and wish we could be doing more sophisticated analytics, but they just keep asking for more dashboards." And in another city, the tech-forward mayor was consistently asking "Can we have an app for homelessness?"
- **Short tenure and turnover.** It can help have leadership who stay long enough to have an impact. This can be challenging as the skills that make for success in government data innovators are also attractive to private sector as well as other public sector employers. In order to have a lasting impact, to build staff capacity and to change culture, innovators need to stay for at least a few years.
- **Avoidance of issues that get public scrutiny.** Too much emphasis can be placed on avoiding conflict rather than proactively addressing issues of concern to the public. In one city, the CDO does not analyze micro-mobility data due to widespread panic in the organization over public concern about privacy. Rather than avoid, data innovators should proactively engage the public, academia, advocacy groups and the private sector in developing and then carefully explaining to the public how data will be managed and secured. Otherwise, outsized fears around data privacy and security will stymie progress on important issues.

Staffing Data Innovation Functions: Two Models

Data, digital, and innovation teams have been in place for many years. They are sometimes part of the same organization but more often are in separate teams. There are myriad ways these roles are organized in government, but one thing is common – most of these innovators start out as a sole hire, and their teams grow organically over time. But where in government are they typically? And does it matter? How do they relate to other innovation roles such as resilience officers, sustainability officers, GIS officers, privacy and data ethics officers, and equity officers? How do they relate to longstanding government functions of finance, procurement, and technology?

In some instances, there is friendly competition between data and innovation teams, while in other cases they collaborate frequently. Looking across the innovator landscape, there are two basic models of how the organizations are structured. Some have consolidated the innovator functions into a single office or under a single leader across multiple teams. More commonly, they are spread across multiple offices, most often including a technology office. When the functions are in separate offices it takes effort to be aligned on mission and priorities. The table below describes the two models and their characteristics and provides a handful of examples where the model is working well.

Data Innovators in Government: Two Organizational Models		
Model	**Characteristics**	**Examples**
CONSOLIDATED	All or most innovator functions are combined in one organization or reporting structure	Kansas City, Salt Lake City, San Diego, Seattle, and South Bend.
DISTRIBUTED	Innovator functions are spread across government. Typically, there is a concentration of functions in one agency, department, or reporting structure with other satellite entities performing innovator functions separately. Most often at least one of the functions is in a technology department, such as the office of the Chief Information Officer (CIO).	Boston, Denver, Louisville, New Orleans, and San Francisco.

Salt Lake City uses the consolidated model, and Kryger describes Mayor Mendenhall as "definitely into data." To staff the city's data and innovation work, she has created a team of equals, four directors who all report to the chief information officer. The roles include Kryger, along with the chief technology officer (CTO), chief information security officer (CISO), and chief innovations officer (CIO). This team of innovators lives by the motto: "Make the quality of life for people in SLC better through data." Another example of the consolidated model is Seattle, where innovation and data teams are together in the Innovation and Performance department, with a nascent digital team embedded. This team is not part of the city's IT organization, unlike many others.

One example of the distributed model is the city and county of San Francisco, an early adopter of the CDO position, and a nationally recognized leader in analytics and data culture. In addition to the CDO, the Mayor's Office of Civic Innovation has run several innovation programs including Civic Bridge which provides pro bono opportunities for private sector volunteers, and facilitates startup technology engagements with the city, while the Comptroller's Office runs the performance management program and much-replicated data academy. The CDO is responsible for open data and data analytics, and digital services are the purview of the city's chief digital services officer.

Does it matter where in government the innovators are situated? Many innovators are a part of or in the same reporting structure as the technology office, with Louisville and South Bend following this model. Others report to the chief executive or to a budget and policy office. What's more important than where a data innovator is located are the operating conditions. They need a clear mission, and their scope must be clear to others so there is no "mission creep." They need to have the resources and authority to adequately carry out their mission. As one innovator pointed out, the political capital of the person in the role sometimes matters more than where the role is in government – someone with the right relationships can often get things done that others would not be able to because they know how things work and know the right people to get to yes.

Sometimes, organizations take on responsibilities simply because they can – competent people and teams are often rewarded for good work by being assigned more work. In this way, many innovators found themselves as the point people on pandemic response, and subsequently on the analysis of ideas and tracking of funded programs for the recent stimulus funding. There are times when the location of a function in government is an artifact not of where it is most appropriately aligned but where the competent people are who can get the job done.

Does it matter if all the innovation teams are in the same reporting structure or if the innovators are distributed across government? The decision to centralize innovators in one reporting structure or to place them separately will depend on the unique assets and challenges of the jurisdiction. One thing to note when placing them in separate reporting structures -- rivalries can occur. When asked if all innovators should be in the same reporting structure, Louisville's Simrall notes, "If they don't report to the same person, then at least the key individuals leading the teams should have a strong relationship. They should be looking at each other as collaborators." And, in addition to working together, they should learn from each other. As Simrall notes, "Don't repeat mistakes, adopt and adapt what you've done that's useful. That's incredibly appealing to people who are drawn to the work to problem solve and want to make a difference."

Does it matter what we call our government data and digital innovators? It doesn't matter what title someone has, as long as the work gets done. A more nuanced answer to this question is that there are tradeoffs. One approach is standardizing nomenclature, so that there aren't different names for the same role depending on the city or state. Experts differ on the importance of standardizing job titles and job descriptions for data and digital roles. In the

private sector there is value in transportability of roles, from one firm to another, an argument in favor of standardization. However, in government there tends to be more movement among roles within the same organization than moving to another government in the same role, making the standardization of titles and job descriptions less valuable. Greater standardization of titles would mean greater interoperability across sites and would bring a level of consistency to the profession.

Yet, the fluidity of these titles does allow each mayor or governor to feel ownership of the role by branding it uniquely to their location. The key is to be flexible on the title and not get wedded to on thing in case the organization, technology, or needs of the public change. It also minimize the chances of being wedded to something that later becomes outmoded – for example, governments no longer employ calligraphers or Morse Code operators.

Hiring for innovation, data, and digital roles can be challenging as state and local governments typically have set salary ranges and job titles that have not kept pace with the market. In fact, one data leader noted that everyone on her team has the title "program coordinator" because data scientist is not an approved job title yet in her jurisdiction, much less user experience designer or human centered process designer.

One good example of where titles don't matter is Kansas City, Missouri (KCMO), among the leading data driven cities. Data and innovation work is housed at DataKC, led by a Chief Analytics Officer, a role now codified in city code. This data team has responsibilities that span open data, performance management, analytics, data storytelling, innovation, partnership with the city's the 311 call center and responsibility for all public surveys about government services, as well as data and process improvement academies to train city staff in these skills.

In this city, innovation is driven by a spirit of public entrepreneurship and service improvement, not simply by titles. The city was among the first to appoint a Chief Innovation Officer in 2013, housed in the mayor's office. While the standalone role provided an independent viewpoint into the organization, the lack of staffing/support was a challenge to building sustainable innovation initiatives that were integrated into the organization. After 2019, the role was unfilled for a period of time. Over the years and over the tenure of the three mayoral CIOs, the data team worked in various levels of collaboration with the Chief Innovation Officer, and also contributed to innovation efforts, even if not calling it by that label. As Bender noted, "The CIOs were champions for innovation, but there was an understanding that much of our data work also contributed to positive change. We used the word continuous improvement instead of innovation to avoid confusion."

KCMO does not have anyone with the title Chief Digital Officer but instead, throughout the data team there is an emphasis on making city services easy to consume for the public. As Kate Bender, then-Chief Analytics Officer noted, "We've not had an explicit focus on digital, instead we focus on customer service, communication, and creating quality data. Those are things that end up pushing us to move forward on creating more and better digital services." Because of

the data team's role in leading innovation for 311 services and its successful mobile friendly app, digital services were a natural outgrowth.

Interviews with a sample of leading chief data officers from both the consolidated and distributed models are summarized in brief city profiles in the appendix to this paper as well as in case studies of San Jose and Louisville published previously.

Conclusion

CDOs were appointed in a handful of early mover cities over a decade ago, and since that time the movement has grown. Yet, with 90,000 units of local government ranging from cities to towns to school districts to water and energy districts, there are many thousands of government organizations without a clear data leaders, and overall the local level remains in the early stages of maturity of the data leader profession.

In a 2015 reflection on progress in the field to date, Harvard University Professor of the Practice and Director of Data-Smart City Solutions Stephen Goldsmith compared the rise of data analytics in cities to the e-government movement of the prior decade, noting,

> In the early days of online government, cities at the vanguard rightly bragged about taking on "e-gov" as a project. Within just a few years, though, e-gov had moved from a set of individual projects to an ingrained part of innovation and customer service. Now, cities around the country are working to make their immense quantities of data more public and actionable. As these initiatives take hold, the success stories of data analytics will, like e-gov, move from the anecdotal to the mainstream.[26]

Today, as a result of the pandemic diverting attention from long term strategic data initiatives and to crisis response, that optimistic prediction remains only partially realized. There is great untapped power and potential in data as a tool for innovation in government. With stimulus funding explicitly for data capacity building, there is a great opportunity to build on existing success and chart an even greater future. Key policy issues like addressing aging infrastructure and closing equity gaps can be advanced by data innovators.

While the challenge ahead is great, so is the opportunity for lasting impact. Along the way, adopting a culture of data-led innovation requires accepting that there will be setbacks and use them to reflect, learn, and pivot. Perhaps one of the greatest aspects of the coming wave of federal assistance to state and local government is the chance to experiment, and to learn along the way from false starts. As Jonah Lehrer points out in his book *Imagine*, when it comes to success stories, “We neglect to mention those days when we wanted to quit, when we believed our problems were impossible to solve. Because such failures contradict the romantic version of events…instead, we skip straight to the breakthroughs. We tell the happy endings first.”[27]

Or as pioneering innovator Walha said, “We had some spectacular failures as well as some tremendous successes.” A strong leader, she took ownership of failure and let her team take ownership of success, telling them, “Let’s try this and if it fails, I own that, and if it succeeds, we all own it.” In a similar vein, in Louisville, Simrall found that the urgency to act during the pandemic relaxed ideas of perfection and enabled more acceptance of imperfection as a gateway to success, noting, “There was an immediacy and urgency to the problem solving right as the pandemic hit. Hurtling from one problem to another and trying to solve multiple problems at once was a forcing function – people didn’t have time to bemoan the fact they had

to solve the problem quickly and not perfectly." And she emphasizes the importance of reflecting on success as well as failure and learning from each and notes, "If we pretend that we don't fail, we'll only make things worse."

In the coming years, and with stimulus funds, local governments should embrace learning from dead-ends and disappointments because they are a natural part of the process, and sometimes, it is just when someone is ready to give up is when the insight comes. Perhaps, with the spirit of experimentation spurred by the pandemic and an embrace of imperfection, coupled with the infusion of federal funding, a new wave of data-led innovation can emerge.

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Appendix A: Background on the Civic Analytics Network

The current generation of advanced data analytics in city government began in 2010 when two mayors saw the potential of data to inform better decisions. First, Mayor Bloomberg tapped Stephen Goldsmith as deputy mayor of operations and tasked him to leverage the vast troves of city administrative data for insight to improve customer service and advance operational efficiency, much in the same way that his business had harnessed the power of data for insight and profit. Following Bloomberg, Mayor Landrieu in New Orleans tapped Oliver Wise to create a data and performance organization in March 2010. The following year the city of Chicago named its first CDO, bringing a private sector title and role into government. The advent of such data leaders in cities coincided with a global growth in access to data on a massive scale - from 2010 to 2020, the amount of data captured and used in the world grew almost 5,000 percent[1]. As data availability, and proliferation of tools to analyze and visualize data grew, so did the movement to appoint data leaders in cities.

By 2015 there were half a dozen data innovators with similar roles across the country who had established an informal network. Many, but not all held the title chief data officer, and each had a unique portfolio of responsibilities, yet all retained authority over the emerging field of advanced data analytics. Each busy with pioneering work in their own city, none had time to coordinate a formal network, yet the urgency to do so grew as the number of chief data officers increased.

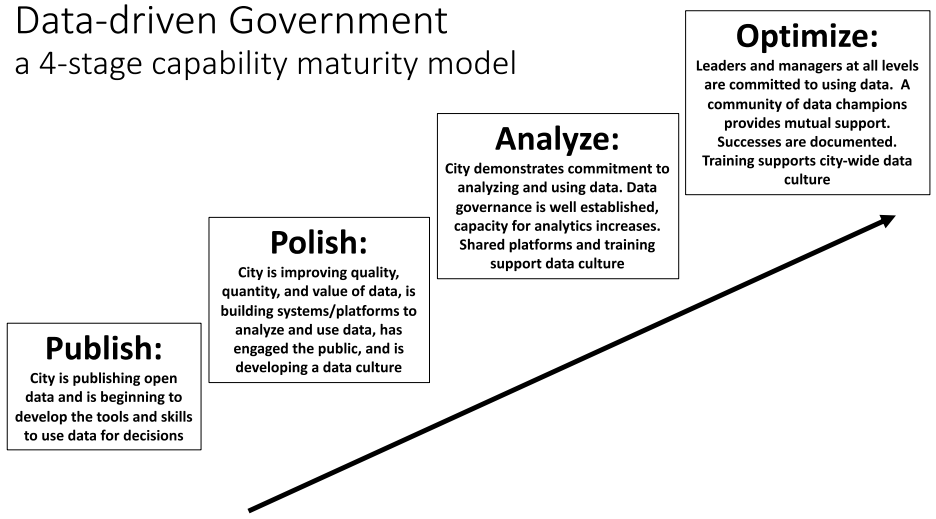
In early 2016, Goldsmith, then at Harvard, received funding from Arnold Ventures to host meetings of this nascent network of urban data innovators, and created the CAN. For the next several years, the network met twice a year at Harvard to exchange ideas and engage in peer support. By coming together as a group, each expanded their own intellectual capital by being able to tap into the ideas of others.

The group brought their combined voice and purchasing power to bear on the vendor community, successfully advocating for needed change among open data platform vendors.[1] They saved each other significant upfront time by sharing tools and templates from both successes and disappointments. They shared models for data training[1] as well as sourcing of analytics projects.[1] Across the network, ideas were more thoughtfully developed via collaboration, including the development of an ethics in algorithms toolkit.[1] Early participants contributed to a roadmap for their successors in how to create and staff a data organization in government.[1] Network participants contributed their insights and lessons learned to a public conference to share their reflections on how to maximize value and minimize disruption using analytics.[1] Network participants contributed case examples to help document the value of the data analytics function in government.[1]

In-person convenings paused during the pandemic but the ongoing exchange of information and peer connection remains. Over time the group grew to over two dozen participants as the role of chief data officer became more common.[1]

Evolution of the CDO role

For many of the first CDOs, the early years were grounded in the open data movement, with an emphasis on creating robust open data portals to provide transparency of government operations to the public, press and academia, but also as a mechanism to share data internally in government in a standardized format. Data governance responsibilities in the early years for many CDOs were about creating data standards and data sharing mechanisms and building the foundation for shared data infrastructure that could be scaled citywide. This open data-fueled movement toward data analytics was tied to the fact that to do big data analytics required large quantities of high-quality data. A theory put forward by this author at the time was that increasing amounts of publicly available government data would drive closer review of that data and would identify flaws and gaps in data that could lead to data quality improvements. And as more and better data became available, that would enable the capacity for more advanced analytics, and for a higher level of data maturity across the enterprise as shown in the diagram below.



Appendix B: City Profiles

Several CDOs from CAN cities shared their time and insights with the author as background to this paper. Summaries of those city discussions follow for Denver, Kansas City, New Orleans, Salt Lake City, San Diego, and South Bend. Case studies for San Jose and Louisville were previously published.

Denver

The city and county of Denver established the CDO role in 2019, after several years of other officials serving informally in that capacity.

This city invests heavily in data and innovation. It follows the distributed model, with innovation work led by the Denver Peak Academy team embedded in the Department of Finance. All other data, digital and citywide communications are under the leadership of the city Chief Information Officer (CIO) David Edinger. This model works well, with excellence in each team reinforcing the success of the other.

Denver Peak Academy trains staff from across departments on process improvement tools, enabling frontline staff and managers to take ownership of the changes needed to make government more efficient and customer friendly. Peak Academy has been in place for over a decade, having started in 2011 to address a budget shortfall by finding efficiencies. Peak's founder, Brian Elms, literally wrote the book on how to do this work.[1] Peak was the first but no longer the only such academy. More than 200 other cities and nonprofits have sent staff to participate, and dozens have replicated process improvement academies locally. More than 10,000 Denver city employees have been trained. They have created more than 4,000 innovations that have saved taxpayers $51 million, including dramatically reducing wait times at locations such as the Department of Motor Vehicles.

During the pandemic, Peak Academy took on a project to help the Office of Children's Affairs distribute funding to more diverse nonprofits, moving beyond just the largest ones with grant writers on staff. By streamlining the funding application from 26 pages to 12, they saw a 30 percent increase in first-time applicants. They also began to collect baseline data on the demographics of who is the leader of the nonprofits, not just who is served, in hopes of growing awareness of the diversity of community-based leadership among funded nonprofits.

The centralized IT organization in Denver covers traditional IT such as hardware and software and application development but also includes information security, data analytics, and all digital services and public communication channels. Denver consolidated IT into a central organization partly to reduce exposure to security issues. During this process, they found the new structure has additional benefits, such as reducing redundancy of software purchases and lowering citywide costs while increasing data interoperability across departments due to greater standardization of platforms.

The central IT organization is now creating a community of practice to increase technology skill levels across the city. Denver is automating a wide range of activities that used to be done by staff, including provisioning servers.

Denver sets its digital transformation goals with a Digital Steering Committee that meets regularly to consider priorities. The committee includes the city's CDO, the 311 director, the chief digital officer, the chief applications officer, and the deputy CIO. Priority is generally based on the value to the public.

Kresser offers this advice to other data innovators. First, build data and organizational infrastructure. Kresser noted the importance of creating policy and practice that will outlive any individual or organizational structure. He pointed out, "If you don't build the infrastructure, it will dissolve when the initial people leave." Kresser also encourages collaboration that is paired with clarity about roles. Reflecting on how Denver integrates its data, technology, and innovation work, Kresser noted, "To be successful, you have to encourage strong collaboration and empower people simultaneously. It's important to be clear about roles because there can be issues around who has what authority, which just lead to unnecessary delays."

Kansas City

Kansas City, Missouri (KCMO) is among the leading data driven cities, with gold certification[1] from What Works Cities, and was one of the few to receive certification in 2018, the first year of the program.[1] This data-driven culture didn't happen overnight, as Kansas City began its performance management program, KCStat (now called Open Data KC) over a decade ago, and was among the first to live-stream and also record performance stat sessions so that the public could learn about progress toward city goals.[1] Data on customer satisfaction with city services has been used to improve service delivery both via an annual business and citizen survey and also by asking for customer feedback on 311 service requests.[1] The city was also among the early adopters of appointing a CDO, in 2015, and has been an active participant in Harvard's CAN since its inception in 2016. The city has embraced data so broadly that even artists are engaged with data, creating an exhibition of artworks based on information on the city's open data portal.

Kate Bender, KCStat co-creator and former Kansas City chief analytics officer, describes the mission of her former organization as using "data, innovation, and engagement" to make city services better and more responsive to public needs. ender's former position has been codified in city code, as has the role of performance management and open data. This work is now vested in DataKC, with responsibilities that span open data, performance management, analytics, data storytelling, innovation, partnership with the city's the 311 call center and responsibility for all public surveys about government services, as well as data and process improvement academies to train city staff in these skills.

The city does not have anyone with the title "chief digital officer" but instead, throughout the data team there is an emphasis on making city services easy to consume for the public. As

Bender notes, “We’ve not had an explicit focus on digital, instead we focus on customer service, communication, and creating quality data. Those are things that end up pushing us to move forward on creating more and better digital services.” Because of the data team’s role in contributing to continuous improvement for 311 services and its successful mobile friendly app, digital services were a natural outgrowth.

Innovation is driven by a spirit of public entrepreneurship and service improvement, not driven by titles. The city was among the first to appoint a chief innovation officer in 2013, housed in the mayor’s office. While the standalone role provided an independent viewpoint into the organization, the lack of staffing and support for the position was a challenge to building sustainable innovation initiatives that were integrated into the organization. After 2019, the role was unfilled for a period of time. Over the years and over the tenure of the three mayoral CIOs, the data team worked in various levels of collaboration with the chief innovation officer, and also contributed to innovation efforts, even if not calling it by that label. As Bender notes, “The CIOs were champions for innovation, but there was an understanding that much of our data work also contributed to positive change. We used the word continuous improvement instead of innovation to avoid confusion.”

The DataKC team is actively working on innovation projects, as well as training staff from across city departments in the key elements of innovation. After taking an interest in the work done by Denver at its Peak Academy, members of the DataKC team went to Denver to receive training and then came back and created their own version, the Process Improvement Academy (PIA) which offers a variety of courses to all levels of city staff. This curriculum serves multiple purposes -- it develops distributed capacity for process improvement and helps change cultural norms toward greater expectation of and acceptance of continuous improvement. As more staff complete the academy it helps employees across city government use common tools and speak the same language.

Bender notes that “process improvement is the 3rd leg of the stool after data and performance. We started with a performance focus, which became a data focus, and now all three are co-located in one organization.” In addition to creating the PIA, DataKC leads process improvement projects for departments, many led by graduates of PIA who want support in carrying out projects, even though they’ve completed the training themselves.

DataKC also developed a data academy, modeled on the San Francisco Data Academy, and trained hundreds of city staff across a wide variety of introductory, intermediate and advanced in-person courses before the pandemic. Graduates of the data academy are helping to grow the city’s data culture.

An example of success for DataKC involved helping the city triple tax revenue using data analytics and lean process improvement. Working with the city’s legal department to examine the process for collection of overdue taxes owed to the city, the team found insights that led to a new way of case processing and the decision to add two dedicated staff for pursuing late tax payments. Annual collections rose from $1.1M in FY15 to $3.2M in FY18, and further upgrades

and improvements have been made to this process increasing overall returns. Counting staff salaries, this is a return of eight times the investment.[1]

New Orleans

In New Orleans, innovation and use of data have become entrenched in the city's culture over the past decade, owing in large part to both the innovation team and to the city's commitment to performance management and data analytics. Staff who previously served in data and innovation capacities are now mid and senior level managers across city government as their skills and talents are recognized and they are attracted into senior leadership roles and away from the data and innovation teams which essentially serve as the "farm team" for citywide leadership roles.

New Orleans was one of the first cities to appoint a CDO, in 2011, and in that same year was one of the initial Bloomberg Philanthropies Innovation Teams (iTeam) grant award recipients. The iTeam set two goals -- to address city permitting and to reduce homicide. The projects funded by that grant were successful, and some of the work is now embedded in city government but renamed or rebranded after the change in mayoral administration. The iTeam was predominantly staffed by new hires who came from outside government, some of whom remain in city government long after the grant funds expired, including one who is now working on enterprise data efforts.

Schigoda, as director, leads the performance team and functions essentially as the city's CDO. She has been in her current role for over four years and has led the data team to great success. She reports to the city's deputy chief administrative officer for business and external services, one of two deputy chief administrative officers (CAO) in the city. Some functions that are often coupled with data analytics, such as the innovation team, open data program, geographical information services (GIS) and digital services are the purview of the city's IT department, which reports up to the city chief information officer, not the chief administrative officer (CAO). Being part of an IT organization can be perceived as being neutral, as opposed to being perceived as a mayoral initiative, which could be at risk when a new mayor takes office. This segregation of some data duties across the two reporting chains of command has not stopped New Orleans from being successful. Partly that is because across years and mayoral administrations, the teams move around periodically on the org chart but the relationships remain.

The city also has a federally funded Resilience Team, which does tactical process improvement projects initiated pursuant to issues identified by the long-term tracking done by the performance and accountability team. As Schigoda's team's long-term tracking uncovers problems the Resilience Team are the sharpshooter team that comes in to fix the problem. This relationship became institutionalized through "911 stat," which involved a deep dive into 911 call data looking at results by geography – examining call response time for each area of the city. They also looked at 911 response time for special events, such as during Mardi Gras celebrations, and looked at the response time and call breakdown by neighborhood and type of call. he analysis also included a review of overtime (OT) used in response to 911 calls and had

to factor in the various rules around OT for EMS, fire and police who all have different staffing models and rules around how many hours they can work. The analysis considered how much the city was relying on OT to staff the units, and whether changes to the scheduling could reduce city expenditures on OT.

There was a rush to digitize services during the pandemic that left little or no time to engage in process mapping and streamlining of paper processes. This was exacerbated in New Orleans by the fact that the pandemic hit as the city was just recovering from a cyber-attack and in rebuilding mode for IT services. As Schigoda says, "There wasn't a lot of re-doing processes when we went digital but now are aware of how important it is and will be doing more of that going forward." The digital services that were built during the pandemic have shown success to date. For example, digital hearings have enabled New Orleans to do code enforcement and different hearings online as it increases the number they can do – instead of waiting for people to walk into and out of the room, hearing officers can just log onto a virtual session.

Schigoda's lessons learned and advice for others reflects the importance of both vision and management. She emphasizes the value of clarifying the "why" at the start of a project. Schigoda notes the importance of strategic planning and thinking ahead, especially when it comes to implementation of new technology, "From the start, there needs to be a sense of the 'why' and when implementing the system, it's important to set up clear processes when setting up data systems so that when data comes out, we are able to do it to measure success." Importantly, and too often overlooked is the benefit of good project management skills. Schigoda encouraged others to realize, "The most important skill for successful innovation is project management. It takes good planning and good facilitation to keep a project on track, and to keep meetings productive. For one thing, a strong project manager is able to recognize and address when there are ego issues that need to be addressed."

Salt Lake City

Equity is a top priority for Salt Lake City and there are several data-driven projects related to equity, including using the city's street light system to supply free Wi-Fi to low-income areas of the city. The city's streetlights are also a testbed for smart street lighting and smart parking.

An intergovernmental project demonstrates the way data fuels innovation in this city. Kryger is working to connect city and state tax data to city geographic data. By pulling real estate tax data from the state and then adding in the city real estate tax data and spatially connecting it to the map, Kryger can for a variety of scenarios show what a specific parcel of land looks like if rezoned a variety of ways and can show this 3-dimensionally. So, for example, a block that had been sitting unused for 10 years was shown under a variety of scenarios ranging from a park to residential units to a commercial property. Using the tax data to show scenarios in real time helped visualize the tradeoffs for the various zoning options and the financial results expected via taxation.

Another interesting use of digital tools created by the city for the public is a tool to help users find and navigate to food, to support the business community during the pandemic. The app allows users to sort food purveyors by location and by type or ethnicity of the food, and has navigation to help the user get there or by car or on foot, supporting walkability for the city.

While many individuals worked from home during the pandemic for public health reasons, Salt Lake City is now gathering real-time data on air quality so that when air quality is bad, the public can make decisions about staying away from work to avoid poor air and the negative health impacts. Publicly deployed sensors, including those on new electric city buses, provide real-time data and air quality forecasts that can be shared with the public, empowering them to make better informed decisions about potentially working from home on days with poor air quality. The information can be sent via push messages to those who opt in. The announcement below went out to city employees on a day with moderate air quality issues, advising those who could, to work remotely.

Source: City of Salt Lake, via email from Nick Kryger

San Diego

In the city of San Diego, the Performance and Analytics Department (PandA) is responsible for open data and data analytics, innovation, performance management, the constituent service call center, the city's customer satisfaction survey, and the city's digital apps for service delivery.

Reflecting on lessons from the COVID-19, Bower notes that her team was viewed as "a bit of a strike team" because they are nimble with skills across data, technology, customer service and creative problem-solving. And as she noted, "When there's a crisis happening what's needed is

someone with a citywide purview to come in and help, across an array of tasks. We helped departments develop plans when the stay-at-home orders came into place."

One key benefit of data teams working alongside city departments is the relationship of trust that helps data teams have influence in other areas. For example, Bower and her team worked with Emergency Medical Services (EMS) on predictive analytics and developed a relationship of mutual trust. The relationship of collaboration is such that the data team was able to influence an RFP for ambulance services, using analysis of historical data to set appropriate service levels and ambulance response times that providers will need to meet.

Digital innovation is part of PandA's portfolio, led by Alex Hempton, deputy director for technology and innovation. The city is implementing a customer relationship management (CRM) system citywide and using it as a work order management system across departments. Each departmental rollout involves process improvements to make it easier for the public to interact with government, much the way the city's excellent Get It Done mobile app does by simplifying the user experience. he collaboration on this is simplified as the PandA team also includes the Performance Management team which created the city's process improvement academy, and which now focuses on collecting and analyzing employee and public feedback through surveying and helping the city develop and track meaningful performance metrics.

South Bend

In the city of South Bend, the Office of Innovation and Technology (OIT), is responsible for data, innovation and digital services. Leaders reporting to Riedl, the chief innovation office, include the director of business analytics, responsible for data analytics, the director of civic innovation, who leads on identification of innovation projects, and the director of 311 customer services, who leads on digital services. For South Bend, Digital Services is a cross-divisional team, with each functional area having a team member responsible for app development, a design specialist, and a civic user testing team member. Given that South Bend is a smaller city, staff are used to wearing multiple hats. Integrating all these functions under one department has advantages for South Bend as the roles are sometimes fluid and the sense of shared purpose and teamwork is strong.

This integration of functions is intentional. As Riedl noted, "At first a lot of people talked about innovation and technology like they are separate, but they aren't. If my IT people feel like they don't have a role in process improvement, that's a problem. In fact, they've sourced a lot of process improvement work themselves."

South Bend has integrated technology and process improvement. As Riedl said, "We send in business analysts to do process mapping before buying the technology to keep the focus on the business problem to be solved, rather than the product or software proposed by the vendor. We do get pushback on that but have the power of the purse." And the culture change is beginning to take root. More than before, city departments turn to OIT proactively, before an IT

purchase for problem solving – instead of coming to them with “we want to buy this thing,” it’s “we have this problem.” This is particularly true with the repeat customers.

As far as providing digital information to the public, OIT provides the standards and protocols and the platform, and then lets the city departments own the process of creating their own content. Playing the role of facilitator and coach, OIT has created a digital information community of practice across city government and convenes the group every couple of months for training to make sure people have the tools they need to do their job. OIT also monitors some of the products the city departments produce to make sure they’re mostly on track. As Riedl stated, “Our job is to make the rules, enforce the rules, do the training, but not take ownership of all of the work ourselves. We do the projects that need the most attention and let agencies handle the rest. We create capacity by teaching them how to do it.”

Members of the OIT team tend to be responsive to the needs of their partners across city government, and this is a good thing, as structurally, those are the “clients” without whose financial contributions the organization would not exist. The entire Innovation Department is a city-wide asset whose costs are shared across all departments on a chargeback basis, similar to how that city funds its legal and finance functions.

In summary, Riedl noted that, “Digital, data, technology – it’s all about how well we’re delivering on the goals of citizens. Without technology it’s hard to collect data, and without digital it’s hard to know what the public wants. We have strong public engagement in our priority-setting for innovation work, and we learn a lot by asking questions. When we work with other city departments, even if there isn’t someone in the room with innovation in their title, you’ll surface the people who informally are the innovators.”

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