Smart Communities & DATA ANALYTICS

ICMA | sas

ICMA, the International City/County Management Association, advances professional local government through leadership, management, innovation, and ethics. ICMA provides member support, publications, data, and information; peer and results-oriented assistance; and training and professional development to more than 11,000 city, town, and country experts and other individuals and organizations throughout the world. The management decisions made by ICMA's members affect 185 million individuals living in thousands of communities, from small villages and towns to large metropolitan areas.

SAS. SAS has served government for more than 40 years and is used extensively by all 15 federal departments, all 50 states and many local governments. Through data management, business intelligence and analytics solutions, SAS helps government agencies enhance program performance, reduce costs, increase transparency and improve quality of life for citizens.

Cited Internet sources were valid as of September 2017. Because URLs and websites are constantly changing, we cannot vouch for their current validity.

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- Cybersecurity: Protecting Local Government Digital Resources
- Smart Solutions: Technology Serving Communities

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FOREWORD

Dear Friends in Local Government,

I am frequently asked, "What is a smart city?" and "Is it realistic to think that my city could be a smart city?" If you are using information technology to improve the lives of your citizens, you are already being "smart." If you are not using information technology but have plans to, you are on your way. Every government—big or small—can employ new technologies to be more effective and efficient.

As you embark on expanding your use of technology, I encourage you to do two things. First, recognize the importance of data. The information that we collect about our citizens, utilities, infrastructure, schools, services, and employees is extraordinarily valuable. And, why collect data unless you are going to use it? When you combine your data, amazing revelations can be found that will save your organization money. Given the importance of data, begin with good data management, integration, and governance rules. Your integrated database will act as the solid foundation for all of your smart city endeavors.

Second, use technology to make improvements that you actually need. This sounds incredibly obvious, but the enthusiasm of smart city vendors has led a lot of local governments to pilot and install technologies that they don't need, can't maintain, or find to have limited impact. Having a Smart City Strategic Plan will help guide your organization's efforts and put the focus on the high-impact, high-return projects.

I hope you find this report as interesting as I have. We can all learn from each other as we strive to use technology to provide the best government and living conditions for our citizens.

Regards,

Jen

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SMART COMMUNITIES
& Data Analytics

Executive Summary

Smart community practices and data analytics are being used by more local governments worldwide every year and are helping them become more efficient and effective at delivering services across multiple disciplines and sectors. Local governments have access to huge amounts of quality demographic, environmental, and economic data that are publicly available, including but not limited to data from the U.S. Census Bureau, National Weather Bureau, Bureau of Labor Statistics, or provided through private vendors. They are also generating their own data through stakeholder engagement, staff, and technology. Putting this data to work means they are able to more strategically deliver services, make more resources available to the public, and improve performance.

This report finds that local governments can begin these practices with existing staff, technology, data, and resources to achieve compelling results, including cost savings and enhanced community relations, economic development, interdepartmental collaboration, public safety, public health, and more. Once started, local governments can continue to find areas where even more advanced systems and technology can amplify the benefits already received. A key to success is realizing that technology and data, while transformative, will realize their potential only if they are being managed competently by people in a system founded on clear communication, political and policy support, and a willingness to adapt.

Section 1.0 Introduction

Local governments are faced with the increasingly difficult challenge of providing high levels of service while limiting the expenditure of precious tax payer resources. Whether it is improving public safety and health, managing traffic flow, providing clear and efficient planning and permitting processes, communicating with the public about performance and budgets, responding to the challenges of climate change and more, local governments are working hard to do more with less. One strategy to accomplish this difficult task is to harness the power of emerging sources of data and technology to become more efficient, transparent, and effective.

Known as "smart communities,"[i] local governments across the United States and internationally are using technology and citizens to collect data, analyze it, and apply the Internet of Things (IoT) to streamline processes and practices, track performance, and strategically allocate resources for more efficient and effective public service delivery.

The use of data to direct public resources is not new, but the rapid evolution of new technologies and sources and volumes of data has made new practices possible, and surpassed the capacity of existing systems to provide effective results. The advancement of cost-efficient sensors, mobile web applications, availability of big data, new analytical systems, and a growing awareness about their potential to make cost-effective and highly efficient operational changes are driving innovation in local government.

Smart community approaches are being implemented across the United States and internationally by our largest and most sophisticated cities, but they are also helping smaller municipalities improve their performance. No matter the size of a place, its ability to respond in real time to changing economic, environmental, and demographic conditions speaks to its commitment to livability, fiscal accountability, and social equity.

ICMA and SAS are working together to bring the power of data analytics and smart community practices

to local governments worldwide. Pairing the unparalleled ICMA network with industry leader SAS, the economic, environmental, and social benefits of smart community practices can be realized on a global scale. When activated, these practices help local governments make informed decisions across operational sectors such as public safety, energy, transportation, purchasing, public health, transportation, land use, water and wastewater, environmental quality, and more. This is becoming even more important to local governments as new types and increasing volumes of data are becoming more prevalent due to the Internet of Things (IoT). Whether data comes from internal systems, social media, remote sensing technology, or citizen engagement, SAS is committed to helping local governments around the world analyze their data to identify trends and opportunities for action that make our cities and counties more efficient, effective, and sustainable.

Section 2.0 Smart Communities and Data

Working together, ICMA and SAS have sought out the smart community practices of leading municipalities, the findings of research conducted by ICMA and others, and highlights from other publications. This report draws upon experiences within the United States, Canada, and other countries.

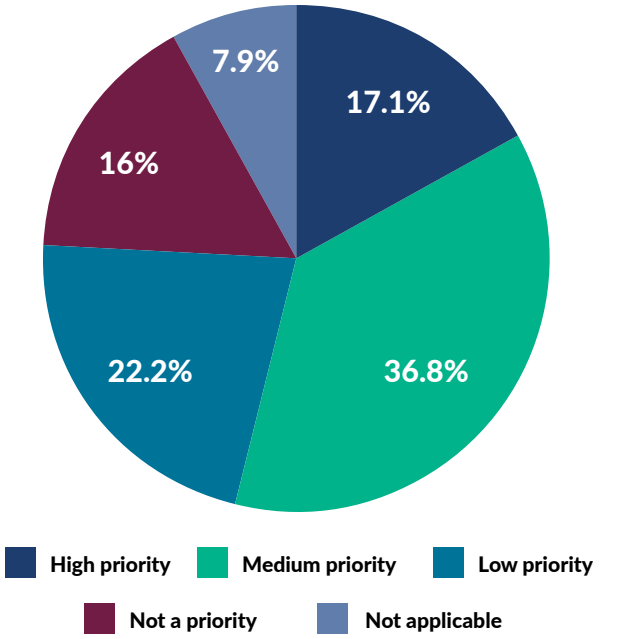
Local governments in the United States interviewed for this report include:

- Las Vegas, Nevada
- Lewisville, Texas
- Kansas City, Kansas
- New Hanover County, North Carolina
- Madison, Wisconsin
- Louisville, Kentucky
- Omaha, Nebraska

The adoption and aspiration to adopt smart community practices was evaluated by ICMA in partnership with the Smart Cities Council (SCC), through a 2016 survey distributed to local government leaders across the United States. Responses from 493 city and county chief administrators identified their priorities, status, motivators, and barriers for the implementation of smart community practices. The SCC is a network of leading companies, universities, laboratories, and standards bodies working to leverage the transformative power of smart technologies to create smart, sustainable cities with high-quality jobs and high-quality living.

According to this survey, 53.9 percent of the respondents considered their commitment to smart community approaches as a medium-to-high priority (Figure 1).

FIGURE 1: 2016 ICMA survey overall commitment question



Survey respondents were also asked to rank their priorities across different categories of smart community sectors. Among those responses, public safety was a clear favorite, with others tracking closely together (Figure 2).

When comparing respondents' priorities to their active deployment of smart community practices (Figure 3), however, a gap between them becomes evident, and this represents opportunity for growth. This is especially evident with the public safety sector, which ranked first in priority but sixth in active deployment. Other areas such as customer service/public engagement and transportation also demonstrate the need for increased attention as they ranked in the top five priorities but did not rank in the top six sectors in active deployment.

Other informative findings from the 2016 ICMA survey include:

- The top motivating factor for engaging in smart community practices is economic development, followed closely by operational cost savings, resiliency for critical operations, enhanced resident services, and safety and security.

FIGURE 2: Top priority summary

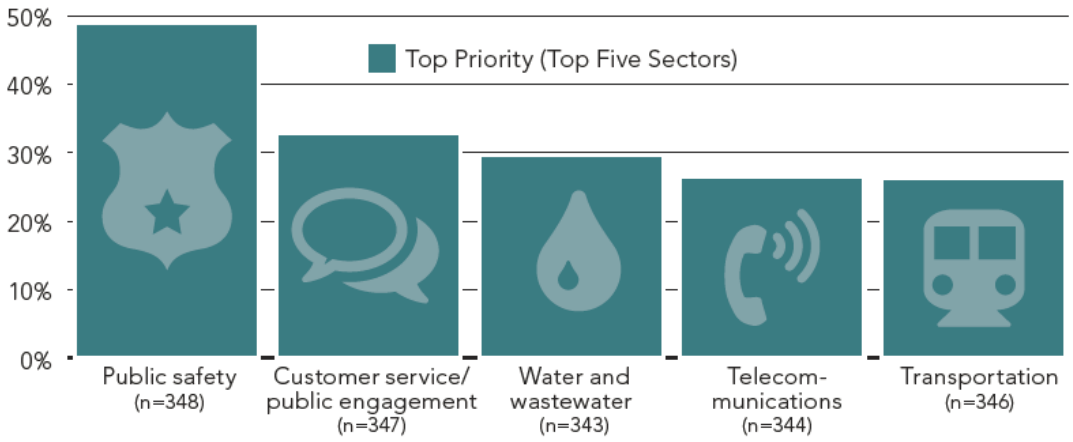
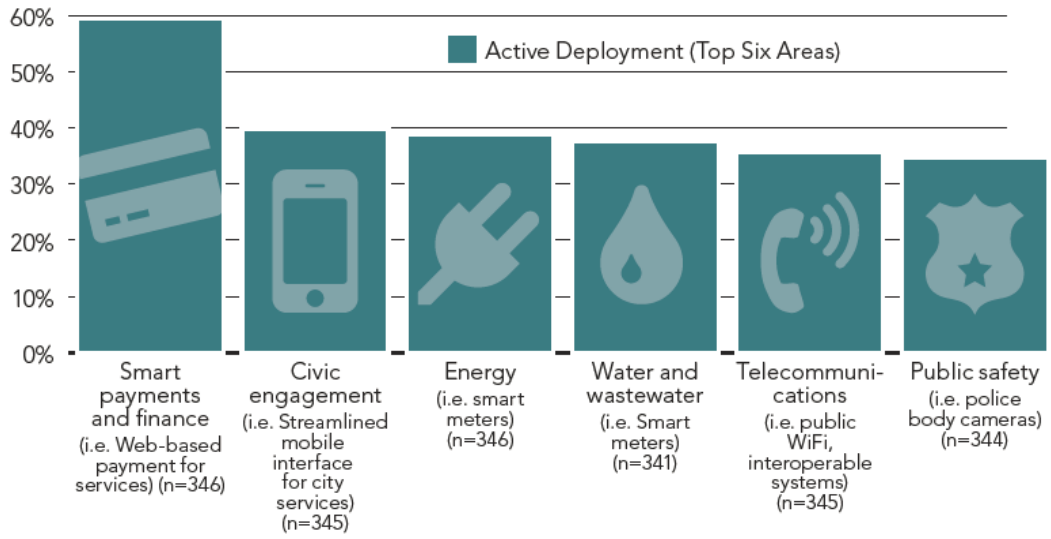


FIGURE 3: Active deployment ranking summary

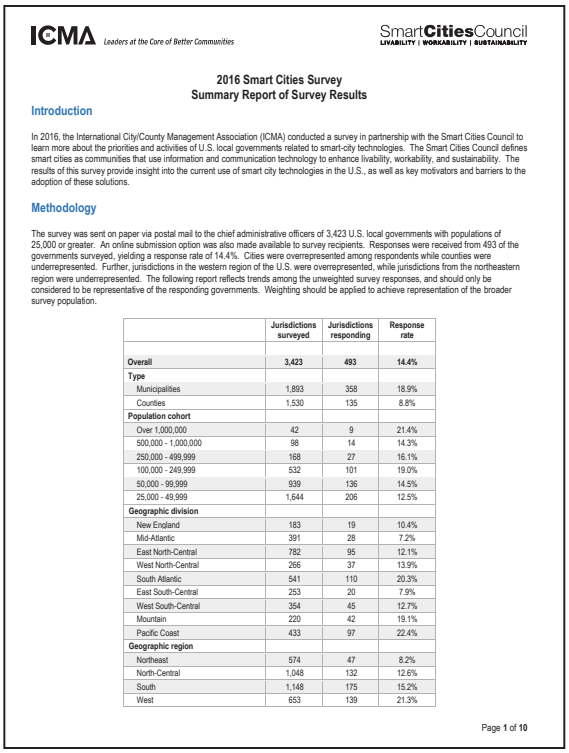


- Respondents are far more likely to engage in smart community practices working collaboratively with a consultant (69.4 percent) than to operate them completely independently (14 percent) or to completely outsource them (4 percent).
- Nearly 75 percent of the respondents indicated that they already engaged or are interested in engaging in smart community practices in collaboration with other communities to aggregate demand and increase purchasing power.
- Public demand was the leading factor in motivating communities to engage in or strengthen their smart community programs, with a clear return on investment and request from elected officials coming in closely behind.
- The two largest barriers respondents face to implementing smart community practices are budget and internal capacity limitations. Other barriers include the need for supporting infrastructure, technical expertise, and reliance on legacy systems.

A full summary of the 2016 ICMA Smart Communities survey can be found here.

The benefits of adopting smart community policies and practices vary from place to place and according to which practice is implemented. This report finds that overall, practices currently being used tend to reflect the top motivating factors for local governments to adopt

such practices as identified in the 2016 ICMA survey. Smart community practices such as open data portals spur economic development by providing companies



ICMA Leaders at the Core of Better Communities

SmartCitiesCouncil LIVABILITY | WORKABILITY | SUSTAINABILITY

2016 Smart Cities Survey
Summary Report of Survey Results

Introduction

In 2016, the International City/County Management Association (ICMA) conducted a survey in partnership with the Smart Cities Council to learn more about the priorities and activities of U.S. local governments related to smart-city technologies. The Smart Cities Council defines smart cities as communities that use information and communication technology to enhance livability, workability, and sustainability. The results of this survey provide insight into the current use of smart city technologies in the U.S., as well as key motivators and barriers to the adoption of these solutions.

Methodology

The survey was sent on paper via postal mail to the chief administrative officers of 3,423 U.S. local governments with populations of 25,000 or greater. An online submission option was also made available to survey recipients. Responses were received from 493 of the governments surveyed, yielding a response rate of 14.4%. Cities were overrepresented among respondents while counties were underrepresented. Further, jurisdictions in the western region of the U.S. were overrepresented, while jurisdictions from the northeastern region were underrepresented. The following report reflects trends among the unweighted survey responses, and should only be considered to be representative of the responding governments. Weighting should be applied to achieve representation of the broader survey population.

	Jurisdictions surveyed	Jurisdictions responding	Response rate
Overall	**3,423**	**493**	**14.4%**
Type			
Municipalities	1,893	358	18.9%
Counties	1,530	135	8.8%
Population cohort			
Over 1,000,000	42	9	21.4%
500,000 - 1,000,000	98	14	14.3%
250,000 - 499,999	168	27	16.1%
100,000 - 249,999	532	101	19.0%
50,000 - 99,999	939	136	14.5%
25,000 - 49,999	1,644	206	12.5%
Geographic division			
New England	183	19	10.4%
Mid-Atlantic	391	28	7.2%
East North-Central	782	95	12.1%
West North-Central	266	37	13.9%
South Atlantic	541	110	20.3%
East South-Central	253	20	7.9%
West South-Central	354	45	12.7%
Mountain	220	42	19.1%
Pacific Coast	433	97	22.4%
Geographic region			
Northeast	574	47	8.2%
North-Central	1,048	132	12.6%
South	1,148	175	15.2%
West	653	139	21.3%

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with readily available demographic, spatial, land use, and economic data available for evaluating location, expansion, and logistical factors. Sensors and real-time traffic tracking help move people, freight, and products faster and more cost-effectively, creating cost savings, reduced carbon footprints, and cost savings resulting from reduced driving times. Technology is increasingly helping utilities manage water, storm water, wastewater, treatment plants, and infrastructure to protect human and environmental health, provide regulatory compliance, and realize operational savings. Data analysis helps protect human health and safety by anticipating water conditions, adjusting treatment options, and developing response scenarios for disasters. These are but a few of the ways in which technology, data analytics, and the IoT are advancing local governments into the next generation of smart community practices for local government.

Where to Begin: Getting started can be a stumbling block for local governments. The ICMA survey in 2016 identified budget and internal capacity limitations as the two most significant barriers to implementing smart community technologies and practices. This might be due to a misperception that adopting smart community practices, such as using data analytics, technology, and IoT, requires big purchases, expertise, lengthy processes, and overwhelming amounts of data. This report finds that starting a smart community approach can be accomplished by using existing data, technology, and staff, and can be executed quickly. New Hanover County, North Carolina and Kansas City, Kansas, are living examples of how this can be done.

In early 2017, **New Hanover County, North Carolina,** adopted a revised special use permit (SUP) process for industrial uses. Amending the existing ordinance included extensive stakeholder engagement through which citizens, businesses, and interest groups voiced their priorities for how they want their county to grow and operate. The county's planning staff and leadership heard repeatedly that the public and businesses need a more accessible way to be informed about develop-

Typical open data process

ment applications, permits, variances, zone changes, and more. In response, the planning department used existing mapping tools, permit, and development data to create the Development Activity page. Now, up-to-date information about SUP, rezoning variance applications, appeals, and more are available to anyone with access to the Internet. The highly intuitive GIS-based tool quickly became the third-most visited page on the New Hanover County website and has not resulted in an increase in telephone calls directly to department staff. This result is interpreted as a significant increase in community awareness without additional burden on staff, all driven by a smart community practice that was created in response to citizen input.

In 2016 the Unified Government of the **City of Kansas City and Wyandotte County**, **Kansas,** tasked staff to create an initiative that tackled the region's vacant, abandoned, and nuisance properties, a significant concern for public safety, health, aesthetics, and economic development. In January 2017 staff presented plans for the Stabilization, Occupation and Revitalization (SOAR) program, a five-year effort to identify and address the negative consequences of these properties. It responds directly to concerns raised in a 2016 Resident Satisfaction Survey, and is focused on communication, appearance, and safety. Their first step was to develop a data-driven understanding of the scope of the issue and its impacts. This involved merging existing datasets managed and owned by the city/county across multiple departments, and accessing publicly available and free data including but not limited to the U.S. Census data and American Community Survey data. Using the existing and free data not only created a cost-efficient way to analyze the issue, it changed organizational culture and operations, increasing efficiency and efficacy. In the spirit of "breaking down silos," the SOAR data analysis involves seventeen departments whose staff became energized by understanding their specific role in a larger initiative and in being connected to their colleagues throughout the region. As of the date of this report, SOAR's data already include an inventory of 3,500 properties of concern being evaluated by the local land bank. Further data analysis is also being done to enhance the city's partnership with the local Habitat for Humanity program and to support their joint pursuit of Nodes of Strength program resources from the U.S. Department of Housing and Urban Development (HUD).

Once initiated, smart community practices have proven to be more than effective tools that improve transparency and performance. By those implementing them, they are quickly recognized as catalysts that transform the way local governments operate, think, communicate, and build relationships for the better.

Section 3.0 Data and Decisions

Among the surge in smart community practices and data analytics, certain trends are emerging and becoming standard practice for local governments. This section captures some of these trends and provides insights for local government leaders and staff to consider when structuring or growing their smart community programs.

Open Data Portals: Perhaps the most popular smart community practice identified for this report is the emergence of open data portals. Open data portals are web-based sites offering publicly available data and other information across a variety of topics and sources. Often built in response to growing public demand for government transparency, these portals offer data about budgets; decision making; finances; performance; and GIS-based information such as land use, development, and zoning.

Citizens are using the openly available data to stay informed and prioritize their engagement efforts, while businesses and community-based organizations are using the data to make informed and strategic investment, operational, and management decisions. Local governments themselves are using the portals to collect information and are applying data analytics to track and communicate performance.

The city of Las Vegas, Nevada, is widely recognized as a national leader in open data and data-driven performance evaluation. In 2007, the city created Performance Plus, an online open data portal used internally by the city and externally by partners to evaluate the city's performance across key performance indicators (KPI). With strong experience with Performance Plus, the city decided to take the next step and evolve it into Results Vegas, a next-generation open data portal and performance tracking tool. Anyone can go online to see how the city is performing according to the KPI, which were created, in part, by crowdsourcing ideas and priorities from the public.

Open Data Protection: If a local government is to generate and make primary data available for public

consumption, the city of Las Vegas advises that local governments first make sure the data are safe and reliable. There are two major factors to consider.

1. That there is no sensitive city or personal information in the data that can be used maliciously.
2. That the data are reliable and its users have accurate expectations about what they describe.

Recognizing the value that dynamic primary data can be to citizens and businesses, the city of Omaha, Nebraska, is just embarking upon an adaptive street signalization process equipped with cameras. It initially plans to make its live video feeds of traffic conditions available to the public, who can make informed decisions about commuting times and routes based on real-time road conditions. From there, it will evaluate the utility of making other primary data collected through its elaborate sensor network available to the public for businesses and others to use.

Local Business Use of Open Data: In line with the results of the 2016 ICMA survey finding that a local government is strongly motivated to adopt smart community practices for economic development purposes, the city of Las Vegas provides publicly available data through its online por tal. Businesses, including casinos, are using the open data to make decisions about their operations and outlook. This includes but is not limited to correlating their revenue with crime statistics in proximity to their business, and make informed decisions about security, marketing, advocacy, and facility improvements.

These trends and insights underscore the understanding that smart community practices and data analytics are an advanced extension of traditional public agency operations across all sectors. They are high tech and sophisticated but at the same time accessible and have the potential to translate complexity into easily accessed information with clear benefits.

Longevity Tied to Policy: As local government data collection and analysis becomes more dynamic, accessible, and utilitarian, local governments are becoming more reliant on these systems for operational efficiency, communication, and service delivery. As such, it is important that these systems are continuous, and treated as essential functions rather than short-term programs or initiatives. This can be a challenge if it is the initiative of an individual elected official, agency leader, or staff person, all of whom eventually move on. For long-term success, it is important that these champions institutionalize smart community practices as direct feeds into policy creation. In Lewisville, Texas, this was accomplished by passing the Open Data Policy, and by tying a part of its operations dashboard to metrics and goals derived from the city's 2020 Strategic Plan. By doing so, it is ensuring that these systems will operate well beyond the tenure of the elected officials, administration, and staff that initiated them.

These policies do not necessarily have to be specific to smart communities or data analysis. In 2014, Madison, Wisconsin, began the City of Madison Racial Equity and Social Justice Initiative, which weaves racial equity and social justice through all of the city's decisions, policies, and operations. Among many other things, the initiative recommended a data project coordinator position, which was created and filled in 2015. This position works to use data to inform city programs, policies, and spending related to equity goals, and "... improves utilization of data toward transparency and accountability in city business as it relates to equity goals."[ii]

Two—or More—Birds with One Stone: Smart community practices can achieve multiple objectives and produce multiple benefits from a single practice. For example, as referenced in a 2016 SCC report,[iii] San Diego, California, is expecting to save more than $250,000 per year with an intelligent streetlight network to control 3,000 lights. By using the system to turn streetlights on and off when needed, San Diego is achieving significant operational cost savings, reducing its carbon footprint, and increasing public safety.

Static and Dynamic Data Both Hold Value: Data can provide a snapshot of conditions (static) as collected in surveys; or they can be a growing, evolving data set (dynamic) as with remote sensors, mobile applications, or changing demographics. Both provide valuable insights for decision making. For example, Lewisville, Texas, launched its open data portal in early September 2017 using and making available both static and dynamic data. This includes community input provided through surveys and stakeholder engagement activities (static) in addition to data that are created and uploaded constantly in real time (dynamic), including but not limited to building permits and inspections projects. Some data sets can change as often as every fifteen minutes as information is updated in different systems across the city, providing a real-life picture of what is happening in the moment. With this information, the city has access to precise locations to which code compliance officers and inspectors can be deployed.

Open-Sourced Applications: From publicly available data, web and mobile application developers can create new applications ("apps") to serve a number of purposes. The apps can then in turn get posted on the portal itself. An example is the Open Checkbook app developed in Las Vegas, tracking public expenditures by department, type, and vendor.

Quality Data: Understanding who owns and manages the data can be surprisingly more complicated than it should be. A common expression regarding data analysis is, "garbage in, garbage out." The quality of the data used in any analysis affects its findings, which leads to important policy decisions and financial and political investments. Local leaders should feel confident in the results of data analytics and smart community efforts by understanding that the data used to conduct analysis are current, complete, and reliable.

The Kansas City, Kansas, SOAR program uses well-known secondary sources such as U.S. Census Bureau data, but it also uses primary data generated by the city, such as code enforcement data, tax assessor data, and more. Assembling these data required significant coordination among different agencies, and ensuring the quality of multiple sources of data, all of whom had different practices for collection and management. SOAR data are shared with the public on its open data portal and can be used to track progress toward program goals. The city of Madison, Wisconsin, had a similar experience. A significant effort of the first data project coordinator's first year was spent identifying and evaluating several sets and sources of data maintained by all departments within the city. With a solid understanding of its data, the local government can use data in a reliable way and make changes to data collection and management practices when necessary.

Cloud-Based Software and Data Access: When purchasing software for any department, considering a cloud-based system is very attractive for several reasons, but one critical consideration needs to be included in discussion and the contract with the vendor: securing access and ownership rights to the complete data sets that are collected by the vendor. It may seem like a common-sense practice but it is not unusual for vendors to collect extensive data but only produce reports for the local government client. Data is a lucrative asset for those who own it, and local governments should not only be able to use their own data, but also not have to purchase it back from the vendor.

Mobile Apps Bridge Gaps: Making mobile apps available for the public to help monitor community assets can lead to more efficient management of those assets and improve public safety and health. They do this by bridging a gap between citizens' and the local government's understanding of the condition of its assets. Through mobile apps, citizens can report things like derelict structures, failing infrastructure like potholes and streetlights (Lewisville, Texas), crime, and public health hazards. With this information easily available, local government can match service delivery with community needs nearly immediately, ensuring problems are addressed quickly and efficiently. These tools are often evolving from existing 311 CRM systems, and can expand their capacity by allowing citizens to upload pictures and answer other questions about the concerns they report.

Link Stakeholder Input to Decisions and Outcomes: It can be difficult to show exactly how local stakeholder input and contributions are reflected in public decision making, spending, and policy. Smart community and data analytics can help make those connections clearer. Many local governments operate mobile or web-based apps that allow citizens to report conditions such as crime, vacant properties, potholes, and more; all this information can be connected to outcomes and displayed on open data portals. For example, in Lewisville, Texas, citizens can report potholes through a mobile app and then review their open data portal to review the budget for such fixes. The city then also has the capacity to display the relationship between citizen input and public spending on the portal.

Kansas City, Kansas, officials took a proven low-tech approach to identifying how the public can use the data: they ask people. So far, vocal responses are for the open data portal to include more detailed information about utilities, historical housing and building data, and infrastructure capacity (road/water/sewer/telecom). Kansas City is also working to integrate its 311 system to the open data portal so the public can see what calls have been made and what responses resulted from them. A new app is also being developed to allow 311 reporting and bill payments.

Traffic Control: Traffic congestion created by morning and evening rush hours, special events, and bad weather is not only a drain on time, but it has negative public safety, health, environmental, logistical, and economic implications. As such, traffic engineers have long sought solutions to shorten drive times. Widening roadways is time-consuming, expensive, sometimes impossible, and too often a temporary solution. The application of advanced technology and data analytics is one approach pursued by the city of Omaha, Nebraska, to help alleviate these problems. With a primary goal of improving safety for all modes of transportation (car, bike, pedestrian, transit, etc.), an upgrade of all 1,000 of the city's traffic signals to an adaptive traffic control system is underway. The first phase of implementation is focused on the two busiest commercial corridors, requires laying miles of dark fiber optic cable, new signals, censors, and cameras. These infrastructure upgrades are important for local governments preparing for Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communication technologies becoming available in new cars.

Section 4.0 Local Governments Using the Power of Data Analytics

Data provide policy makers, managers, and elected leaders a foundation upon which to make decisions, allocate resources, and deliver services. Data also set a baseline of conditions against which progress toward policy goals and needs can be measured. Local gov-

ernments in the United States and internationally are seeing their operations become more efficient, processes become more transparent, and delivery of public safety and health services become more effective.

Facilities: The city of Lewisville, Texas, has been using its data analytics to make strategic decisions about public facilities. Most recently, this included using their internal data to relocate a fire station to better protect a growing population and changing growth pattern. Making this data-informed decision is increasing public safety by ensuring that fire response times are shorter and the protection of humans and property is more effective.

Stronger Interdepartmental Collaboration: One of the pitfalls a local government can fall into is when its departments operate too independently in "silos." This can lead to financial, logistical, and political problems stemming from insufficient communication, shared purpose, and sense of unity. Local governments instituting smart community and data analytics policy and practice are finding by adopting this approach, they have created a system that breaks the silos and creates opportunities for departments to collaborate to achieve a common purpose.

These ideas have been put in motion in Madison, Wisconsin, by designating a point of contact in all twenty-six city departments who convene and communicate to ensure ongoing data collection and refinement for publishing on the city's data portal.

Anticipate and Respond: For utilities, like the Cape Fear Public Utility Authority, maintaining and restoring water and wastewater services before, during, and after natural disasters is critical to the protection of human and environmental health and safety. There are a few off-the-shelf analytical and technology tools that utilities can use to help accomplish this. HURREVAC is a free online tool for emergency managers provided by the Federal Emergency Management Administration (FEMA), National Oceanic and Atmospheric Administration (NOAA), and United States Corps of Engineers (USACE) that helps simulate real-life disaster scenarios and anticipate potential operational failures. Being able to anticipate failures allows the emergency management teams to develop responses to each failure so when disaster does strike, they will be able to better protect human health and safety by becoming operational again. HURREVAC also provides a communication network for emergency managers to share best practices, lessons learned, and other resources.

Other existing tools used to anticipate disaster impacts and help develop responses include the U.S. Department of Defense IC Waters software, and Information Sharing and Analysis Centers (ISAC).

Public Health in Real Time: Data analytics can compare existing data against data created in the field to estimate where certain services and/or enforcement actions might be needed in the community. For example, Lewisville, Texas's system tracks public health inspector information created daily as these individuals conduct restaurant inspections. This information can also help the public make informed decisions as the data portal allows the public to track each permitted facility's scores over the last three inspections. As Lewisville develops a robust dataset of these health inspection results, it can correlate scores to other factors such as seasons, demographics, and more to enable informed decisions about which businesses should be inspected and when.

Drinking Water and Technology: Providing safe drinking water is a major task. Starting at the source of the water, visual and laboratory testing characterizes the conditions, such as turbidity and total organic carbon (TOC), so the drinking water treatment facility can adjust its treatment process accordingly. Leading utilities, such as Cape Fear Public Utility Authority (CPUA) in North Carolina, use advanced cloud-based communication systems, such as Utility Cloud, as a direct link from field observations to treatment. Using cameras and staff observations in the field, conditions are immediately uploaded and available at the plant and managed through the utility's supervisory control and data acquisition (SCADA) system. If problems are identified in the field, knowing about them in real time allows troubleshooting to start as the problems are identified. Utilities can also save the data collected in the field year after year, allowing for analysis to help anticipate changes in water conditions relative to other factors such as weather events, development patterns, and disasters.

Water treatment plant

Crowdsourcing Public Safety Solutions: In Louisville, Kentucky, a pilot program using innovative technology and communication is protecting public safety by detecting fires in vacant and abandoned structures. Louisville has approximately 8,000 vacant/abandoned properties. These properties have been subject to arson, endangering the lives of citizens living around them. In 2017 the city piloted a program using a locally created technology affectionately called Casper. Casper is a solar-powered, wireless-connected microphone that detects the sound of smoke alarms. Mounted on vacant structures, Casper sends a warning to the fire department when it detects the sound of a fire alarm in the vacant structure. Because the structure is unoccupied, the alarm would not otherwise trigger a response, allowing the fire to grow and spread to adjacent structures.

IT Staff Considerations: Many local governments across the country have proven that smart community and data analytics efforts can be started with existing staff and resources, but a couple of key insights can help this move forward more smoothly. From an operations standpoint, some departments have internal IT staff who work for the department itself (transportation, housing, planning, etc.) instead of within an actual IT department. This can lead to the department IT person not understanding the processes and capacity of the central IT department. Conversely, the central IT department might not have a firm grasp on the needs and capacity of each department. Local governments can consider having a worker from the central IT department posted in each department involved in the smart community and data analytics process. This way, there is continuity between departmental needs and efficiency in delivering services.

In cases where there is a central IT department whose staff remains internal, inefficiencies can be mitigated by designating a representative from each department and convening them regularly. In Kansas City, Kansas, a performance innovation team of six to seven representatives from city departments is coordinated out of the IT office. While the IT department is centralized, it operates in a way that mimics a consultancy, learning what each department needs, and tailoring solutions to meet those needs. Kansas City has found that a centralized IT role provides reach into all departments and provides access to tools it didn't have before.

Connecting Technology, Communication through Place: The true potential of smart community practices is more fully realized if it involves the entire society, not just those with natural tendencies to participate in such activities or those with access to technology. In Louisville, Kentucky, people are being connected to technology in a place called the Gigabit Experience Center. It is in an underserved neighborhood and serves as a hybrid of incubator, technology library, and community and event center. At the center, residents have access to high-speed wireless Internet access, laptops, tablets, work stations, refreshments, and events. Since 2016 it has improved public safety by activating the streetscape and improving public perception and activity in a relatively high-crime area. Additionally, it has resulted in economic development in a neighborhood that previously lacked investment by luring office tenants into the building with the improved safety and high-speed Internet access.

Louisville will use data analytics to evaluate Internet speed across neighborhoods, crime statistics, demographics, and property/facility availability to identify additional locations for similar facilities.

Using Data to Protect Children: SAS and New Hanover County, North Carolina, are pioneering predictive analytics to identify and track risk factors for children. The county's Department of Social Services (DSS) is an overburdened agency that deals with nearly ten child abuse or neglect cases each day, and case workers need tools to understand where help is needed the most. With SAS support, DSS is able to evaluate multiple risk factors for children and identify which children might need that help. The results are anticipated to be compelling, including reduction in child fatalities, paid placements, and savings of over $1 million annually.[iv]

People Are Still Essential: Regardless of how advanced technology and data analytics are, they still cannot function efficiently without real people at the helm. This is especially true with open data portals or with 311 systems that receive input from the public. If the public's input is going to yield efficient service delivery and cost savings, it is essential that this input be screened for relevance, validity, and priority. The 311 system in Kansas City, Kansas, uploads public comments directly into a queue in the Public Works Department where a person looks at the requests, makes an expert assessment, and issues work orders, or not.

Technology to Retain, Grow, and Attract Businesses: Local governments are in a continuous struggle to retain their business base, grow it, and attract new businesses. The quality and capacity of infrastructure such as roads, water, wastewater, and telecommunications are major components of their ability to be successful. This includes but also extends beyond traffic congestion, road conditions, proximity to highways, and the availability of high-speed Internet. Having advanced traffic control systems like those being installed in Omaha, Nebraska, are important economic development tools. They instill confidence in businesses that the city is making investments that help them operate efficiently. In the not-too-distant future, the sensors included in these systems will aid the navigation and safety of the forthcoming wave of autonomous vehicles.

Section 5.0 Looking Over the Horizon—Smart Communities and Data Analytics

The future of smart community and data analytics is dynamic, reflecting the growth of existing trends and responses to gaps identified in existing practices. The number of local governments adopting smart community practices will grow as will their staffs' ability to collect and analyze data, make operational changes, and disseminate the data and outcomes. In addition to having more effective operations and informed citizens, analytics can help communities become healthier, safer, and more efficient. Here are a few things for public officials, managers, and others in the practice to keep an eye on.

Newer, Cleaner, Real-time Data for More Efficient Service Delivery: As technology, such as remote sensing technology, continues to evolve, local governments will continue to have better access to data that represent more than a snapshot in time. These sensors deliver data on a regular basis and allow services to be delivered where they are needed in a much more strategic deployment. When collecting these data for long periods of time, data analytics will then be able to estimate where services will be needed in advance of incidents.

Connecting Input to Output on Data Portals: Even though data, the ability to interpret data, and their availability have moved far beyond their status of even a few years ago, current practices such as open data portals have yet to realize their full potential. To date, they largely serve to collect data from the public and to make other data publicly available. Two possible areas of growth involve connecting the data collected to decisions made and then reflected in publicly available data.

1. Portals can be used to communicate how stakeholder input has been used to inform policy, budget, and service delivery choices.
2. Portals can also grow to help local governments better understand how their open data are being used by businesses, community organizations, or other stakeholders and the resulting economic, environmental, and social gains.

In Madison, Wisconsin, for example, city officials aspire for their data portal to be used as a problem-solving tool by local community-based organizations, governments, citizens, and businesses to solve the city's pressing social equity and justice issues.

Additionally, some local governments are recognizing that their open data portals might not be serve as the sole source of data for internal use. Rather, a data portal's primary use can be to make data available to the public. To maximize accessibility, some local governments are using Graphic User Interface (GUI), the use of icons and images, to describe data making it more relatable and impactful for more people.

More Public/Private Partnerships: The concept of public/private partnerships is nothing new, but these partnerships are vehicles that can continue advancing the application of smart community and data analytics in the future.

Omaha, Nebraska, is in the initial phase of deploying fiber optic cable along its two major transportation corridors and upgrading its legacy traffic signal system, which still uses dial-up modems to communicate with the city's traffic control center. This upgrade to an advanced

traffic management system is being financed, in part, through collaboration with private sector partners in the wireless communication industry, such as Verizon, Mobility, and United Private Networks, which also want a fiber optic network throughout the city to better serve their business needs. In this partnership, the private companies will attach their cell technology to the public right of way, including traffic light poles and light poles, and lay the fiber optic wiring, providing the city with a conduit and a 24-strand dark fiber optic cable in exchange. This results in minimal cost to taxpayers and maximum benefit to the greater community.

Technology Upgrades: The shelf life of technology seems to keep getting shorter with upgrades needed regularly, which becomes technically and financially straining for local governments. When buying technology or software, local governments should do what they can to ensure the solution has the ability to accommodate new data or adapt to changing demands in the future. As Omaha, Nebraska, is upgrading its street signalization system, the city is working hard to ensure that the next upgrade does not require a full system replacement.

Data Integration: Kansas City, Kansas, sees the future including better data integration among systems, across city/county departments, and regionally with other public and private partners. These include improvements by vendors who provide services to the City/County Unified Government. Specifically, the government wants vendors to more regularly provide application programming interface (API) capabilities with their services in order to allow for more direct integration of the vendor's systems and data with the city/county's systems.

Several cities surveyed for this report echoed an important lesson they learned: realize that mistakes are going to be made along the way. It is important to make them as early as possible because corrective actions are more likely to be effective and ensure financial resources and political capital are spent wisely. That shouldn't stop local governments from pursuing smart community and data analytic approaches to becoming stronger, more resilient, and adaptive. Getting started is the key to success.

Omaha, Nebraska

COMMUNITY PROFILE

Population: 446,970
Land Area (in sq. miles): 127
Median Household Income: $49,896
General Fund Budget: $370,013,250
Total Staff FTEs: 2,827
Major Industries: Insurance, call centers, healthcare, rail, education, manufacturing, agriculture
Website: www.cityofomaha.org

Introduction

Omaha, Nebraska, rises from America's heartland along the Missouri River, surrounded by farmland as far as the eye can see. Once known as a pioneer town, and then for its expansive stock yards and meat packing industry, Omaha is a modern city that hosts corporate headquarters like Warren Buffet's Berkshire Hathaway, Mutual of Omaha, Union Pacific Railway, ConAgra, TD Ameritrade, and more.

Recent economic analysis evaluated the nation's 100 largest metropolitan areas,[v] and Omaha was among only three that offer a rare alignment of three key factors:

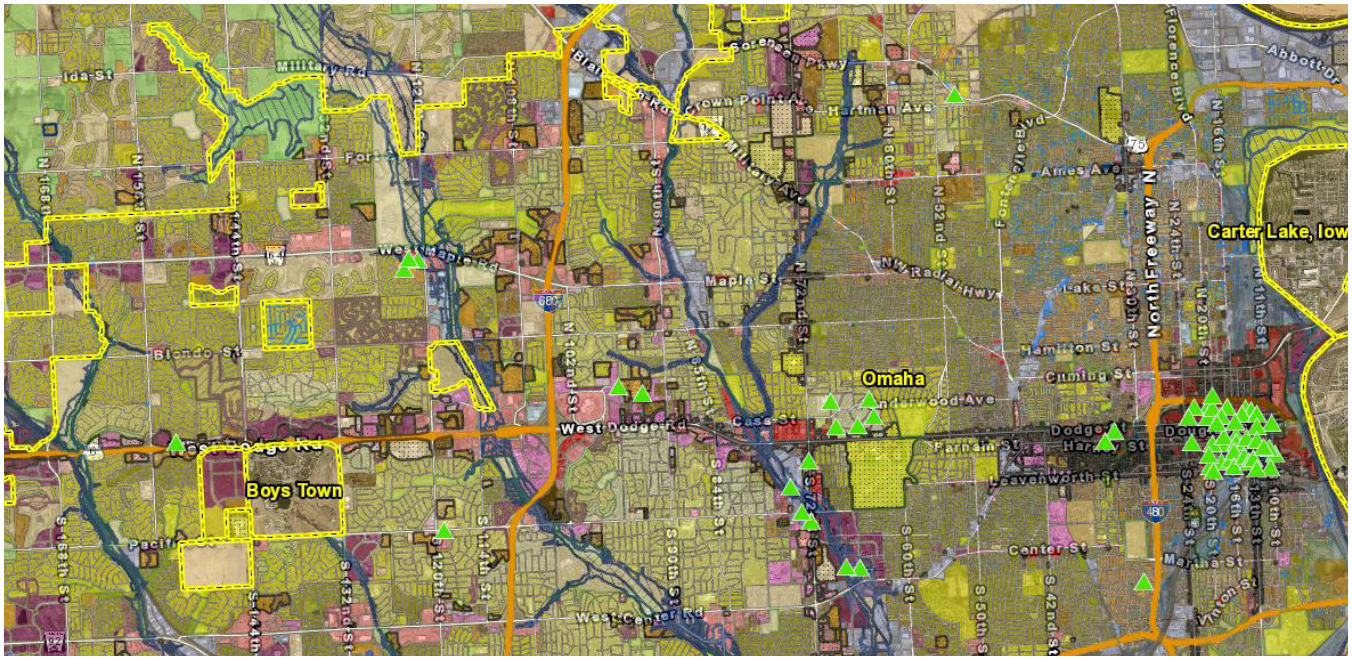
- Strong economy
- Affordability
- Quality of life.

With a diverse economy, available and affordable housing, quality schools, and other strong quality-of-life indicators, Omaha is poised for continued growth in the years to come. A component of Omaha's prosperity is the local government's commitment to openness; transparency; and using data, technology, and the Internet of Things (IOT) to be a smart community.

Intergovernmental Collaboration through Data

The city of Omaha and Douglas County understand the importance of regionalism and that the economy, environment, and culture do not begin or stop at a municipal boundary. While they are not formally merged, they do collaborate and share resources. One example is the Omaha/Douglas County Open Data Portal, where data, maps, information, and applications relevant to the city and county are made available to the public in one place. Plans, reports, and maps are downloadable, as are full datasets in comma-separated values (CSV) spreadsheets, keyhole markup language (KML), or Shapefile formats. Too many to list in this report, these data include information pertaining to subjects spanning from planning and development to recycling drop-off sites, demographics, and much more. They are organized by five major categories:

- Planning
- Transportation



A GIS map created with data from Omaha's open data portal

- Boundaries
- Elevation
- Points of Interest.

In addition to those data categories, the portal offers mapping applications, allowing users to tailor, save, and print maps and save images for their own uses. Among these is the Douglas-Omaha geographic information system (GIS) application, which enables users to create maps that identify infrastructure, zoning, code violations, trail, development jurisdictions, council districts, overlays, census tracts, floodplains, and more.

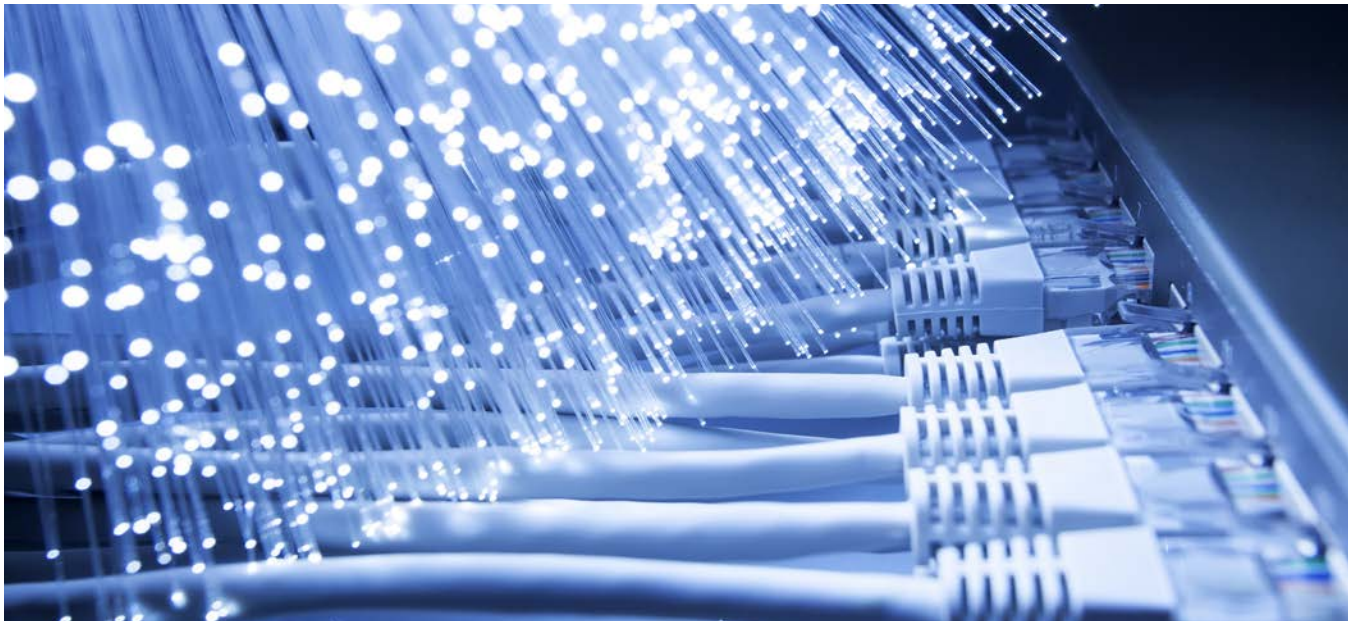
Data, Technology, Infrastructure, Public Private Partnerships: Oh My!

Omaha's prosperity, like other cities in the United States, comes with its share of challenges to address, including managing traffic, ensuring public safety, and being future-ready. In 2012, stakeholders discussed the issue of transportation safety, and automobile and pedestrian safety were called out as important issues to address. This led to an initiative to increase safety along the city's main transportation corridors. Among the city's responses was a plan to use smart community practices, technology, and data to improve safety, reduce traffic, and prepare for the future.

The city engaged the services of a consulting firm, and together they created a master plan for upgrading the city's 1,000+ traffic signals with modern and future-ready technology. It was time for the city's traffic management system to get smart and upgrade to an advanced traffic management system (ATMS). It was estimated to take 7 to 10 years to install a complete system throughout the city, but action was taken immediately with Phase A, which included approximately 200 ATMS signal upgrades along the city's busiest arterial, Dodge Street. The primary goal of these upgrades is public safety for all modes of transportation.

Safety would be achieved not by eliminating traffic, because that is an unrealistic expectation, but by reducing it, minimizing the number and duration of stops, and shortening peak traffic times overall. Doing this provides benefits beyond shorter commute times, but also results in greenhouse gas (GHG) reductions and improves public safety.

Public-Private Partnership (PPP): The ATMS upgrade is being financed, in part, through collaboration with private sector partners in the wireless communication industry, such as Verizon, Mobility, and Unite Private Networks, that also want a fiber optic network throughout the city to better serve their business needs. In this partnership, the private companies will attach small cell/micro cell 5g technology on publicly owned traffic poles and light poles. In exchange, they are laying conduit and 24-strand dark fiber optic cable accessible through a 20-year lease agreement. This results in minimal cost and maximum benefit to taxpayers. Of the 24 strands,



18 are dedicated to the ATMS system and another 6 strands are made available to other city departments such as police and fire, providing them with advanced communication technology to protect the public.

Smart Sensors Support Bus Rapid Transit (BRT) and Streetcar: In 2014 the city of Omaha was awarded a $15-million Transportation Investment Generating Economic Recovery (TIGER) grant from the U.S. Department of Transportation toward building a BRT system. Installing smart technology along Dodge Street will help with the planning, operation, and growth of the BRT system. Remote traffic sensors will create data that track the BRT's use and efficiency, and help guide its expansion in the future. A streetcar is also planned on Farnham Street, which will benefit from the same technology.

Lessons Learned

- **Setting the Right Expectations Is Critical for the Public and Decision Makers.** City officials should not over promise. To demonstrate how the ATMS works, Omaha has commissioned a before/after study to quantify the actual outcomes of its ATMS. It is partnering with the University of Nebraska to help with data analytics and quantifying outcomes.
- **Keep an Eye on the Future.** Make sure that hardware and software upgrades can adapt to autonomous technologies that come up in the future; this will extend the life of the city's investment rather than replacing entire systems more frequently at great expense. For example, signal phase and timing (SPaT) technology being used in Omaha can support the near-term introduction of smart cars and autonomous vehicles. Omaha is making decisions knowing it can support the technology that businesses and citizens will demand.
- **Regionalism Is Important, Especially in Transportation Networks.** Omaha is collaborating with several communities and agencies, especially the Metropolitan Area Planning Agency (MAPA), to ensure its data, investments, and communication reflect the region's needs.

Interviewee

Murthy Koti
Traffic Engineering Division Director

Kansas City/Wyandotte County Unified Government, Kansas

COMMUNITY PROFILE

Population: 163,831

Land Area (in sq. miles): 155.7

Median Household Income: $40,113

General Fund Budget: $345,751,474

Total Staff FTEs: Approx. 2,000

Major Industries: educational services, health care, scientific management, waste, manufacturing, transportation, warehousing, arts, entertainment, and recreation.

Website: www.wycokck.org

Introduction

Kansas City, Kansas, sits at the confluence of the Missouri and Kansas rivers on the eastern border of the state, adjacent to Missouri. The region is known around the world for its jazz, barbecue, and proud heartland heritage. Kansas City, Kansas, is often associated with neighboring Kansas City, Missouri, and while they share a regional economy, environment, and culture, they operate under different government structures, and offer unique attributes and identities.

Factory fallen to blight

Kansas City is the third largest city in Kansas, with the city and Wyandotte County merging to become the Unified Government in 1997. Kansas City's population peaked around 1970—prior to consolidation—with approximately 168,000 residents. The population declined to a low of about 143,000 in 2005, but it has been increasing since that time. As many cities across the United States know, the loss of population comes with challenges, and Kansas City is using smart technology and data analytics to tackle them.

BLIGHT BUSTING

One of the unfortunate consequences of population loss, especially in older urban cores, is the proliferation of vacant and/or abandoned properties. They represent unrealized tax revenue, pose safety risks,

and stigmatize neighborhoods that might otherwise receive investment.

In 2016 the Unified Government staff met this issue head on, and by January 2017 it presented plans for the Stabilization, Occupation and Revitalization (SOAR) program, a five-year effort to identify and address the negative consequences of these properties. SOAR responds directly to concerns raised in a 2016 resident satisfaction survey, and is focused on communication, appearance, and safety. The first step in the program was to develop a data-driven understanding of the scope of the issue and its impacts. This involved merging existing datasets managed and owned by the city/county across multiple departments, and accessing publicly available and free data including, but not limited to, American Community Survey data and other U.S. Census Bureau data. Existing data included age of building stock, housing values, permits, code violations, and more. When assembling the data sets, the SOAR team encountered questions about who owns the data, how "clean" it is, and how was it maintained and managed. Some gaps were identified in this evaluation and to make sure the data was useful, the city received assistance from What Works Cities (WWC)[vi] to define a path forward.

Using the existing and free data not only created a cost-efficient way to analyze the issue, it changed organizational culture and operations, increasing efficiency and efficacy. In the spirit of "breaking down silos," the SOAR data analysis involves seventeen departments whose staffs are energized by understanding their specific role in a larger initiative and in being connected to their colleagues throughout the region.

As of the date of this report, SOAR's data already include an inventory of 3,500 properties of concern being evaluated by code enforcement and the local land bank. Further data analysis is also being done to enhance the city's partnership with the local Habitat for Humanity program and to support its pursuit of Nodes of Strength program resources from the U.S. Department of Housing and Urban Development (HUD).

Building Internal Capacity

Working with the International City/County Management Association (ICMA), Code for America, What Works Cities, and others, Kansas City came to understand that it needed to build its internal capacity to lead effective smart community and data analytics efforts. In 2016 it created and hired for the new position of chief knowledge officer (CKO). This position is responsible for the 311 system, IT department, and geographic information system (GIS), and for managing a performance innovation (PI) team. The CKO position and the six-to-seven person PI team are centralized out of the IT department, but team members are dedicated to specific departments. This empowers each department by having the full resources of the IT department at its disposal while each member develops a nuanced understanding of its respective department's needs. While this arrangement is still in an experimental stage, it is already changing culture and weaving city departments together.

Technology + Data + People = System

It is a mistake to think that data and technology used in smart community practices are taking the human element out of decision making and governance. In fact, it is the interface between technology, data, and people that makes these systems function properly. Technology accelerates data quantity, quality, and speed of delivery but the decision about how to use it is still a human function. Kansas City's 311 system, used by citizens to report issues such as damaged infrastructure or downed trees, is no different.

Facilitated through new fiber optic cable, the city's 311 system is using cloud-based data storage and communication. The system delivers reports directly to the public works department, which then issues work orders to fix problems in a matter of hours, not days, weeks, or longer. To ensure that work orders are issued for real problems that need priority, a public works employee first screens the incoming reports for validity and importance.

Fiber Optic Cable for Public Health, Safety, and Transparency

The recent investment in fiber optic cable is helping the whole city operate more efficiently. The new fiber network includes connecting sensors to water and wastewater pump stations to monitor functionality and security. In the future, the network will also be able to monitor and communicate other conditions such as weather, which the treatment plants relies upon to manage operations.

The fiber network will also support the police department's body-worn cameras which are coming in 2018. Body-worn cameras generate a large amount of data that must be downloaded and stored every day. The high-speed fiber network will allow the downloading to occur at each station, which will transmit that data to a central data storage facility. Without the high-speed capacity, each station would need to store its data internally, requiring a large amount of space, time, and expense.

In the future, the city wishes to use the fiber optic cable to support smart traffic signals to reduce commuter times, improve public safety, and make data available to the public.

LESSONS LEARNED

As Kansas City, Kansas, grows its smart community efforts, it has already learned some lessons others can benefit from. Its experience so far has also provided it some insight into future applications for data and technology that can benefit the community:

- **Regionalism:** No city or county is an island. It is important to work closely with surrounding governments, businesses, and organizations to develop the scope of efforts, collect data, and disseminate data.
- **Technical Assistance:** Yes, local government can manage smart community practices on its own, but having technical expertise to help guide the way is invaluable and will save time, money, and heartache in the long run.
- **Vendor Data Integration:** Kansas City is encouraging its vendors to create application programming interface (API) functions so the vendor and city can move information in and out of their central system more efficiently and at will. Vendor services that can do this include, but are not limited to, permitting systems, assessor and tax payment systems, code enforcement software, Computer Aided Design (CAD) systems, and more.

Interviewees

Melissa Sieben
Assistant County Administrator

Alan Howze
Chief Knowledge Officer

Las Vegas, Nevada

COMMUNITY PROFILE

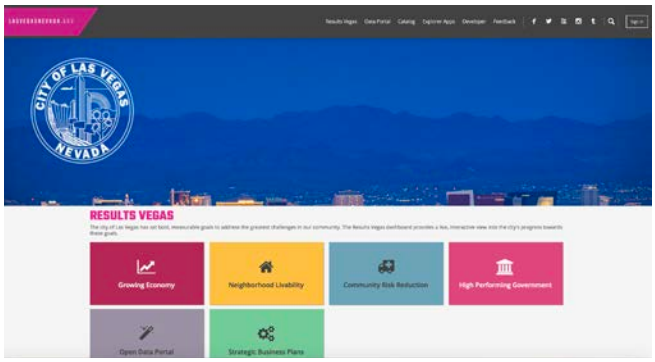
Population: 632,912
Land Area (in sq. miles): 135.9
Median Household Income: US$ 50,202
General Fund Budget: $549 million
Total Staff FTEs: city employees: approx. 11,000; IT Department = approx. 390; Analytics Center of Excellence = 10
Major Industries: wholesale and retail trade; healthcare and social assistance; construction; professional, scientific, and technical services
Website: www.lasvegasnevada.gov

Introduction

Las Vegas has long been known for its world-class entertainment, casinos, and outdoor recreation. It receives nearly 43 million visitors[vii] from around the world who might not know that Las Vegas is also a national leader in its use of data, technology, and the Internet of Things (IOT), and in being a smart community. Routinely identified as one of the fastest-growing cities in the country, Las Vegas has rapidly evolved from a gambling destination to a highly livable, well-managed, and forward-thinking modern city.

Overview

Las Vegas was an early adopter of smart community practices and use of data analytics. For more than ten years, city leaders and managers have been applying these techniques to improve performance, accountability, and efficiency. Recent efforts include an open data portal, called Data Las Vegas, and a performance management portal, called Results Vegas. These portals are much more than programs: they are integrated functions of local governance that weave agencies, the public, and businesses together.



Data Las Vegas is an open data portal that provides public access to:

- Raw data
- Geographic information system (GIS) portal
- Charts
- Maps
- Open budget

- Web/app developer datasets
- Explorer apps made by outside users using city of Las Vegas data.

The Results Vegas program collects, analyzes, and makes available data across several sectors. The main page contains links to information about the city's goals for certain metrics, progress toward those goals, and information specific to the subject matter. The High Performing Government page shows users the status of different metrics, such as financial analysis, and indicates if performance is on track, if more data is needed, if measuring is in progress, or if improvement is needed. Other sections are labeled:

- Growing Economy
- Neighborhood Livability
- Community Risk Reduction
- Strategic Business Plans.

Beginnings

More than ten years ago, Las Vegas started the Performance Plus program, working to improve the city's performance and transparency. This evolved into Results Vegas and Data Vegas and included changes to what and how data were used. It also changed the way in which data management was administered.

The Performance Plus team would meet independently with different departments to improve performance and refine data collection and management practices. Today, Results Vegas groups activities across topics (mentioned above), and clusters four to five departments under each topic for regular meetings. Clustering departments around topic areas and meeting regularly increase interdepartmental collaboration and help share responsibility.

Before instituting Performance Plus and then Results Vegas, the application of smart community practices tended to be temporary, reflecting topics that might have been popular in the moment, a trend that left issues unresolved and used resources inefficiently. As the city's data analytics, open data, and performance management became more essential, Results Vegas became an integral component of operations and the foundation of more smart community investment.

Data + Technology + Infrastructure

Las Vegas is not only dedicated to data and operational performance, but its leaders are fully committed to making the city's infrastructure's capacity future-ready. Innovate Vegas envisions the city's future and establishes an Innovation District in the city's urban core to concentrate smart city technology infrastructure investment.

City leaders have already invested $500 million in smart infrastructure and technology within the Innovation District. This investment is testing smart technology and infrastructure so it can be refined before deployment citywide.

Innovate Vegas includes investing in, testing, and deploying technologies to support autonomous vehicles. Autonomous vehicles are currently under significant scrutiny, and public safety is a top concern. Las Vegas wants to be a leader not only in deploying these vehicles but also in using them to increase public safety. As such, it is installing smart infrastructure, such as fiber optic cable and remote sensors.

As of September 2017, the city has laid more than 123 lane-miles of fiber optic cable, upgraded 14 traffic signals with dedicated short-range communications (DSRC) radios, and has an additional 24 DSRC radio traffic signal upgrades underway. Through these innovations, Las Vegas intends to enhance mobility, reduce congestion, improve resident safety, reduce carbon emissions, and grow the economy.

Anticipated and Real Outcomes

The city's innovation goals are interconnected and ambitious, and they reflect long-term thinking that can serve the city for generations to come. The city's goals are to:

- Improve interoperability among all public service sectors
- Catalyze economic growth
- Provide reliable and energy-efficient transportation options for all people, including low-income and senior populations
- Apply transportation technologies and make infrastructure smarter
- Provide information in a personalized way to empower people to choose whichever mode of transportation they prefer
- Keep citizens and tourists safe
- Enhance freight mobility
- Support acceptance of autonomous vehicles
- Create a connected downtown with vibrant experiences to drive economic development and a sense of safety.
- Increase access to high-speed Internet among low-income residents and small businesses, and apply civic technology to aid socially marginalized people.

Businesses Using Data: The open data portal is already being used by private businesses to improve operations, allocate resources, and be more dynamic. Casinos and other downtown businesses are using open data to evaluate their activity relative to security issues; correlating revenue with factors such as crime, homelessness, and other challenges; and making appropriate adaptations.

Civic Engagement: The city hosted a hackathon, which was won by a team from the University of Nevada, Las Vegas. The winning app promoted a program to evaluate expenses related to streetlighting.

Operations and Facilities: Operational efficiency is being realized in the parks and recreation department with a better understanding of what watering needs to be done and what maintenance is necessary.

Public Safety: Data analysis is being used to minimize response times through a better understanding of how to distribute and deploy equipment among stations.

LESSONS LEARNED

As they move forward on their ambitious agenda, city leaders have learned lessons that inform their approach and can benefit other local governments as they contemplate or adopt smart community practices:

- **Lean and Mean.** Do not unnecessarily overinflate operational capacity. When possible, use off-the shelf-technology, publicly available data, and internal capacity.
- **Staff Capacity.** Use existing departmental staff to speed data collection, input, and tracking needs early on.
- **Primary Data.** Be careful about creating primary data and making it publicly available. Make sure it is high quality, clean, reliable, and up-to-date.
- **Understand the User.** While the city has an understanding of who is accessing what data, there is still not a solid understanding of how users are putting the data to work. The city will try to improve its understanding so its services and data can better serve the end users.

Study Interviewees

Scott Adams
City Manager

Michael Sherwood
IT Director

SMART COMMUNITIES AND DATA ANALYTICS PROFILES

Louisville, Kentucky

COMMUNITY PROFILE

Population: 253,128

Land Area (in sq. miles): 325

Median Household Income: $45,762

General Fund Budget: $565 million

Total Staff FTEs: 5,400

Major Industries: automotive, bourbon, home appliances, finance, communication, construction, mining, health care, higher education

Website: https://louisvilleky.gov

Introduction

The largest city in Kentucky by size and population, Louisville is well-known as the home of the University of Louisville and the Kentucky Derby, and for its leadership in the American bourbon industry. Louisville is tucked along the banks of the Ohio River, providing residents with access to world-class outdoor recreation, arts, sports, and more.

Louisville has experienced disinvestment in its urban core over the last several decades as people moved to the suburbs and industry relocated. One result of this trend is an abundance of vacant or derelict properties throughout the city. But where some see blight, others see opportunity, with a strong network of infrastructure, buildings, and people that can serve as the foundation for Louisville's renaissance.

City leaders and staff recognize that successful economic and community development in the 21st century is different than the models that shaped the city in the early/mid-20th century. Instead of relying solely on large manufacturing facilities, a contemporary approach integrates technology, data analysis, and the Internet of things (IoT) with human-scale solutions and civic engagement. Louisville sets a good example of how smart community practices can serve people and stimulate the economy in unison.

Overview

Louisville's smart community and data analytics efforts were officially kicked off in 2013 when Louisville Mayor Greg Fisher signed the Open Data Executive Order. The major voiced support for information disclosure during a Code for America Summit in October 2013, declaring that "It's data, man." Since then, the city passed an Open Data Policy and started its open data portal, and it publishes annual open data reports.

Since 2013 Louisville has been offering more data to staff and citizens each year, with 196 data sets available through the city's portal in 2016 and more being added in 2017.

Louisville became a What Works Cities (WWC) participant in 2015 as part of its efforts to strengthen

its smart community and data analytics, and conducted a program evaluation to improve performance.[viii] Since 2015, the city's open data quality has improved, analytic practices have been made more efficient, and data has migrated to an ArcGIS platform.

Facing Facts, and Open Discussion

Shortcomings in Louisville's smart community efforts were identified when the city applied for a U.S. Department of Transportation Smart Cities Challenge grant in 2015, and that discovery spurred the city to widen its efforts further. The city was not successful at securing this particular resource, but the process of assembling the proposal shed light on what it needed to do to be more competitive and where there were areas for improvement and growth. Rather than being discouraged by these findings, city officials rolled up their sleeves and got to work with internal resources, staff, partnerships, and true Louisville grit.

The grant process showed that more strategic collaboration among city agencies was required for smart community efforts to function effectively. Where a "hodgepodge" of staff and leaders previously scrambled to assemble information for the grant proposal, city leadership created a new structure of collaboration between employees from different agencies. Now, frontline employees are designated across subject areas, establishing teams which meet regularly to discuss issues and ideas early in the process to anticipate outcomes, pitfalls, and potential unintended consequences so they can pivot and proceed.

Technology for Traffic Control, Efficiency, and Public Safety

Technology also plays a role in Louisville's smart community leadership, most recently in the form of fiber optic cable and real-time communication with 14 traffic signals on a busy corridor. With over 1,000 traffic signals in the metro region, the city's recent investment in this technology is a pilot that, if proven successful, could expand to over 300 signals.

Sharing costs through a public-private partnership (PPP) with Verizon, the pilot smart community solution alerts the city the moment a signal goes down, allowing crews to deploy and repair that signal in the span of a day rather than weeks. Additionally, the timing of these signals can be adjusted remotely rather than relying on crews to be on site to adjust them, an improvement that saves time and money, and increases safety. Other partners, including Kentucky Transport Cabinet (KYTC) and Waze, are helping the city use data analytics to optimize traffic patterns for safer and quicker commutes.

The fiber optic cable is also freeing up public safety resources, allowing the police department to spend its budget on much-needed officers instead of vendors. Currently, Louisville uses a Metro Watch system of cameras that observe roads and sidewalks. This system is managed by a private vendor. With the fiber optic network in place, the cameras can tap into the city-owned network, allowing a reduction in payments to the vendor.

Data + People + Place = Equity and Economy

The true potential of smart community practices is more fully realized if they involve all members of society, not just those with natural tendencies to participate in such activities or those with access to technology.

Creating Place: In Louisville, people are being connected to technology in a place called the Gigabit Experience Center. Located in an underserved neighborhood, the center serves as a hybrid of incubator, technology library, and community and event center. At the center, residents have access to high-speed wireless Internet, laptops, tablets, work stations, refreshments, and events. Since 2016, it has improved public safety by activating the streetscape, improving public perception, and promoting activity in what has been a relatively high-crime area. Additionally, it has resulted in new economic development projects being started in a neighborhood that lacked investment by luring office tenants into the building with the improved safety and high-speed Internet access.

Louisville will use data analytics to evaluate Internet speed across neighborhoods, crime statistics, demographics, and property/facility availability to identify additional locations for similar facilities.

Bringing Access to the People: Through the city's Digital Inclusion Plan, the city is using technology and data to increase socioeconomic mobility and job attainment for residents who otherwise do not have adequate Internet access. This is partially facilitated through the new fiber optic network, which is also being used to provide free wireless access in public

High-speed internet in low-speed neighborhoods

buildings, such as libraries and community centers, and along the Market Street corridor, an area where residents are known to have low Internet accessibility that limits their upward mobility.

Crowdsourced Solution: Louisville is also infusing technology and data with human solutions in a pilot program selected through a "Hackathon," organized by the city where the public submitted competitive conceptual solutions for addressing some of the city's pressing problems. The winner proposed a method to strengthen public safety by detecting fires in vacant and abandoned structures. Louisville has approximately 8,000 vacant or abandoned properties. They have been subject to arson, endangering the lives of citizens living around them. In 2017 the city put the hackathon winner's concept into action in a pilot program called Casper. Casper is a solar-powered, wireless-connected microphone that detects the sound of smoke alarms. Mounted on vacant structures, Casper sends a warning to the fire department when it detects the sound of a fire alarm in the vacant structure. Because the structure is unoccupied, the alarm would not otherwise trigger a response, allowing the fire to grow and spread to adjacent structures.

Expansion plans for Casper include eventually tapping into city-owned fiber optic network, enabling the sensors to perform additional functions such as detecting motion to alert the city of intruders.

Performance Enhancement…With Numbers

The city's Office of Performance Improvement and Innovation takes a data-driven approach to evaluating city departments' functions and progress toward their respective goals. The office does so, in part, as owner and manager of a performance management program called LouieStat. All departments in the city use LouieStat to break down their performance measures, and they use the system to upload their performance indicators, identify weaknesses, and make improvements accordingly. LouieStat enables this evaluation to occur in real time, and encourages the use of cross-functional teams to craft responses when inefficiencies are identified or benchmarks are not being met.

For example, with LouieStat the city is able to anticipate when and where properties will become vacant or abandoned, and align city services accordingly. Data such as code citations and tax delinquencies can be analyzed to anticipate upcoming vacancies or abandonment. Responses can include code enforcement, property assistance, or technical assistance to help ensure property owners stay in their homes or businesses.

Lessons Learned

Louisville's smart community story is compelling, but the city has not gotten to this level without a few hard-earned lessons along the way. City officials offer a few tips to local governments starting or growing their smart community efforts:

- **Identify Willing Participants within Each Department.** Organize these individuals into "cross-functional teams" that cut across departmental boundaries and advise on upcoming ideas and plans as they become viable.
- **Don't Grow Too Big Too Fast.** Building a data analytics culture across all departments takes time. Pick some low-hanging fruit at the beginning, and demonstrate to each agency how these initial steps benefit them. That makes getting their commitment a lot easier.

Study Interviewees

Michael Schnuerle
Data Officer

Matthew Parish
IT Operations Manager

About the Authors

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Endnotes

i SAS views smart community practices as a tool to "Enhance quality of life by dynamically analyzing data on economic development, sustainability, transportation and citizen engagement. Adopt the internet of things as an enabling technology to become more innovative and productive – and provide better citizen services." See https://www.sas.com/en_us/industry/government.html#local-government

ii *A Strategic Vision for the Future: City of Madison Racial Equity and Social Justice Initiative*, City of Madison, Wisconsin, 2014, p. 20.

iii *Smart Infrastructure Unlocks Equity and Prosperity for Our Cities and Towns*, Smart Cities Council, 2016, p. 4.

iv "SAS Analytics® to help protect at-risk kids and reduce fatalities in NC County," SAS press release, August 30, 2016. https://www.sas.com/en_us/news/press-releases/2016/august/analytics-at-risk-kids.html#

v Josh Lehner, "The Housing Trilemma," Oregon Office of Economic Analysis, June 8, 2016. https://oregoneconomicanalysis.com/2016/06/08/the-housing-trilemma/

vi What Works Cities is a national initiative, launched by Bloomberg Philanthropies in April 2015, that helps 100 mid-sized American cities enhance their use of data and evidence to improve services, inform local decision making, and engage citizens. See https://whatworkscities.bloomberg.org/

vii "2016 Las Vegas Year-to-Date Executive Summary," Las Vegas Convention and Visitors Authority, http://www.lvcva.com/stats-and-facts/visitor-statistics/

viii WWC is an initiative of Bloomberg Philanthropies that works with 100 mid-sized American cities to "enhance their use of data and evidence to improve services, inform local decision making and engage residents." See https://whatworkscities.bloomberg.org/about/