CITY OF SCOTTSDALE

City of Scottsdale
Smart City Strategic Roadmap

JUNE 2020

PREPARED BY thinkBIG

Acknowledgments

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Please Note: This project work was conducted prior to the COVID-19 pandemic and should be viewed as such. Some revisions have been made to reflect the impact of the coronavirus and COVID-19 pandemic and may not reflect stakeholder input received prior to COVID-19.

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Executive Summary

The City of Scottsdale has been consistently recognized as one of the best places to live in the United States. Whether you are seeking a healthy environment to raise a family with access to great public schools, or wanting to retire in a great climate, Scottsdale is hard to beat.

Not surprisingly, Scottsdale has also experienced tremendous growth because of these positive attributes and the attractiveness of the overall Maricopa Country region. According to the U.S. Census American Community Survey estimates, Scottsdale's population has grown nearly more than 17% between 2010 to 2018, compared to the US average population growth of 6%[1].

Like many other cities, Scottsdale continues to experience population growth, also known as urbanization. Unlike many other cities, however, Scottsdale's population growth is significantly faster than other cities and is part of the fastest growing county in the United States with an average of 200 people moving there per day[2]. This growth can create many positive opportunities for the City to support choices that people and business are making to live, work and play in Scottsdale, but must be managed smartly to avoid potential negative consequences of this growth and the stress that it places on the city and its infrastructure.

Historically, a city's infrastructure was thought to be only physical and technology was not strongly associated with its function. But there is a fundamental paradigm shift to understand that today's modern city infrastructure is more than just roads, bridges and buildings. It is also made up of digital platforms, data and policies designed to help address the challenges of urbanization. By using connected technologies, also known as the Internet of Things (IoT) technologies, cities are becoming "smart." This is where the transformation journey to becoming a smart city begins.

Smart cities bring together infrastructure and technology to improve the quality of life of citizens and enhance their interactions with the urban environment. To appreciate the full potential impact of smart technology, we must understand that cities are giant systems with countless subsystems. But there are costs to making this journey. These costs can be financial or social and are a series of "tradeoffs" the city and citizens alike must embrace. For Scottsdale to make this journey successfully, it must make it together with the residents, businesses and visitors on a local and regional basis.

These systems provide essential city services (such as electricity, clean water, etc.) to Scottsdale citizens to create a safe, vibrant community in which to live their daily lives. Every system today relies on a blend of physical and digital infrastructure that is affected by technology.

In order for the City to thrive in the 21st century, both reaping the benefits of its population growth while preserving its attractive, high quality of life, technology must be seen as an essential foundational layer for success across every system, subsystem and function. Technology will create a platform to more effectively, efficiently and strategically address Scottsdale's current and future needs. This platform will also create large amounts of data,

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[1] Population estimates, United States Census Bureau, 2010 thru 2019
[2] Office of the Governor of Arizona, *Maricopa County #1 In U.S. For Population Growth*, 2019

which is a powerful tool to enable the City to make more informed, real-time decisions to help improve the quality of life for all people.

Every system and subsystem will not only benefit from more precise control, but the city will also be able to lower its operating costs, increase efficiencies and help the City stretch its budget further by using technology as a "multiplier." This exponential effect can produce significant financial, social and strategic benefits and an extremely attractive return on investment (ROI). Conversely, there is also a cost and negative ROI impact in doing nothing. A well-designed smart city platform designed with a human-centric focus will provide a Scottsdale a powerful tool to help address the challenges of urbanization, preserve a high quality of life and help it maintain its attractiveness as one of the best places to experience.

A smart city is about the modernization of digital, physical and social infrastructure to improve people's lives. It is important to build on foundations that Scottsdale already has in place while keeping up with the demands of urbanization and taking advantage of rapid advances in technology.

Think Big Partners' was retained by Scottsdale to develop this important Smart City Strategic Roadmap. Think Big's analysis process relied on its experience, expertise and insights derived from its smart city work in over 30 communities across North America. Through a series of workshops, interviews and research, a Smart City Strategic Roadmap has been created.

The goal of this roadmap was to inform the City on how to build a smart city program that would:

- Help define the smart city vision of city leadership while reflecting the needs of the community
- Complement and take full advantage of improvement efforts (physical and/or digital) currently in progress and build on Scottsdale's existing foundation
- Create an adaptable platform to integrate new technological advances as they become available
- Provide a platform for new common (Scottsdale-wide) or department goals as they are adopted
- Identify and prioritize technology recommendations in support of Scottsdale's smart city transformation efforts
- Provide insight into financing strategies to help fund technology investment, develop funding partnerships and support procurement activities
- Organize these recommendations into an easy to understand narrative to inform the community, educate stakeholders and provide a mechanism to engage partners

The biggest drivers to Scottsdale's smart city success will be:

- **Managing Growth**
    - Managing the challenges of urbanization and above average rate of population growth that will stress physical infrastructure.

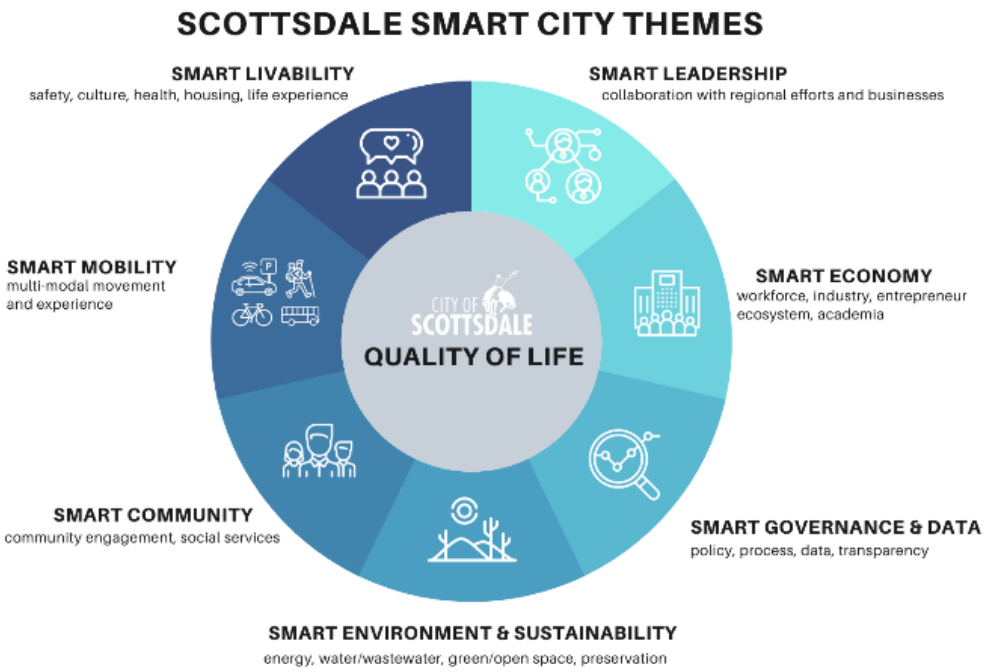
    - Anticipating the future needs of the citizens, especially the above average population of aging residents (with increasingly longer life expectancies) balanced with the needs of the next generation of workers (Millennials and early Generation Z).
    - Preserving the rich cultural history and natural beauty of Scottsdale while adapting to the needs of all people.
- **Governance**
    - Creating policies that will reflect the rapidly evolving needs for effective digital infrastructure, to help maximize the value of existing physical infrastructure while developing new, modernized physical infrastructure as budgets allow.
    - Making data-driven decisions based on insights derived from smart technologies, existing city systems and ongoing collaboration that can produce a robust, relevant understanding for city officials to implement into their long-term general plan.
    - Understanding the financing requirements and risk versus return relationship between smart city capital expense and operating expense investments.
- **Enhancing Mobility**
    - Responding effectively to the citizens' needs for better mobility options for people of all socio-economic types and ages.
- **Citizen Engagement and Impact**
    - Developing a trusted, active relationship between the city and its residents, business community and regional stakeholders to best understand the needs of the whole community.
    - Creating an inclusive city that can provide a modern high quality of life regardless of location or socio-economic limitations while preserving unique neighborhood identities.
- **Data Management and Supporting Policies**
    - Embracing the value of data and the future role it will play which will require an open, transparent and responsible relationship to the citizens regarding data privacy, security, management and related communications.
- **Collaboration for Economic Development**
    - Maintaining a healthy environment for innovation that embraces the role that public-private partnerships can play with private companies, academic institutions and the people of Scottsdale. Emerging technologies, such as autonomous vehicles, artificial intelligence, machine learning, computer vision, drones and blockchain, will represent some of the most important opportunities for cities to embrace. Exponential gains for the citizens' benefit will be attained but this requires the right mentality to foster pilots that can support the procurement process.
    - Investing in the training and development of new skills for the city workers will be required to successfully navigate this digital transformation. Equipping them with the right tools, new knowledge and enhanced expertise will be essential for long term smart city success.

Smart City Themes

This planning process distilled down Scottsdale's goals into seven smart city themes:

1. **Smart Leadership** (collaboration with regional efforts and businesses)
2. **Smart Economy** (workforce development, support of industry, entrepreneur ecosystem development and the role of academic institutions)
3. **Smart Governance and Data** (the role of data and the policies/processes that affect it)
4. **Smart Environment & Sustainability** (conservation, the protection of the environment and its natural resources)
5. **Smart Community** (the engagement of people to develop an inclusive and equitable community and social services supporting the community)
6. **Smart Mobility** (the ability to move about the city as easily as possible using different modes)
7. **Smart Livability** (the preservation of a high quality of life, to include creating a safe, accessible places to live, promoting public health and wellness, and supporting the arts and Scottsdale's rich cultural history)

Figure 3: Scottsdale Smart City Themes, page 14



Smart City Technology Layers

All recommendations have been associated with the required technology or other infrastructure through the “lens” of layers. These layer-oriented categorizations are based on the component’s critical architecture, functional impact and/ or complementary characteristics. Each recommendation discussed in this plan has been classified under one or several of three different categories:

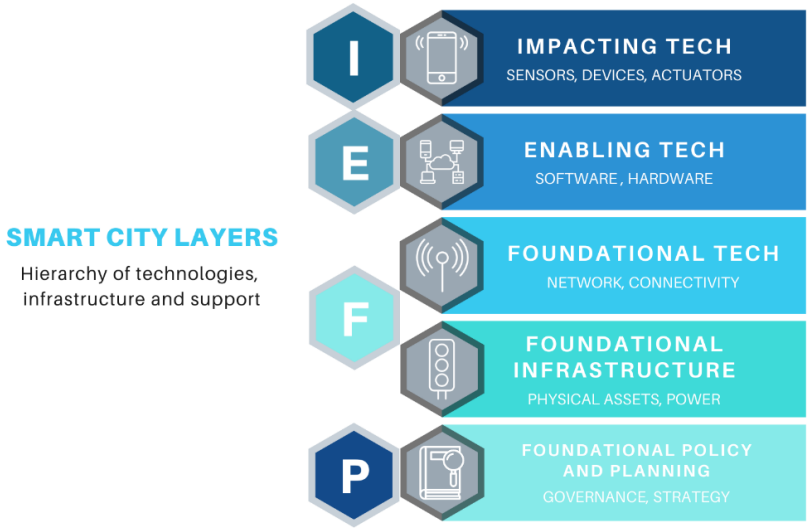
Foundational - Essential technology that provides a dependent foundation for other technology applications to function

- It should be noted that physical infrastructure can also be a foundational layer, although it may not be “technology”
- Policies can also provide a foundation for operational compliance and may be depicted in this plan as a foundational element

Enabling - Technology that provides specific functions

Impacting - Technology that enhances or complements technology, usually at the enabling technology layer

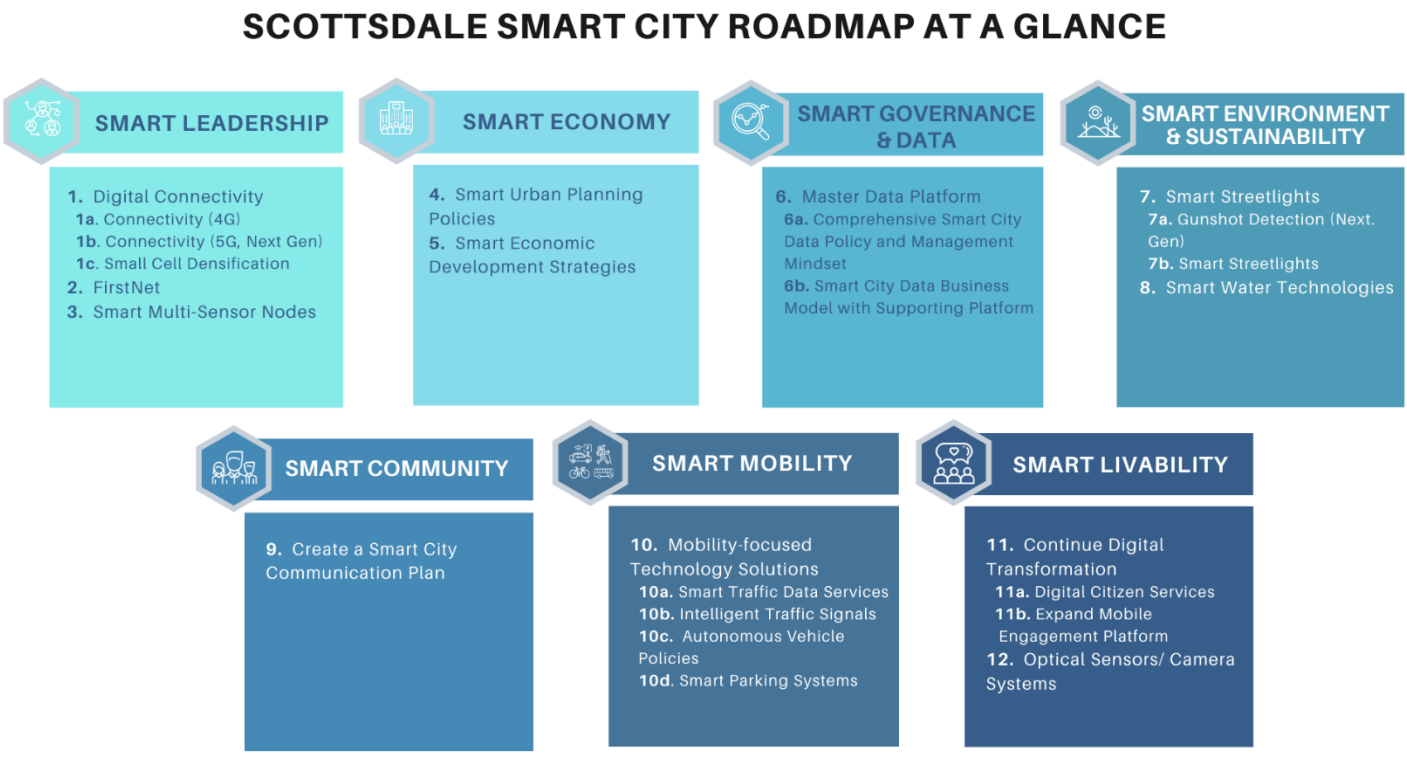
Figure 4: Smart City Layers, page 26



Smart City Recommendations

The following Roadmap at a Glance represents the recommendations classified by theme, then cluster. A brief summary of each recommendation cluster is included and expanded later in the report. This reflects a holistic view of Scottsdale's needs and smart city technology opportunities.

Figure 5: Smart City Roadmap at a Glance, page 27



TOP RECOMMENDATION CLUSTERS

LEGEND – F or P = Foundational (Technology, Infrastructure or Policy) Layer, E = Enabling Layer, I = Impacting Layer

SMART LEADERSHIP

1. **Digital Connectivity (F)** - Continue to develop existing and new connectivity. This includes the enhancements of existing 4G/4G+ and fiber, along with the development of newer 5G services. Work with service providers as needed and identify areas that need new or enhanced connectivity. Develop policies as needed for 5G rollout.
2. **FirstNet (F)** – This technology provides a secure, robust and dependable connectivity network for first responders during a crisis. This is critical for future safety, security and resiliency. Scottsdale should make efforts to adopt this technology throughout the entire city.
3. **Smart Multi-Sensor Nodes (E, I) -** Multi-sensor nodes provide a cost-effective solution to impact a wide variety of areas and needs. These sensors are highly customizable, and Scottsdale should deploy these nodes in tandem with physical infrastructure modernization (or new installation) to provide future functionality for certain needs.

4. **Smart Urban Planning Policies (F, P, E)** - Smart urban planning and policymaking must be in order to address the challenges of urbanization balanced carefully against the region's appetite for innovation. Areas such as autonomous vehicles and housing need to be evaluated with peoples' needs and urbanization challenges in mind.
5. **Smart Economic Development Strategies (E)** – Continue efforts to attract both talent and employers who can provide high quality jobs, retrain workers (reskill) to modernize their knowledge and talents to meet modern industry needs and take an integrated view of the workforce development, transportation and mobility, and housing dynamics. Additionally, engage top employers to understand their unique needs.

6. **Master Data Platform (F, P)** – Creating this will provide a platform for the collection of smart technology data which enables better, more impactful decisions. This system may be comprised of a single vendor platform for an end-to-end solution, or several vendors to provide all functions needed to include storage, visualization and provide access via an open data platform. Develop supporting data collection, usage, sharing, privacy and other policies as needed at a local and regional (Maricopa County) level. Develop business models within each department that can benefit from access to new data to create specific ROI and workflow process improvement opportunities.

7. **Smart Streetlights (F, E)** – Smart streetlights (networked, tunable LED lighting systems) not only can reduce operating costs, but this physical asset can provide a secure location for other technology installations that provide additional functionalities (foundational, enabling and impacting technology layers). Smart streetlights are also potential revenue-oriented partnership opportunities as Scottsdale grows, which will require more connectivity that can be placed on these assets.
8. **Smart Water Technologies (E)** – Scottsdale should continue to work on its automated metering system program upgrades that provide an integrated system of smart water meters, communications networks, and a data management that enables two-way communication between Scottsdale Water and its customers.

9. **Create a Smart City Communication Plan (E)** - Community engagement events revealed the Scottsdale community wants to be involved to better understand Scottsdale's smart city plans. Provide a mechanism for residents, businesses and other stakeholders to help "co-create" Scottsdale's smart city platform.

10. **Mobility-focused Technology Solutions (I)** – These technologies include but are not limited to intelligent traffic signals that can also provide traffic signal pre-emption, accident related re-routing insights, enhanced parking solutions and geospatial intelligence regarding traffic patterns. Smart traffic data services will help Scottsdale manage its growth as it brings on additional modes of transit.

11. **Expand Mobile Engagement Platform (E)** – Scottsdale should expand the mobile phone engagement through either mobile optimization of websites or an application (app). Being a mobile-friendly, engaged city is important to digitally engaged citizens of all ages seeking digital citizen services. Functionality such as wayfinding (pedestrian navigation), integration with city services (interaction with departments to include making payments) and communication tools to enhance user engagement are extremely valuable. Tourism also will be enhanced, especially if multi-lingual. Additionally, any mobile phone access should consider Scottsdale's older than average resident population and design functions for the vision and/or hearing impaired.
12. **Optical Sensors / Camera Systems (E, I) –** Public cameras systems, along with modern optical sensor-based systems (that can interpret what the camera "sees" without an operator), can provide enhanced public safety, security and functions that support Scottsdale's most important goals. Surveillance is also important to protect tourism and Scottsdale's reputation.

Additionally, technology maturity will continue to be a factor in the design, development, enhancement and future modification (technology replacement) to Scottsdale's smart city platform. Each of the seven themes have associated technology solutions that are continuously undergoing active innovation.

Funding and Procurement

Scottsdale must have adequate financial resources to procure the technologies required to achieve these goals. Many of these technologies require both a capital expense (Cap Ex) to purchase and an operational expense (Op Ex) to operate the technology solution. Additionally, while many of these technologies will provide financial savings, there is also a cost of human capital (training, new skills or even new employees) that should not be overlooked.

The procurement strategies must:

- Provide the vendor marketplace confidence that the City has the financial capacity to procure technology (City should be ready to fund technology partially or entirely)
- Provide a risk management assessment (due diligence of technology to make sure it should perform as stated, delivering an acceptable ROI within the stated range or internal projections)

- Be aligned with budgeting cycles (city along with regional, state and federal when possible)
- Be “agile and creative” in respect to potential public-private partnerships (P3)
- Cultivate collaborative opportunities stretching budgets between departments or the region
- Cluster together technologies that can be deployed with a multiplier effect based on installation efficiency, technology layer dependencies or specific technology solutions that work better together

The following models could be used:

- ***Public Private Partnerships (P3)*** – Engage potential funding partners in dialogues designed to identify solutions powered by technologies that have mutually beneficial impact.
- ***Self-funding Pools Based on Expense Reduction*** – Evaluate existing budget to understand the current funding available and the ROI impact that smart technology can have during planned modernization or achieved costs savings.
- ***Grants*** – Confirm the technology solution as “awaiting funding” and identify federal, state, regional and niche grant opportunities as they become available and respond quickly to RFPs.
- ***Data Monetization*** – Evaluate data that may be shared or sold in an acceptable manner (Scottsdale policy, resident sentiment, General Data Protection Regulation (GDPR), etc.)
- ***Performance Based Financing Models*** – Develop a financial model to procure the technology while having a third party pay for the Cap Ex and/or Op Ex based on the cost savings derived from the gained financial efficiency of the replaced asset with the new solution.

The average “smart city” technology ROI’s has been reported between 3.1% to 4.1% annually:

- Traffic Management – 3.3%
- E-Governance – 4.1%
- Public Health – 3.9%

Activating Scottdale’s Smart City

Prioritization Scoring

The objectives shown in this plan are classified based on priority score (Figure 10 in full document) which is derived from rating the following variables:

- **Citizen Value** – People are at the center of Scottsdale’s smart city design. The positive impact that technology can make on improving the quality of life remains as the top priority. Accordingly, the more positive impact an objective makes, the higher the score. This is the highest weighted variable in our model.
- **Importance** – Each objective has its own varying levels, types and underlying reasons for importance (urgent, foundational, leadership priority, related dependencies, etc.). Some are the result of insights gained from interviews. Other levels of importance were

established based on past planning documents and stated goals. The objectives are scored on general importance while weighing all relevant factors.

- **Difficulty to Deploy** – The difficulty level of deploying a technology plays a part in the speed of rollout, likelihood of immediate impact and dependencies on other technologies for its success. The ability to rollout projects faster and show quick wins produces significant dividends in terms of trust, perception and the ability to demonstrate value to all stakeholders. A project's difficulty to deploy may place a strain on resources, which would result in a lower score.
- **Revenue Generation / Positive Financial Impact** – If there is opportunity to generate revenue or reduce expenses (direct or indirect) from the achievement of a certain objective, then those funds can be used to pay for other smart city projects or technologies. A higher score is given for positive financial impact opportunities on a relative basis.
- **Supports Goals of the City** – Each objective has been compared to the prior planning documents to ensure the smart city program aligns with the city's vision and goals. A score is assigned based on the strategy alignment (aligns with more city priorities receives higher rating). Please note: The rating does not indicate the strength of support for any one specific goal.
- **Technology Maturity** – The technology marketplace is rapidly changing as the result of innovation. The ability to assess the maturity of a specific technology is an important factor to consider when prioritizing projects. A higher score is given to those technologies that are more mature (proven). Rapidly evolving or emerging technologies should not be considered negatively, however, the risks must be managed accordingly.

Recommended Next Steps

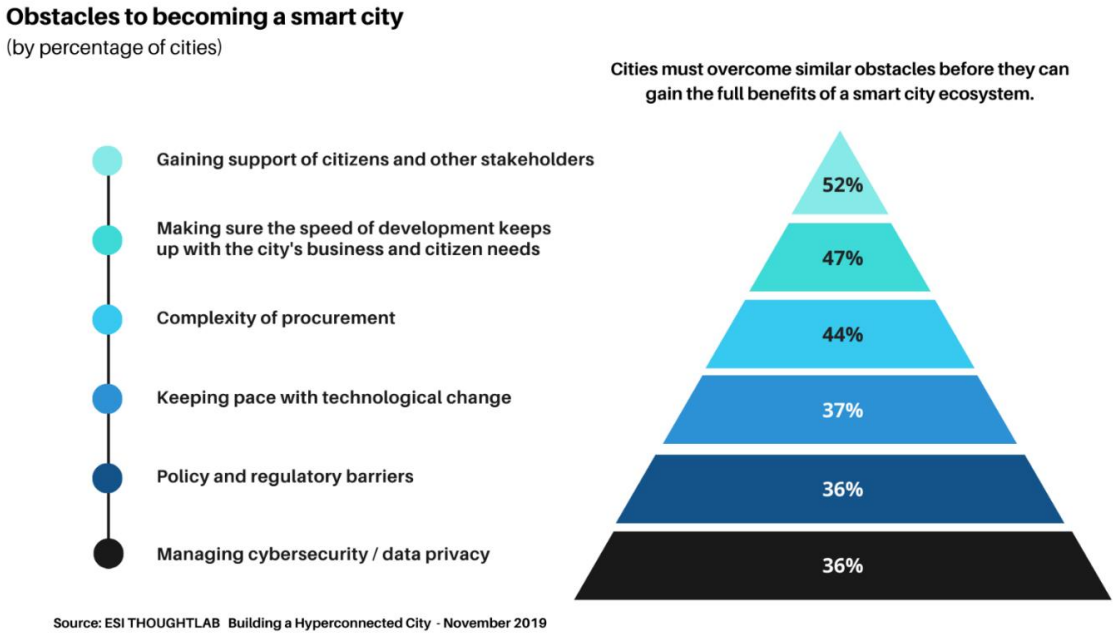
1. **Review this Smart City Strategic Roadmap**
    a. Develop a thorough understanding of its meaning, relevance to Scottsdale's goals and provide an education to stakeholders that may not be familiar with the concept of smart city or its necessity to address urbanization.
2. **Identify the people that need to be involved in the execution of Strategic Roadmap**
    a. Create a master planning group and/ or a project-based group to identify and confirm the most important technologies, initiatives or objectives to act on now, to deliver either "quick wins" or a long-term impact
3. **Determine the requirements necessary to move each project forward**
    a. Identify the necessary resources such as people, plan, policy, communications strategy and procurement model with financing options
4. **Manage each individual project as part of an integrated smart city program**
    a. Develop a communication strategy to keep all stakeholders informed
5. **Manage each project until completion**
    a. Understand that the technology landscape is dynamic, but goals must be met to ensure long term project support from senior leadership and residents alike.

Ongoing activities for success:

6. **Engage the community**
    a. To develop a bi-lateral exchange of information, education and trust to make sure Scottsdale's smart city plan keeps the human-centric focus in view, it will be critical to engage the community along the way in various methods

7. **Evaluate financial resources on a regular basis relevant to the selected technology solutions**
    a. Identify gaps in funding, enhancements to ROI and prospective inter-department collaboration opportunities that result in self-funding opportunities
8. **Begin a procurement strategy**
    a. Where there are funds, begin a procurement strategy that manages the risk while seeking enhanced ROI and ensures foundational technology is in place
    b. Where insufficient funds exist for desired technology, develop alternative strategies that include P3s, performance-based models, grant support, data monetization or any combination of these
9. **Create a smart city platform procurement model**
    a. Develop a procurement model that encourages the private sector to "self-organize" and take on as much of the risk (financial, ROI attainment, technology performance, interoperability, etc.) as possible for asset classes that have more mature technology or underlying systems and subsystems
10. **Enlist the help of qualified experts, industry partners, potential regional collaborators and others as soon as able to develop micro-strategies to execute this roadmap**
    a. Including Scottsdale's and senior leadership and sponsoring stakeholders

Figure 1: Obstacles to Becoming a Smart City



Project Overview

Introduction

The City of Scottsdale, Arizona is interested in integrating smarter ways to provide city services and benefits to its residents and businesses, increasing efficiency internally and discovering opportunities for public-private partnerships that can multiply resources and efforts. The city is already progressive in many departments and has a history of creating opportunities for innovation. Concurrently, Scottsdale has joined the regional smart city consortium, The Connective, to leverage regional planning and partnerships for smart city efforts.

Engagement Scope

To better understand and plan Scottsdale's most impactful and valuable smart city opportunities, the City hired Think Big Partners to assist with the following items:

- Discover a holistic perspective and insight into gaps, challenges, opportunities and needs of the City by meeting with the following stakeholders:
    - City Departments
    - City Leadership
    - Scottsdale Businesses and Community Leadership
    - Young (high school-aged) Scottsdale Citizens/Students
- Analyze and develop opportunities, themes and assets
- Design and deliver a Scottsdale Smart City Strategic Roadmap for implementation

Key Objectives

Scottsdale envisions this Smart City Roadmap will:

- Define a vision for a smart city in Scottsdale that aligns with the Strategic Plan and General Plan
- Co-create smart city strategic priorities for Scottsdale that reflect the needs and voice of the stakeholders, especially citizens and businesses
- Provide recommendations for smart city projects, including quick wins and long-term initiatives that work towards the vision, and the current emerging technology solution marketplace
- Provide insight and recommendations into financial strategies to provide a path forward
- Provide insight into the economic development impact of a smart city roadmap
- Identify opportunities for public-private partnerships for Scottsdale and the Scottsdale Industrial Development Authority
- Recommend clear next steps as a roadmap for action

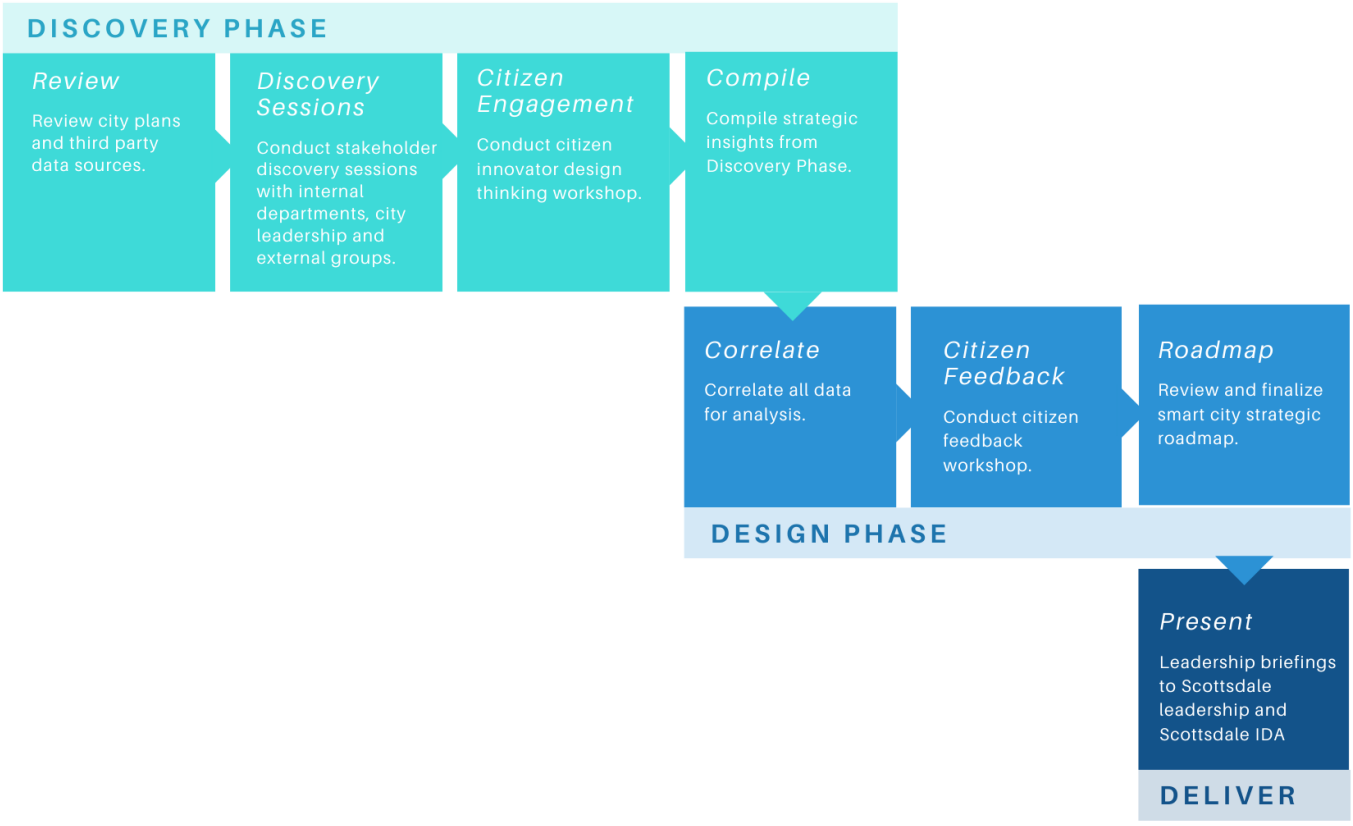
Methodology

The term "smart city" is ambiguous and means many different things to different people. Think Big looks at smart city design through an economic development lens that ultimately aims to improve the quality of life for residents and enhancing the Scottsdale business climate.

Smart cities are not primarily about technology; smart cities are most importantly about the people. A Smart City Strategic Roadmap for Scottsdale will provide a framework for informed decision making and prioritization of projects that lead back to supporting core City goals and citizen needs. This roadmap will serve as an actionable guide to create public-private partnerships and other funding opportunities, and give Scottsdale an advantageous position in the regional and national marketplace. Effective smart city planning requires a holistic view of a city's goals, needs, problems and challenges before solutions, strategies or an implementation playbook can be developed. Think Big's design thinking inspired process develops the roadmap from both the "bottom-up" by engaging the citizen voice (sentiment, beliefs, goals) and "top-down" by incorporating city goals, objectives and current characteristics.

The team completed this engagement using Think Big's smart city analysis methodology as shown below and summarized in Figure 2.

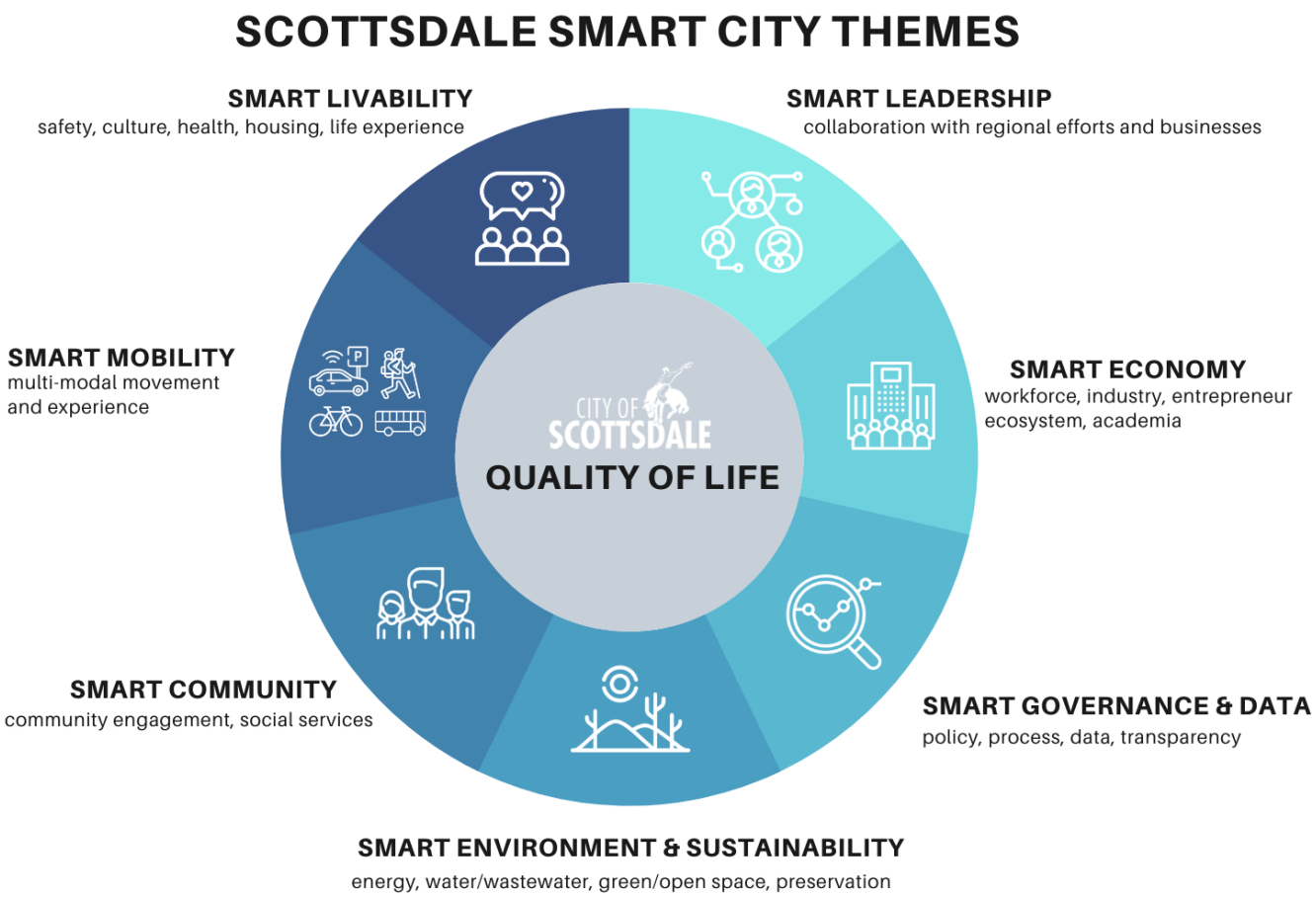
Figure 2: Think Big's Smart City Design Methodology



Smart City Themes

Think Big identified seven smart city themes for Scottsdale that served as the guiding principles when evaluating Scottsdale's smart city challenges and opportunities. These themes have been developed from the findings during the Discovery phase, extensive market knowledge and experience, to incorporate the core principles in the development of the Scottsdale Smart City Strategic Roadmap. The themes are used to organize discussions and recommendations throughout this Roadmap. If Scottsdale can achieve excellence in each of these themes, it will build a smart, connected and resilient community for its citizens to maintain a high quality of life for generations to come.

Figure 3: Scottsdale Smart City Themes



SMART LEADERSHIP

Smart Leadership looks at the collaborative mindset that city leadership takes and acts on, including with regional partners/jurisdictions and private sector businesses.

Scottsdale has been recognized for its leadership, management and performance. It is one of only 13 jurisdictions in the country (only one in Arizona) that has been recognized with What Works Cities Certification, a national standard of excellence in city governance. To Scottsdale's benefit, Maricopa County is one of the more collaborative regions in the nation, even more so in smart city efforts. Scottsdale is already actively participating in the regional smart city initiative, The Connective. For Scottsdale to build a world class smart city that is right for its residents, it must continue to be progressive and should consider the following:

- The use of high-quality data to make data-driven insights that lead to effective, timely decisions. Smart technologies will provide new opportunities to gather useful data that allows leaders to make the best decisions.
- The city should provide its citizens a transparent view of its mission, vision and goals for the city. This transparency leads to collaboration opportunities with an engaged citizen population that fosters trust, along with building regional and national partnerships.
- The city should create and actively conduct regular programs to engage all residents, the business community and other key stakeholders (locally and regionally). Providing a meaningful, deliberately inclusive engagement model (physical and digital) helps the city develop a co-creation mentality critical for Scottsdale's success as a smart city platform.
    - A special emphasis may be placed on engaging the youth of Scottsdale as a voice with deep insights to issues that will be important for future generations.
- Maintain a high level of "learning" in the smart city space. Policy making can be complicated and the smart technology that will deliver services in future years will require a purposeful approach to examining the needs of its citizens, balanced against technology capabilities.
- Leadership must provide its staff members the proper skills to succeed in the modern, digital smart city era. Technological skills may have gaps around data science, artificial intelligence (AI) and cyber-security. Employees will need training on ethics, trust, privacy and the protection of personal data as it pertains to the smart city applications, policies and new use cases that emerge.
- Cross-departmental collaboration will become more important. Staff members in departments like Information Technology, Public Works, Economic Development, Community Services and more will need to work with Purchasing, the City Manager's Office and senior leadership to identify problems tied to smart solutions that may benefit multiple departments. Smart procurement will be an essential strategy for Scottsdale to consider, especially if regional collaboration is possible for additional value.
- The City must continue its willingness to be a leader with its High Performance and Innovation Initiative. This means being open to pilots to test technology and use a "pilot to procurement" mentality for emerging smart technologies. Continuing its willingness to innovate is important, as Scottsdale could face significant urban challenges related to growth.

Smart Economy looks at the productivity of the economy in the city, especially at workforce development and attraction, industry, academic institutions (all levels) and entrepreneurship activity.

Scottsdale is part of the Greater Phoenix area. Therefore, a regional outlook must be used when thinking in terms of a Smart Economy. Scottsdale's labor force is made up of 136,586 people with a 4% unemployment rate[3]. Top jobs by occupation are:

- Office and Administrative support - 15.71%
- Sales - 11.97%
- Executive, Managers, and Administrators - 11.38%
- Production Workers - 7.31%
- Food Preparation, Serving - 6.8%

Tourism is Scottsdale's major industry and largest employer, providing jobs to 39% of the city's workers. Scottsdale is also home to more than 60 hotels and resorts with a combined total of more than 12,000 rooms that hosted an estimated 4.5 million overnight visitors and 4.4-million-day trip visitors in 2017[4]. These visitors had a $2.4 billion economic impact to Scottsdale.

Additionally, other large industries in Scottsdale are Health Care & Social Assistance (17,746 people), Professional, Scientific, & Technical Services (14,909 people), and Retail Trade (13,211 people)[5]. The Scottsdale Airport/Airpark houses approximately 2,200 businesses with a combined economic impact of nearly $3 billion annually.

For Scottsdale to continue its success, we recommend the following:

- Identify technologies that can attract more visitors to the Scottsdale area. For example, various wayfinding applications (especially multi-lingual) make it easier to navigate as a tourist or city resident, helping to drive a smart economy.
- Develop a "community for all ages" mentality. Scottsdale has a higher than average median age (Scottsdale's median age is 47, compared to the US median age of 38)[6] for its population and should seek out technologies that provide a higher quality of life for citizens that are aging. Design thinking can develop insights into new applications that can benefit the broad community, and especially those residents and visitors that seem to make up Scottsdale population and tourist base.
- Scottsdale needs to consider more workforce housing options. These options can address the needs of existing workers that may commute from increasingly longer distances across Maricopa County to provide the labor force for Scottsdale's economy,

[3] Choosescottsdale.com, Workforce Overview, 2015
[4] Scottsdaleaz.gov, Scottsdale – Tourism Study – Visitor Statistics, 2018
[5] Datausa.io, Scottsdale, AZ, 2017
[6] Scottsdaleaz.gov, Demographics – City of Scottsdale, 2019

or be a soon-to-be college graduate that is considering moving to Scottsdale, but doesn't feel like they have affordable housing options.
    - Policy making may need to evolve as new "co-living" trends take root and other new, innovative housing developments may require ordinance revisions.
- Scottsdale should seek to partner with both the Scottsdale Unified School District and Arizona State University (ASU) more to help develop the workforce for Scottsdale's future. For the fifth year in a row, ASU has been named the Most Innovative University in America by U.S. News & World Report. This distinction is notable, and Scottsdale should create a strategy to take advantage of this talent pipeline.
    - By creating a more livable community for all ages using smart technologies. Scottsdale may be able to draw more people to stay in the region after graduation.
    - Scottsdale should also work more closely with ASU to develop a stronger relationship to engage entrepreneurs. Scottsdale retirement-age residents may provide rich sources of retired executives that have deep domain expertise in a variety of industries that may be seeking mentorship opportunities with early stage companies and entrepreneurs.
    - ASU has also been recognized for supporting women entrepreneurs. Scottsdale's diversity goals are aligned with providing more opportunities to disadvantaged groups like this.
    - ASU's Open Innovation pitch competition is in its fourth year. Scottsdale should consider ways to become more involved in programs like this as they become a smart city and want to develop a smart economy that relies on more early stage companies and innovation-led businesses.
- The city should seek to partner with Scottsdale Community College as a local asset contributing to workforce development. Smart city programs, innovation competitions, hackathons, skills training, and technology pilots are just a few examples of what a partnership may look like. Many of Scottsdale Community College's degree programs produce talent beneficial to the smart city platform so early exposure for students and university partnership will be valuable to all parties.
- The city may consider developing a robust "pilot to procurement" program to encourage entrepreneurs and startups to develop new applications that can be tested in partnership with the city. An innovation partnering program can be powerful, low risk and a good role for the city to act as a convener and "first customer."
- The city should pay special attention to develop more ways to celebrate Scottsdale's rich art history and promote future arts vibrancy. Developing programs that can appeal to younger generations is critical for Scottsdale's culture to continue for future generations. This can have a real impact to the economy, and paired with technology, there are digital strategies to help arts to thrive in the city through experiences.

Smart Governance and Data looks at the city internally and how it processes and communicates to external parties, namely through policy, data, process and a transparency mindset. Ultimately, excellence in Governance and Data should create a responsive, engaged city that makes decisions based on data and understands the needs of its citizens while communicating those decisions back to the citizens.

Smart cities are fueled by data that has been gathered from Internet of Things (IoT) connected devices. The goal is to capture high-quality information that can be used by Scottsdale city leaders, along with other permitted stakeholders, in order to identify opportunities to enhance the quality of life for city residents, businesses and visitors. Over 2.5 quintillion bytes of data are created every single day and it's estimated that in 2020, 1.7MB of data is created every second for every person on earth[7].

Data and corresponding data governance policies must be created very carefully. Additionally, the city leadership should also understand that policies will need to evolve over time to reflect the dynamic nature of this smart city environment that will continue to produce new technologies to respond to new citizen needs. It will be important for Scottsdale to keep the following considerations in mind while implementing smart city projects:

- Residents, businesses and visitors have the right to data protection and understand how their data is going to be used.
- GDPR (General Data Protection Regulation)[8] is a set of guidelines for the collection and processing of personal information from individuals who live in the European Union. Although rooted in European Union law, GDPR's reach exceeds the physical boundaries of the EU. If nothing else, the implications to cities and citizens in the United States is very real and establishes a baseline standard for best practices. The California Consumer Privacy Act (CCPA) was inspired by GDPR and was enacted in January 2020. Similar to GDPR which went into effect in the European Union in May 2018, CCPA is consumer-focused. While the CCPA only holds jurisdiction over the state of California, other states are paying attention to CCPA and GDPR as it will help shape how consumers think about their data rights and provide insight for cities in the development of governance best practices.

  The State of Arizona and the Arizona Attorney General's office have made data security a priority, striking a balance between supporting innovation and protecting Arizonans' privacy rights. With the full support of Governor Ducey, Arizona is taking active steps to broaden the scope of state privacy protection initiatives and Scottsdale leadership should continue their already active efforts to support this.

- The city should recognize the value of ongoing, proactive communication with the citizens of Scottsdale as they develop their smart city platform. It is important to adopt a "co-creation" mentality that empowers citizens to take an active role in their own

[7] Forbes, How Much Data Do We Create Every Day? 2018
[8] Intersoft Consulting, GDPR, 2018

personal data privacy practices while recognizing the needs of the city to use their data to provide essential city services. This data may be in the form of de-identified, aggregated data (that has been anonymized) or could exist in personally identifiable information (PII). Smart cities like Scottsdale will continue to face challenges as they strive to balance innovation with personal privacy needs.

- Information security will be an ongoing challenge given the sheer number of cyber-security threats that exist today. Scottsdale has done an excellent job in developing a proactive security policy and practices but must remain vigilant as the threat environment is constantly evolving. Additionally, it should enlist the help of its private sector partners to further assist in addressing the cybersecurity threat . Regular security audits should continue to maintain a front-line defense against cyber-security threats and security breaches. Policies will need to be put in place to monitor the relationship and contracts between Scottsdale city government and its business partners.
- Regional collaboration is important in the development, adherence and ongoing evolution of data security and governance. A citizen of Scottsdale's data profile will be visible as they live, work and play throughout the Maricopa County region. Coordination between local governments and the creation of best practices from lesson learned would be extremely valuable for the regional stakeholders.
- Scottsdale should understand its legal rights to use data under the guidelines of GDPR and the CCPA. Policy must be put into force to adhere to the emerging guidelines set forth by governing bodies. It should continue to develop an updated understanding of the role of open data, a data platform's role in creating a data exchange, and how a data "marketplace" can help strengthen the urban economic ecosystem by enhancing collaboration. Open data has a strong way of creating new opportunities to empower citizens and organizations. This equation can help Scottsdale (and the State of Arizona) continue its role as an innovator to help improve the lives of its citizens. It should have both a centralized and decentralized architecture and promote the development of responsible artificial intelligence, blockchain and machine learning capabilities to attain the highest level possible for data value (Level 4 - Prescriptive).
    - Currently, 47 datasets can be found on Scottsdale's open data site that can also be accessed by API. The City has made significant efforts to make it easy for the citizens to understand what kind of information can be found on this portal and how to interact with city officials. Currently, there is a limitation on the commercial use of open data in Scottsdale. The CCPA guidelines allow for cities to use their data within the guidelines that are being set by the CCPA and GDPR. A legislative program to change state law to allow the use of open data commercially would bring value to citizens and organizations in Scottsdale. The City can benefit from permissible use of the data if the citizens have their rights protected within the CCPA commercial use framework. These guidelines will continue to evolve as more practical scenarios emerge that will help further shape the law.

Smart Environment & Sustainability looks at protection of the environment while creating sustainable options where possible, especially within energy, water/wastewater, green and open spaces and natural environment preservation.

According to a November 20, 2019 article in the *Daily Independent*, Scottsdale is attracting nearly 11 million visitors[9] from around the world on an annual basis. Tourism as a vital industry is in no small part related to Scottsdale's beautiful environment. Consequently, the environment must be protected for quality of life, environmental and economic reasons.

Additionally, sustainability is a top priority for many communities around the world. The use of smart technologies helps improve sustainability goals through data insights, controls and other technological advances that help reduce consumption. Environmental impact and sustainability are closely aligned, and Scottsdale should approach the development of policy and technology solutions unique to each goal. It is critical to plan these two focus areas together. The following are general considerations for Scottsdale to support environmental and sustainability goals in smart city projects:

- Scottsdale should continue to promote citizen involvement in its environmental policymaking. The City Council appointed a citizen commission (The Environmental Advisory Commission) to provide guidance on the prioritization of current and future environmental activities and recommends environmental policies.
- Smart city technologies are designed to provide a higher quality of life for all residents, including improving environmental concerns. Smart city solutions, such as air quality monitoring, energy use optimization, electricity, water and waste tracking can produce results such as 10-15% fewer greenhouse gas (GHG) emissions, 30-130 fewer kilograms of solid waste per person per year, and 25-80 liters of water saved per person per day[10]. Smart city applications that contribute most to Scottsdale's environmental improvements include those focused on mobility, water, energy and waste.
- Scottsdale should maximize the open data available to the public in the areas of environment and sustainability. This can engage the public and private sector partners to gain deeper insights that can spur behavioral changes in Scottsdale residents and businesses. Additionally, this can fuel innovation in a globally important sector.
- Scottsdale needs to continue to embrace new technologies, such as advanced solar, electric vehicles (and EV charging station deployment), smart LED lighting, smart building controls, smart water systems and smart mobility (that decreases reliance on personally owned fossil fuel vehicles).
    - Renewable energy and environmentalism is not only important for the environment, but studies have shown that the "next generation workforce" prefers to live in a city that provides a reduced environmental footprint while also providing a modernized quality of life with amenities like micro-transit, walkable spaces and energy-efficient building structures.

[9] Daily Independent, Experience Scottsdale fuels Valley of the Sun International tourism, 2019
[10] McKinsey & Company, Smart Cities: Digital solutions for a more livable future, 2018

Smart Community looks at creating an engaged, inclusive and equitable community that can provide a high-quality life for all in Scottsdale through engagement programs, social services, communication strategy and more.

Due to urbanization challenges that cities are facing across the country, smart cities and the associated advanced technologies are an absolute reality. These technological advances are increasingly going to be part of Scottsdale's collective future, promising to make each citizen's life more convenient, more secure and more sustainable. Providing a high quality of life is the ultimate goal for a city. With this reality, there are tradeoffs. This dynamic is important to understand and to be embraced by both the citizens and city leadership. An ongoing dialogue that is built on trust must occur to provide a bi-lateral communication relationship. Mostly, the stakeholders of smart city projects are city leaders, academic institutions and technology companies. However, the most important group of stakeholders are the citizens that will have to live in these transformed cities and recognize the tradeoffs associated with it. In short, Scottsdale must continue its people-centric approach and use human-centered design principles that are informed by engaging the citizens.

Scottsdale should consider the following:

- Use both a top-down and bottom-up design thinking approach when developing new services.
- Communicate Scottsdale's mission, vision and goals to the citizens on a regular basis using a variety of engagement methods and platforms. Recognize that generationally, there are different ways people consume information. The receiving party's platform preference is critical to consider and should be given priority over legacy systems, when possible.
- Continue to be very deliberate by engaging diverse voices in the community. This includes socio-economic diversity, age diversity, and geographic diversity (e.g. north and south Scottsdale). Inclusion of regional stakeholders should be considered, too.
- Provide insight to the data collected and corresponding analysis that drives your decisions.
- Adopt a "citizen innovator" mentality in which citizens can help identify problems, provide new ideas and help develop and test those ideas prior to mass scale implementation. Innovation must be inclusive to provide some of the most meaningful insights to Scottsdale.
- Reiterate the tradeoff dynamics on a regular basis, asking the community to help craft the best decisions that can be made knowing they will also have to live with those decisions to enjoy the benefits.
    - Example: Data governance and privacy concerns must remain as a top priority but also must realistically be understood by all parties that there is no ideal solution that can provide all of the benefits to the citizens without a tradeoff occurring.

Smart Mobility looks at the ability to move throughout the city in all relevant ways (walking, biking, public transit, driving, micromobility, etc.) and also considers the experience from going from one mode to the next (seamless is optimal).

Scottsdale's 184 square miles of land mass, situated next to Phoenix's Metropolitan area (consisting of Maricopa and Pinal counties) land mass of 14,599 square miles, can present transportation and mobility challenges simply due to its sheer size. Combined with Maricopa County's growth rate (ranked #1 in the US for the 3rd year in a row)[11], mobility issues are top of mind for any community wanting to be successful.

Enabling mobility is critical as it is the lifeblood of a smart community. Smart mobility options are growing. Not only to include new multi-modal transit options, but also the recognition that cities are increasingly being built for pedestrian traffic to create more walkable cities, too. By improving urban mobility within cities, we enable them to thrive. It is imperative for Scottsdale (and the region) to understand the interconnectedness each community has and the dynamic this plays regionally and locally in the daily life of the Scottsdale resident, business owner or visitor. Scottsdale's economic vibrancy is highly dependent on satisfactory mobility experiences. Without reasonable mobility options that continue to respond to the needs of the citizens over time, the city can face dire consequences. Below are a few key mobility considerations while implementing smart city projects:

- Understand the "first mile" and "last mile" needs and experience for the stakeholders that live, work or play (visitors) in Scottsdale. The mobility ecosystem is complicated for each participant and a broad, holistic view must be taken when considering smart city decisions.
- Recognize the role the city can play as a convener, innovation partner and ultimate user for new mobility solutions.
- Embrace innovation in shared-use mobility solutions, autonomous vehicles, electric vehicles, micro-transit, traffic management (that impacts mobility and pedestrians) and the infrastructure requirements necessary to enable these developments.
- Create more choices for consumers in terms of type of mobility solution, payment methods, availability and experience.
- Leverage data to develop deep insights to improve all aspects of planning, operations and congestion mitigation.
- Understand the environmental impact that transportation and mobility choices have.
- Improve the efficiency of the roadway network by continuing to add lanes that can accommodate bikes, scooters and other future transit modes.
- Continue to add electric vehicle (EV) charging stations in the Scottsdale area, especially to new residential real estate developments. Currently, there are approximately 183 publicly available EV charging stations (level 1, level 2 and DC Fast Chargers) and more will be needed based on Department of Energy (DOE) federal initiatives affecting personally owned vehicles.

[11] AZgovernor.gov, Maricopa County #1 in US for Population Growth, 2019

- Recognize that smart mobility will also play a role in making Scottsdale a safer community. Each day in the United States, approximately 9 people are killed and more than 1,000 injured in crashes that are reported to involve a distracted driver. An estimated 391,000 drivers were injured in distracted driving crashes in 2017. Additionally, given Scottsdale's older than average resident with an increasing life expectancy, smart mobility can provide safer options for older drivers for a longer period of their life.

SMART LIVABILITY

Smart Livability looks at the vibrancy of the quality of life with specific considerations for public safety (and perception), culture and arts, housing accessibility and general daily life experiences while in Scottsdale.

According to a 2018 study[12], Scottsdale has the highest life expectancy in Maricopa County at 85 years old. Maricopa County has a life expectancy of 80.1 years old and South Phoenix (zip code 85004) has the lowest life expectancy in the Valley at 71 years old. Much of Scottsdale's high life expectancy can be attributed to the high quality of life that Scottsdale residents enjoy, and the health that they seek to maintain.

Smart livability addresses the various factors that affect this high life expectancy and more. Safety, culture, housing, health and even life experience all contribute to a person's life expectancy and Scottsdale must continue to make sound decisions to preserve this quality of life and promote an overall healthy lifestyle environment.

Additionally, Maricopa County has experienced tremendous population growth and Scottsdale has been part of that growth dynamic. The Scottsdale community is extremely attractive to live, work and play in and is expected to maintain the high quality of life for future generations that may move into Scottsdale as the region grows. Scottsdale should consider the following:

- Understand the role that data will play in developing new services that can help enable a Scottsdale resident to maintain a healthy lifestyle. Data driven insights combined with research into new innovations will produce opportunities for Scottsdale city leadership to embrace technology with a "community health ROI" in mind.
- Air pollution, water quality and other hazards can be measured and ultimately reduced using smart technologies. Health implications are a primary benefit beyond making sound environmental and sustainability choices and should be considered in technology selections.
- Housing plays a role in the health and vibrancy of a community. Affordable housing and understanding the needs of next generation workers is critical to the future success of Scottsdale.
    - Recognize the housing needs and preferences for "millennials" that are vital to future workforce development and talent. Green energy options, sustainable buildings and smart appliances are more than just modern amenities; these are the features that millennials want. Smart cities and smart housing come together to create smart, livable communities.
    - Scottsdale (and the Phoenix metro area) is becoming increasingly attractive to people living in San Francisco, Los Angeles and Seattle. The relatively lower cost of living will drive people to move from these areas and Scottsdale needs to be prepared to deal with (or take advantage of) this situation.
    - Scottsdale needs to understand the "millennial renter's dilemma". Home ownership is not as widely viewed as an option as once before.

[12] abc15.com, Study: Scottsdale has highest life expectancy in the Valley, 2018

    - Collaboration with regional partners to provide housing options (ideally paired with mobility solutions) may provide a practical solution for workforce housing. Scottsdale's commute time is lower than national and regional averages and this can provide a dynamic in which workers are willing to travel to work in Scottsdale. By working with regional partners, job creation could occur in Scottsdale while housing could exist in a neighboring community.
- Scottsdale has a rich cultural history that the community should strive to incorporate into its digital transformation led by smart city planning efforts.
    - Technology functions (such as wayfinding to cultural destinations) can increase interactions with Scottsdale's rich arts culture. Smart technologies like a city-wide mobile app can also help enable more visitors to discover cultural destinations in Scottsdale. The ability to provide multi-lingual wayfinding, information and even native currency exchange embedded into a digital payment system are all examples of how Scottsdale can create a more livable community.
- The public health of a city is paramount to creating a smart livable community. There is an opportunity to connect health-related data to city-related health and human services. Being able to integrate data across multiple departments that touch a citizen's life is important to maximize the return on investment for smart technologies and make a seamless experience for the citizen as they try and live a healthy life.
    - Isolation among senior Scottsdale residents can pose a big challenge in the future due to its impact on mortality. Smart city applications, to include a mobile app, can monitor people that need it the most in ways that do not necessarily compromise personal privacy. Technology (such as voice-enabled smart speakers, telehealth and remote health monitoring) all depend on enhanced connectivity. When coupled with other types of de-identified aggregated data that may be specific to an older community, a public health picture emerges and isolation (and other negative factors that impact health) can be reduced.
- Public safety and smart city technology present some of the most important ideas for Scottsdale to embrace. The delicate balance is often a tradeoff scenario in which the greater good and individual benefits during a crisis event can outweigh the negative consequences. Surveillance, facial recognition, location-based services, drones and communications are all important considerations that Scottsdale needs to make when adopting new solutions to known or anticipated problems.

Scottsdale Smart City Recommendations

How to Read This Section

There are three layers of technology that are referenced in this recommendation section. Due to some technologies being complementary and accretive to others, it's important to note that Technology A may be required to enable Technology B's core functionality or full capabilities, even if Technology A isn't necessarily a priority for the city.

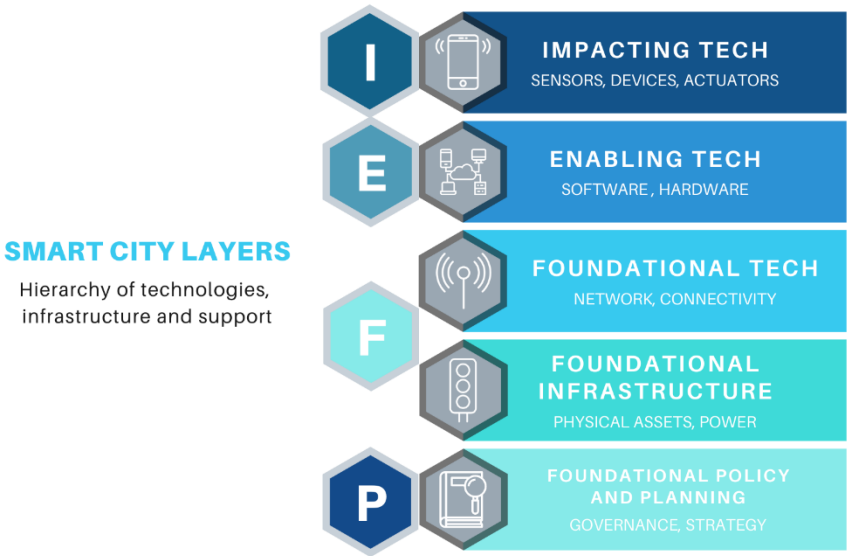
The first layer is associated with traditional infrastructure, both physical and digital. This layer will be referenced as the "foundational layer" and is essential for build out of additional layers. An additional noteworthy dimension to this layer is the "policy layer" which also provides an additional foundation that enables the technology to function in terms of governance, policy, regulatory compliance, etc.

The second layer will be referenced as the "enabling layer." This layer provides the technology base that includes networks of connected devices and sensors that operate through some type of connectivity layer.

The third layer will be referenced as the "impacting layer." This layer of technology is comprised of the smart applications and data analysis capabilities that operate "on top" of these networks.

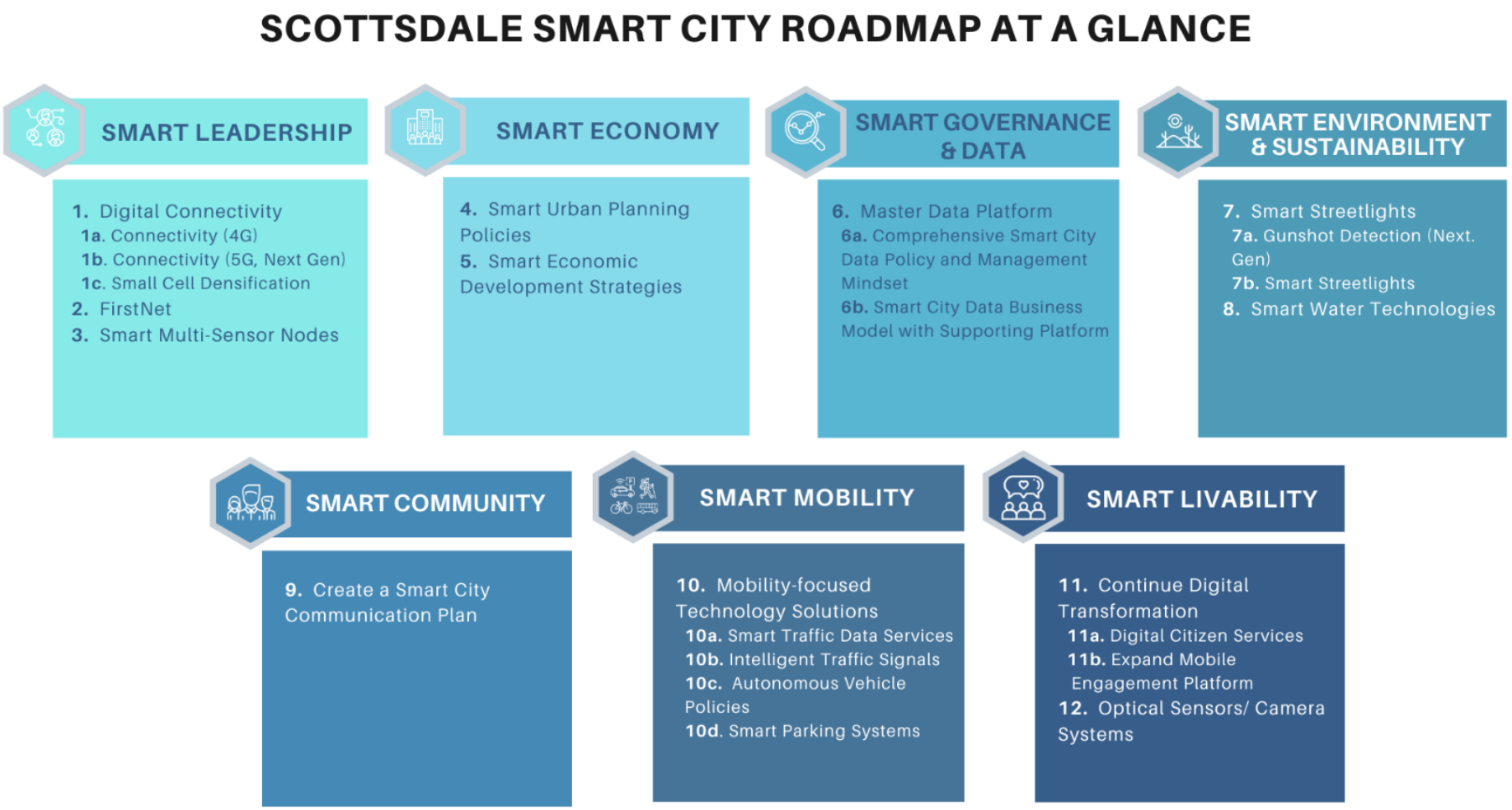
As citizens in cities interact with technologies that are dependent on these various layers, the impact on their quality of life is more profound. This often leads to better insights to city leadership, enabling better data driven decisions and operational changes in real time.

Figure 4: Smart City Layers



Smart City Recommendations at a Glance

Figure 5: Scottsdale Smart City Roadmap at a Glance

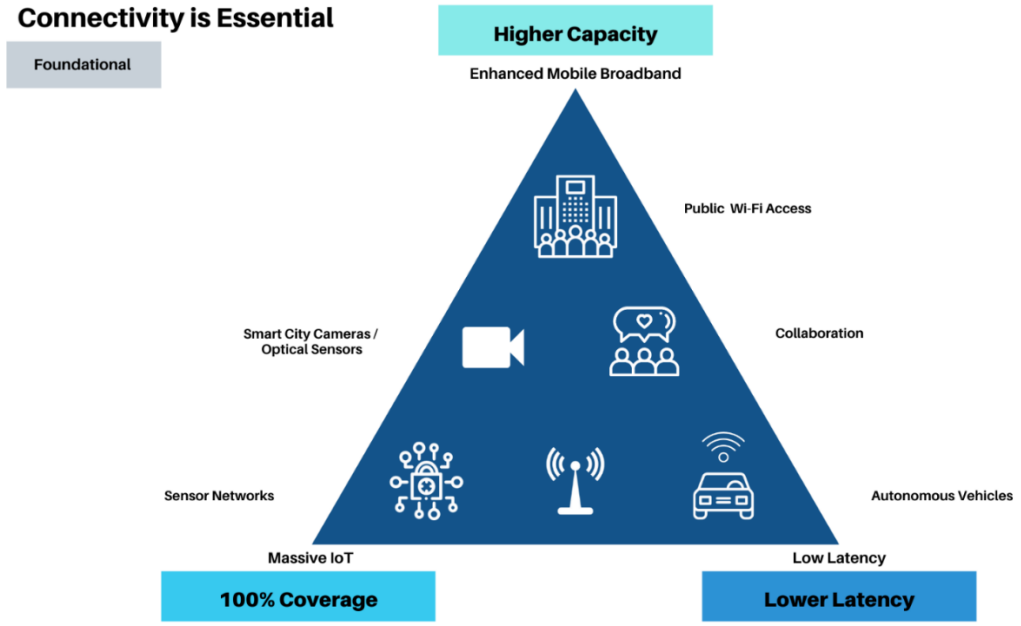


1. Digital Connectivity

1a **Connectivity (4G, 4G+)** FOUNDATIONAL	Without connectivity, it is not possible for Scottsdale (and its 184 square miles) to become a true "smart city." Smart cities rely on networks to provide connectivity to Internet of Things (IoT) connected devices. The connectivity quality (speed, latency, etc.) and reliability are critical components when evaluating the technology that enables Scottsdale current and future needs. Scottsdale should continue to identify coverage needs and/or anticipate connectivity gaps/needs as the community grows. The city and the marketplace will determine if it is a 4G or 5G solution. Upon evaluation, the City should then contact the right solution providers and encourage co-development of proposed solutions. The City should look at incumbent providers but remain open to niche, private sector solutions especially in localized locations.
	Technical Insights: 4G is the fourth generation of broadband cellular network technology, succeeding 3G. A 4G system must provide capabilities defined by ITU in IMT Advanced. 4G+ Means LTE-Advanced aka True 4G, and it is faster than 4G. The only difference is the maximum theoretical speed, bandwidth and minimum latency you can get. 4G can reach speeds of 25-100Mbit/s, while the 4G+ (LTE-A) can reach up to or over 1GBit/s, with less than a few milliseconds of latency.

1b **Connectivity (5G) - Next Generation** F FOUNDATIONAL	5G delivers a significantly improved platform to deliver scalable and reliable connectivity. The technology is designed to provide high data-rates with low-latency. These two characteristics allow for fast real-time transfer of data between two or more points and is essential to the next generation of smart city technologies, especially ones that require low latency such as autonomous vehicles. This will allow for many new applications to be deployed that were not possible before 5G. Scottsdale's population of 250K people is expected to grow in tandem with Maricopa County's growth, which was rated #1 in the US of population growth. Scottsdale should identify current coverage needs and also anticipate new connectivity gap/needs as the community grows. The city and the marketplace will determine if it is a 4G or 5G solution. 5G solutions may be the result of additional vendor deployments that want to gain a market advantage over its local competitors. Upon evaluation, the City should then contact the right solution providers and encourage co-development of proposed solutions. The City should look at incumbent providers but remain open to new providers that may be offering new 5G services in additional parts of the frequency spectrum.
	Technical Insights: 5G speed (200-400 Mbit/s or even up to 1Gbit/s) is expected to be as much as 100 times faster than 4G. Those speeds are possible because most 5G networks are built on super-high-frequency airwaves, also known as high-band spectrum. Low latency is another key differentiator between 4G (20-30 milliseconds) and 5G (<10 milliseconds), which is the time it takes for devices to communicate with each other or with the server that's sending them information. Additionally, 4G can support about 4,000 devices per km^2, whereas 5G will support around one million per km^2. This is critical to understand as the total number of connected devices is increasing rapidly. Currently there are over 26 billion IoT devices in the world and is expected to grow to over 75 billion devices by 2025[13].

Figure 6: Connectivity is Essential



1c **Small Cell Densification (Where Applicable)** F FOUNDATIONAL	Small cell densification will continue to support current and future (5G) network needs. This will consist of erecting a series of small low-powered antennas (often called nodes) that provide coverage and capacity in a similar way to a tower but with a few notable differences. Small cells are often attached to existing infrastructure in the public right of way such as on a streetlight or traffic signal. Small cells also provide better outdoor wireless service in high traffic or low signal areas that may need better connectivity to enable specific digital applications (such as enhancing coverage for robust wayfinding or potential citizen engagement technologies in Old Town, etc.) Scottsdale should identify current connectivity gap/needs as the community grows and determine the role that small cell densification can play to fill in coverage deficiencies. Upon evaluation, the City should then contact the right solution providers, looking at both incumbent providers and also niche, private sector providers.
	Technical Insights: Network densification is an integral part of deploying 5G architecture. Until 5G takes over the primary network load, 4G will continue to play an important role and network densification is expected to continue until 2022 to support current and future network needs. The role of a physical network infrastructure will grow as Scottsdale's 5G rollout continues. Sprint and Verizon launched new 5G services in Phoenix in August 2019. 5G requires at least a 10-fold increase in the density of cellular antennas within the same geography. 5G wavelengths have a range of about 1,000 feet (in some cases it can be even less).

2. FirstNet

2 **Deploy FirstNet (at scale, when practical)** F FOUNDATIONAL	The First Responder Network Authority (FirstNet) is an interoperable, nationwide public safety broadband network that will help police, firefighters, emergency medical service professionals and other public safety officials communicate in times of crisis. Scottsdale should continue to support the FirstNet deployment. Scottsdale has piloted FirstNet in support of a golf event but has not yet deployed at scale. Currently, the Police Department is using it and the Fire Department is evaluating possibly deployed. Next steps would include engaging vendors (AT&T and Verizon) in conversations about deploying this technology at scale.
	Technical Insights: FirstNet is a federal entity charged with building a nationwide wireless network for public-safety agencies, including police, firefighters and others, using around $6.5 billion and 20MHz of unused spectrum in the 700MHz band. AT&T won the FirstNet contract in 2017 with a 5-year goal to construct a network using currently available spectrum and operates on Band 14. AT&T is installing FirstNet 700MHz transmitters on its existing towers, and its FirstNet and commercial customers both have access to FirstNet's spectrum as well as AT&T's other spectrum bands, though FirstNet customers receive priority access. Conversely, Verizon traditionally has a large market share of the public safety market. Notable: FirstNet offers a physically separate core network, and access to this core is something that AT&T seems unlikely to offer Verizon. That presents a challenge for full

	interoperability. AT&T invested more than $525 million in its Arizona wireless and wired networks during 2016-2018. Some of this investment improved critical services that support public safety and first responders.

3. Smart Multi-Sensor Nodes

3 **Smart Multi-Sensor Nodes**  ENABLING  IMPACTING	The City should evaluate the needs to various types of environmental, optical, public safety or other sensors and implement multi-sensor nodes strategically. The goal is to provide a cost-effective hardware solution to impact a wide variety of areas that are important to the city. These sensors are highly customizable and can detect a wide variety of conditions with a variety of applications, often times creating enhanced capabilities through additional software. Sensor capabilities examples: vehicle counting, vehicle type recognition, vehicle proximity and presence detection, height warnings (tall vehicles) for underpasses, parking space monitoring and occupancy, adaptive lighting controls, pothole detection, road status monitoring, people counting, public space monitoring, gunshot detection, air quality monitoring, noise monitoring and more. The value for these nodes is especially rooted in that once the hardware is installed, future capabilities are somewhat determined by software. This data can be used to enhance other data streams or entire event analysis using edge computing.
	Technical Insights: There are many different vendors that offer a "plug and play" approach, which use multiple sensors on a single power and data hub to makes it easy to set up custom sensor arrays and capabilities. These sensors can be mounted in a wide variety of areas provided they have some type of power source in a secure location. Typical reading distances are up to 60 meters and can provide update rates as high as over 1,000 readings per second. Sensors can be connected using a wide variety of communication protocols to include 4G/5G, LTE M1/NB1, LTE Cat-1, LoRa and more. There are more than 90 different prominent sensor companies today. These companies can be classified as broadly "smart city" focused or niche "sector" or "function" oriented. Monitoring examples: traffic, environmental, energy, public safety, network, health, building / infrastructure, lighting and more.

4. Smart Urban Planning Policies

4 **Smart Urban Planning Policies** FOUNDATIONAL  POLICY	In 2015, Governor Ducey issued an executive order that provided nearly unrestricted access to state roads for autonomous vehicle testing. In March 2018, a pedestrian was killed in Arizona by an Uber autonomous vehicle whose safety driver was distracted as she watched a video on her phone. The accident was primarily the result of human error, not technology. Scottsdale should continue smart urban planning and policy making, in order to address the challenges of urbanization balanced carefully against innovation. Scottsdale leadership should continue to embrace innovation and the needs of its citizens and their desire for modern transit options. Urban planning policies and corresponding infrastructure decisions may also be made in the forms of HOV lanes, dedicated bike lanes and ordinances like Ordinance 4372 that affected bicycles and related devices, including electric bicycles and scooters. It is critical to balance all vehicle types with pedestrian needs, as urban planning policies should encourage multi-modal transit while keeping public sidewalks and spaces unobstructed (such as improving the walkability by connecting Civic Center, Arts and Canal Districts). Drones policy will also need to be modernized from time to time as new use cases and technologies emerge that could be used effectively to address the needs of the city. *Technical Insights: While ride-hailing services like Uber and Lyft are now mostly regulated at the state level, cities remain in charge of overseeing e-scooters. This creates an opportunity and responsibility for the city to understand the needs of the residents with modern transit options. There is current legislation being proposed (House Bill 2817) that affects Scottsdale as it is anchored by the Phoenix airport (that serves Scottsdale) and affects airport fees on rides to and from the airport. Lime, which had as many as 700 scooters in Scottsdale in 2019, announced in January 2020 that it will completely pull out of the Arizona market. Their decision seemed to have been made due to business profitability but is worth noting as fare increases or other city revenue support may be needed if other scooter operators have difficulty in making the market work, but the city may want their presence. Five other scooter companies (Bird, Lyft, Razor, Wheels and Spin) will continue to operate in the area. Additionally, an effective policy development process will need to consider the evolution of things like drones, gig-economy and sharing economy activities. Some of these policies (such as drones) are at a state law level that was supported by SB 1449, Arizona Revised Statute 13-2904, with further modifications based on ARS 13-3729. On August 18, 2016, the city adopted Ordinance 4276 (Drone operations in city parks and preserve). This applies to: McDowell Sonoran Preserve, Pinnacle Peak Park and Trailhead, Mescal Park and Stonegate Park. Scottsdale should make sure to be compliant to their evolving needs for drone use while staying in sync with state laws.*

5. Smart Economic Development Strategies

5 **Modern Smart Economic Development Strategies** E ENABLING	According to a McKinsey Global Institute report on the impact of digitization on the US economy, 50% of workforce activities could be automated with technology, but only 15% have been automated to date. These conclusions rest on a detailed analysis of 2,000-plus work activities for more than 800 occupations. As a result, more than 30 percent of US workers will need to change jobs or upgrade their skills significantly by 2030. Additionally, 85% of the jobs that will exist in 2030 have not been invented yet. Scottsdale's job market has increased by 3.3% over the past year. Future job growth over the next ten years is predicted to be 51.2%, which is higher than the US average of 33.5%. For Scottsdale to remain competitive, it must focus on: 1. Attracting both talent and employers who can provide high quality jobs 2. Retraining workers (reskilling) to modernize their knowledge and talents to meet modern industry needs 3. Take an integrated view of the workforce development, transportation and mobility and housing dynamics The City should continue to develop its understanding between the correlation of a technology enabled “smart city” and its impact on GDP, economic development and other long term strategic areas of desired impact.
	Technical Insights: According to the Bureau of Labor Statistics, Maricopa County added more jobs than any county in the nation from December 2018 to December 2019 with a net gain of 89,328 jobs[14]. According to Hoover’s Inc. nearly 17,000 companies have started operations in Scottsdale from 2010-2017. Scottsdale should recognize the role that smart city technologies, policies and creating a vibrant city (as a result of the impact of the technology) can have in attracting new entrepreneurs, companies and other ventures to Scottsdale. Partnering with the regional players can create a collaborative opportunity and develop a symbiotic relationship to neighboring communities. Additionally, Scottsdale should cultivate and support programs for entrepreneurs, that bridges the gap between founders, mentors, investors and entrepreneurs while also promoting diversity and inclusion. Scottsdale has many successful prior founders, business executives and prominent community leaders as part of its citizenship and this could provide a valuable component to the overall regional ecosystem for entrepreneurship and innovation. Technology companies can leverage the large and talented workforce that is produced by Arizona State University. ASU is the largest engineering school in the nation with over 24,000 engineering students enrolled. ASU is creating a pool of workforce talent and Scottsdale could leverage its retired residents as mentors to this workforce and/or emerging companies.

[14] Signalsaz.com and Bureau of Labor Statistics, Arizona Leads Employment and Wages Growth, 2020

6. Master Data Platform

6a

Create a Comprehensive Smart City Data Policy and Management Mindset

F

FOUNDATIONAL

P

POLICY

Smart cities use Internet of Things (IoT) technologies (devices, sensors, connected hardware, etc.) that create large amounts of data. As Scottsdale's smart city plan is implemented, and projects continue to expand and evolve, data will be more important than ever before to fuel decisions.

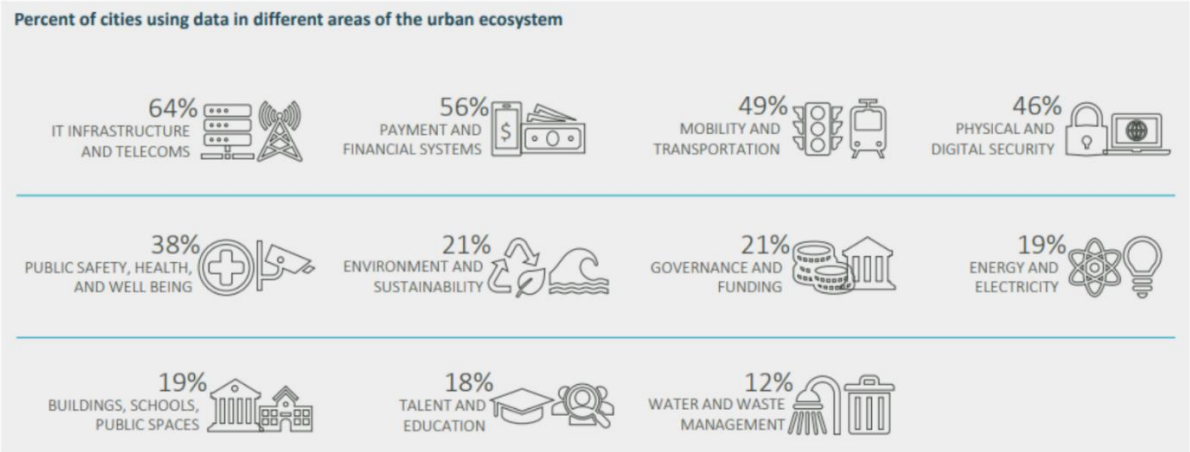
The City must create a comprehensive policy that addresses data collection, data use and data management. City leadership must understand the current platforms in use, the current data that is available and most importantly the types of data that need to be collected, stored and used. It will be critical to include the citizens in the creation and design of the data management policy as transparency and privacy concerns were expressed numerous times in the citizen sessions. Additionally, a regional view of the data is helpful as Scottsdale's residents traverse Maricopa County daily, and Scottsdale land mass only represents 2% of Maricopa County. Scottsdale will benefit from data sharing across all departments, but sharing among neighboring cities, as well as the development of data exchanges and platforms, will demand Scottsdale leadership to have effective policies in place to attain the higher levels (Levels 1 - 4) of data value creation for citizens and local government.

Technical Insights: Data driven insights leads to data driven policy making. The creation and implementation of a comprehensive smart city data management plan is critical to unlocking the full value of smart city technologies long term. Essential elements of a policy will include managing GDPR (General Data Protection Regulation) which is still evolving as a body of law and its impact on the US. It is worth watching California's Consumer Privacy Act (CCPA) which became law on January 1, 2020. Inspired by Europe's GDPR, the CCPA is the largest statewide privacy law change in a generation. The new law lets users request a copy of the data that tech companies have on them, delete the data when they no longer want a company to have it, and demand that their data isn't sold to third parties. A recent study by a large consulting firm (PWC)[15] found that only 40% of the largest 600 U.S. companies had a data portal, which is a critical element to compliance. Percentage of cities using data across different areas of the urban ecosystem is shown in the ESI graphic below for reference. Scottsdale should take cues from the private sector and understand its role with the citizens and its uses of data. Key components for a data policy include:

1. *What data should be collected? Why is it being collected (business use)?*
2. *How will the data be used?*
3. *Who will have access to the data?*
4. *How will the data be stored and safeguarded?*
5. *How will the data be managed (GDPR and other requirements)?*
6. *Who will manage oversight and create policy?*
7. *How will data be made public (when required)?*
8. *How will the data policy reflect the needs of Scottsdale and its citizens?*

[15] PWC, Readiness Roadmap Research Report for CCPA, 2020

Percentage of cities using data across different areas of the urban ecosystem

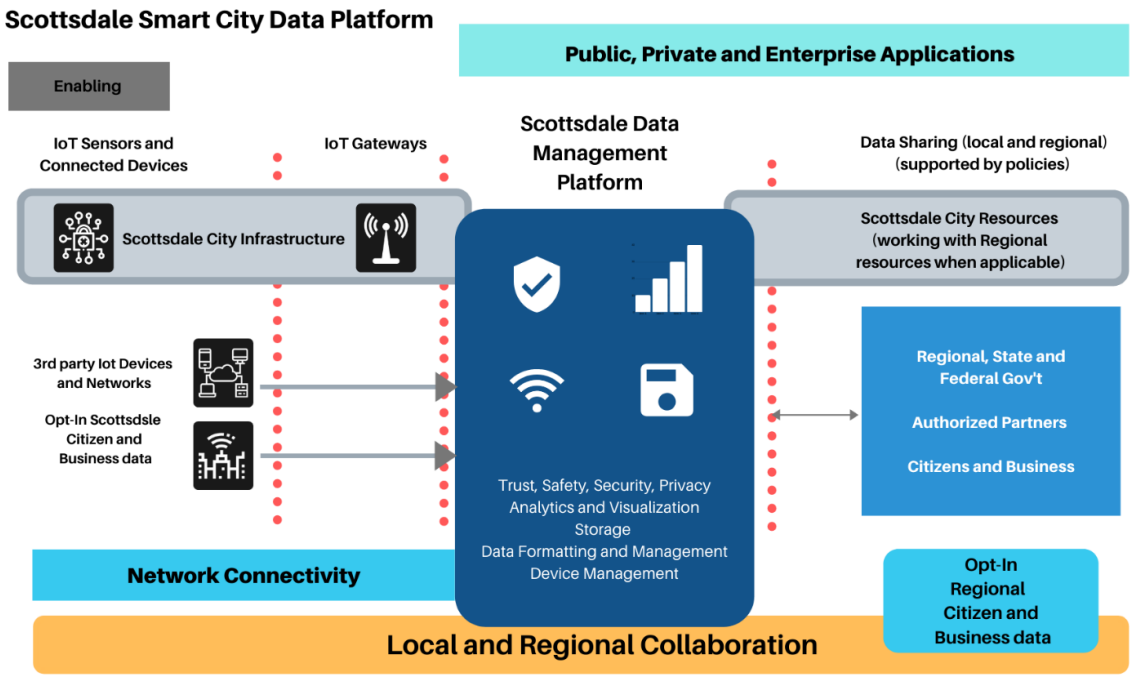


Source: ESI THOUGHTLAB Building a Hyperconnected City - November 2019

6b **Develop a Smart City Data Business Model with a Supporting Platform** F FOUNDATIONAL	According to the consulting firm McKinsey & Company, less than 1% of the data currently used (mostly for alarms and real-time control) can be used for optimization and prediction. Additionally, it should be recognized that interoperability (between hardware, software and other IoT devices) is required to capture 40% of the total value of data . Scottsdale should evaluate the role that they want data to play and the supporting business processes and skills required to execute their data-driven business plan for the city, then procure a master data platform. The platform that can support this must be able to create a framework for ingesting the data, validate its integrity and source (to maintain trust), allow for access and integration to other platforms (interoperability), and ideally offer a customizable analytics layer for data analysts or leaders. This platform then becomes the data foundation (basis) for Scottsdale to make intelligent, data-driven decisions. Currently, there are approximately 31 different platform vendors in the smart city marketplace. These range from large legacy technology companies (Cisco, Nokia, IBM) to niche vendors (GE, Amazon, Phillips) to communication service providers (Verizon, AT&T) to other platform vendors (Silver Spring, Ortelium, Fybr, NVIDIA). The city should understand its essential use cases and identify legacy systems prior to undergoing a formal search or procurement cycle. Ideally it would be good to make sure the platform is interoperable with other regional communities, too, possibly through a regional

	Technical Insights: Many cities enter the smart city planning process without a full understanding of the value of data and its potential to impact city operations. There are four levels of data Scottsdale should understand, as business policy and processes are being modernized to reflect smart city data opportunities. • ***Level 1 - Descriptive:*** *"What is happening in my city?" This requires comprehensive, accurate, and live (or near-real time) data. Additionally, a visualization layer provides instrumentation for decision makers and stakeholders.* • ***Level 2 - Diagnostic****: "Why are things happening in my city?" This level of data sophistication requires the platform to allow data to be "drilled down" to understand and identify root-causes. Additionally, the platform should allow data to be isolated, to identify the true cause and effect of events.* • ***Level 3 - Predictive****: "What's likely to happen in my city?" The platform should provide enough information, combined with people using data analysis skills, to identify historical patterns that are occurring to be able to predict specific outcomes. Algorithms created to identify these patterns and predictions can be generated to help alert city officials or stakeholders of the likelihood of events occurring so they can act if necessary.* • ***Level 4 - Prescriptive****: "What does the city need to do?" This is the highest state of smart city data value. At this level, the city can create actions, coupled with implementation strategies (and potentially regional coordination) to incorporate processes developed based on "champion/challenger" testing models that can optimize results. The data has been used to optimize the systems, resource management and outcomes for all stakeholders at this level. The application of advanced analytical techniques, incorporating machine learning and developing artificial intelligence occurs at this level.*

Figure 7: Scottsdale Smart Data Platform



7. Smart Streetlights

7a **Gunshot Detection (Next Generation)**  IMPACTING	First generation gunshot detection technology (GDT) uses audio sensors to detect gunshots which creates a series of actions that can notify police, etc. The City should consider deploying the next generation of gunshot detection which incorporates additional sensors (optical to provide video, interpretive data, license plate recognition (LPR), etc.) and provides significantly enhanced functionality using edge processing and artificial intelligence. Some of these systems can be solar powered which allows easier deployment in some locations. The GDT collects information including the date and time the sound was recognized, audio clips that capture the duration of the shooting, the number of shots fired, and the geographic location within 25 meters. After an acoustic anomaly (gunshot) is detected, it takes approximately 60 seconds or less for it to be published as a gunshot. Audio and metadata files are transferred either to the vendor or the law enforcement agency for review. Upon confirmation, an alert is sent to police via computer-aided dispatch (CAD) for an officer to respond. The City should consider placement near schools and public gathering spaces.
	Technical Insights: Gunshot detection technology (GDT) systems use acoustic sensing technology to identify, discriminate and report gunshots to the police or a command center. A typical system is comprised of a network of sensors to detect the sound of a gunshot (mounted on high structures such as telephone poles, streetlights and the roofs of buildings), transmitters to send a message to the police or command center, and software to process the event, transmit data and perform other actions. The leader in this technology is ShotSpotter but other competitors are emerging quickly with platforms that may have advantages over this legacy provider. ShotSpotter uses a triangulation algorithm to pinpoint the location of the gunfire. ShotSpotter publicly claims, that their private research shows that its system is accurate 80 percent of the time within a 25-meter range from the gunfire source. Once GDT has been deployed, Scottsdale can analyze data both independently and with other "smart" data to identify trends and concentrations in gunshot incidents. These analyses inform tactical decisions for law enforcement and public safety officials. By examining spatial patterns in combination with other data that produces more in-depth intelligence, analysts can track gang violence, crime sprees or other local (or regional) groups that can affect Scottsdale's public safety. If can be combined with regional smart assets, this can be a very powerful crime reduction tool but requires a robust next generation technology stack for maximum impact.

7b **Smart Streetlights** FOUNDATIONAL  ENABLING	The City should upgrade its standard streetlights to smart LED streetlights. Especially when newly developed areas are selecting streetlights, use this as a policy standard and once established, refresh the 6,000 city-owned lights (currently high-pressure sodium) when practical. In addition to energy savings of 50-70% (or more), LED streetlights represent one of the most actionable smart city applications today. Additionally, smart streetlights also create a "platform" in which other devices can be mounted. Lamp posts are ideal structures to mount smart city technologies as the pole can provide power and a secure, hard to "tamper with" location that provides clear visual lines of sight and signal paths. Applications such as gunshot detection, air quality monitoring, traffic management and data systems, smart parking, smart surveillance (optical sensor), EV charging and more can be deployed in conjunction with smart streetlight replacement. These lights are usually "quick turn off", have immediate restart capabilities, attract fewer nocturnal insects and can be "tuned" for light color (temperature) preference. Scottsdale should coordinate replacement and upgrades with local utility companies (APS and SRP). The same considerations for smart LED lights should be given to any parking lights, park lights, commercial building facilities the City controls. Streetlight projects often have a high financial value in the public-private partnership marketplace. *Technical Insights: Smart LED streetlights use light emitting diodes (LED) to produce light. They are "integrated lights" because the luminaire and fixture are one manufactured component. The shape of the LED streetlight depends on several factors, including LED configuration, the heat sink used with the LEDs and aesthetic design preference. LED streetlights can be functionally designed or be quite ornamental, which is often preferred in historical districts or areas seeking a custom aesthetic. LED lighting does not typically fail (burn out). Instead, light output decreases over time and once it reaches 70% of original output, it is considered to be at the end of its service life. The projected lifetime of LED streetlights is usually 10 to 15 years, 2-4 times longer than the typical standard lighting (high pressure sodium). The American Medical Association (AMA) recommends streetlights should be 3,000 Kelvin or lower for outdoor installations[16]. High Kelvin lighting (greater than 3,000K) create a harsh glare, making it difficult to see clearly at night. Above 3,000K can also suppress melatonin production, leading to disrupted sleep and other health risks for people living nearby. Excessive lighting can also disturb nocturnal wildlife, negatively affect birds and other wildlife. Especially near the parks and outdoor areas, light tuning and controls should be used to manage unnecessary light production. Early generation LEDs typically produced light at 5,000K or higher and should be replaced if applicable. Responsible smart lighting practices should be used to maximize benefits while managing the unintended negative consequences.*

[16] American Medical Association, CSAPH Report 2-A-16: Human and Environmental Effects of Light Emitting Diode (LED) Community Lighting, 2017

8. Smart Water Technologies

8 **Smart Water Meters / Advanced Metering Infrastructure (AMI) or Similar Platforms (AMR or AMA)**  ENABLING	Scottsdale should continue to work on its automated metering system program upgrades that can provide an integrated system of smart water meters, communications networks, and a data management system that enables two-way communication between Scottsdale Water and its customers. Smart water systems help cities manage water consumption and conserve water resources. Due to historical homeowner association restrictions, AMI (automated metering infrastructure) was very difficult to get approved and AMR (drive by automated meter reading) that didn't require unsightly communication poles was preferred. Smart meters can save money (labor cost), provide more accurate readings (benefitting the water department and customer alike) and help detect water loss. Smart meters produce a very large amount of data. Meter Data Management (MDM) systems are essential to convert meter data into useful and actionable insights. At the time of this report, the upgrade included 40,000 AMR and 10,000 AMI of the 90,000 total meters (approximate numbers). *Technical Insights: Water conservation is one of the most critical goals worldwide, but especially for arid west locations like Scottsdale. The city draws its water from multiple water sources, including groundwater wells and three surface water sources (Verde River, Salt River and the Central Arizona Project which diverts water from the Colorado River). Additionally, the city also uses advanced wastewater treatment facilities for more water production capacity. Customers depend on more than 2,100 miles of relatively young pipe, with the majority of pipes being less than 40 years old. The water department must manage 146 hydraulic grade levels, 18 pressure zones, more than 700 pressure-reducing valves, 48,000 main valves and 11,000 hydrants. Investing in smart meter technologies will help the City reduce operational costs and help recover revenue from non-revenue water loss. Lastly, smart meters can also provide customers (residential and commercial) with more detailed insights and real time consumption data to help them manage their water bill.*

9. Create a Smart City Communication Plan

9 **Create a Smart City Communication Plan to the Citizens and Residents of Scottsdale** E ENABLING	The community engagement events revealed that the Scottsdale community stakeholders want to be involved and better understand Scottsdale's smart city plan. Some of the key concerns were privacy, use of data, physical impact to the city (visual and infrastructure), maintaining open space, attracting youth/talent, health impact, costs and timeline. Residents want to better understand how a smart city will affect them, both positively and negatively. The City should develop a proactive communication strategy (that incorporates the use of technology) that is executed in tandem with an effective communication plan is critical to establishing (and maintaining) citizen trust, identifying the full potential impact (and needs) of the residents, creates a dynamic of co-creation and fosters cooperation. *Technical Insights: As cities move into a new era of smart cities that are based on connectivity to drive intelligence, it's important to look beyond smart city infrastructure projects and make sure that the residents feel connected to and understand the benefits. It's not surprising to see that the average consumer is less familiar with smart city concepts than government officials. On a national basis, only 26 percent of consumers say that they have familiarity with smart cities[17], though this number is higher among consumers that own some type of smart home technology. Based on Scottsdale's higher average age, more information may be needed to educate the residents in the Baby Boomer classification that may not be as comfortable or familiar with the engagement technologies employed. Communication that includes in-person events will be an important dynamic to consider and continue beyond the initial smart city citizen engagement workshops that were held as a part of this process.*

[17] Meeting of the Minds, Making Sure that Smart Cities Work for Citizens, 2018

10. Mobility-focused Technology Solutions

10a

Smart Traffic Data Services (TDS)

Smart traffic data services (TDS) can provide Scottsdale tremendous insight into its traffic to provide better planning, management and improve safety.

The City should purchase TDS software for integration into existing, compatible traffic systems or from standalone vendors who offer their own integrated product suite. Over the past 10 years, the average American commute has been getting longer. Employees in Scottsdale have a shorter commute time (22.1 minutes) than the normal US worker (26.4 minutes)[18]. Additionally, 15% of the workforce in Scottsdale, AZ have "super commutes" in excess of 90 minutes. In 2017, the most common method of travel for workers in Scottsdale, AZ was “Drove Alone” (77.7%), followed by those who “Worked At Home” (11.4%) and those who “Carpooled” (5.94%). Only 1.2% take mass transit. Traffic data services can help inform traffic planning to reduce congestion, design safety regulations, create real estate and economic development insights and improve the daily lives of the residents and visitors alike.

Technical Insights: Traffic data services can provide real time geospatial insights, increase safety and help Scottsdale become more informed to manage traffic congestion. The typical solution is comprised of multiple types of sensors (installed base and mobile device), analytics and a platform that can provide control. Data can be used to learn from historical patterns and can be shared with multiple stakeholders such as city officials, transit planners, ride hailing companies and more. Real time responses to actual traffic situations can inform adaptive signal controls and incorporate multi-modal information, integrating vehicle, pedestrian, bus and bicycle traffic flows. This data can help get Scottsdale residents to their destinations faster by eliminating stops, reducing wait time and increasing travel speeds. This also helps reduce CO_2 emissions by reducing unnecessary drive time, idle time and potentially reduce “vehicle miles traveled” (VMT) during congestion. Systems measure speed, idle time, location and provide root cause analysis data to improve parking, traffic signal performance, reduce traffic congestion and improve planning. Smart traffic system platforms should provide anonymized data with street-level accuracy that is hosted in the cloud but works with edge processing. Scottsdale can use systems like this to protect its shorter than average commute times and if regional collaboration is possible, can be even more effective as people move about Maricopa County. Public transit information could be fed into a Scottsdale app, if available. Additionally, this information can also be used to feed smart parking systems beyond just a localized Old Town footprint.

[18] Bestplaces.net, Commuting in Scottsdale, AZ, 2020

10b **Intelligent Traffic Signals**  IMPACTING	The City should continue to build out capabilities in the city's Traffic Management Center. The Scottsdale Traffic Management Center already uses an Intelligent Transportation System (ITS). This system is designed to reduce traffic congestion, improve driver information and help manage traffic incidents that can impact drivers. The system includes approximately 175 miles of fiber optic cable that connect traffic signals and cameras to operators in the Traffic Management Center. The system also includes more than 90 radios that allow communication with additional intersections.
	Technical Insights: ITS functionality depends on a robust communications networking traffic signals, cameras, traffic data collection sites and fixed Dynamic Message Signs (DMS), to be able to provide insights to Scottsdale and information to the general public. If Scottsdale adds additional traffic data related capability using Smart Traffic Data Services, then this information can help provide an even more robust platform for traffic management. Be sure that all vendors have interoperability and all data can be ingested into one single platform for multiple stakeholder access, analysis and trigger-based events. As Arizona is already a leader in AV testing, autonomous vehicles will become more common, and this will affect traffic signals. Ultimately, it could eliminate the need for traffic signals as AV's do not require them, however until AV adoption becomes 100%, other modes of transportation that do not have level 5 autonomy will need signalization.

10c **Autonomous Vehicle Innovation Mindset and Supporting Policies** FOUNDATIONAL  POLICY  ENABLING	Scottsdale needs to continue its efforts to prepare for autonomous vehicles (AV) be creating policies conducive to testing, innovation and adaptability. One example might be a lower speed lane connecting major hubs (Airpark to Old Town) that anyone can drive in but observes lower speed for Level 5 AVs. AVs present an opportunity for Scottsdale to help address mobility issues that may exist as transit alternatives like light rail are not available. Light rail is likely no longer an attractive solution to mobility needs, as it is extremely expensive, would take a considerable amount of time to build and by that time AV's may be widely in use at the personal owned vehicle (POV) and public transit level. Autonomous vehicles could save thousands of lives per year. There were 1.16 fatalities for every 100 million miles driven in the US in 2017. US DOT research estimates that fully autonomous vehicles could reduce traffic fatalities by up to 94% by eliminating those accidents that are due to human error. Innovation partnering with leading AV companies will provide mutually beneficial opportunities that can help advance AV technology faster, more prudently and more effectively. *Technical Insights: On August 25, 2015, Governor Ducey signed an executive order, allowing for the testing and piloting of driverless vehicles on certain public roads. By establishing the ADOT Self-Driving Vehicle Oversight Committee, Scottsdale (and the greater Phoenix metro) will be one of the first communities in the United States to get widespread adoption once AV's are ready. Fully autonomous cars and trucks are predicted to become a widespread reality - but no one exactly knows when. These self-driving vehicles ultimately will be fully integrated onto U.S. roadways by progressing through six levels of driver assistance technology advancements. According to research polls, 69% of people are ready to ride in an autonomous car in their lifetime. 60% of consumers believe that autonomous cars are better drivers than humans or will surpass human abilities by 2029. Currently (according to Pew)[19], 56% of Americans would not feel safe in a driverless vehicle. As of January 2020, there has been 13 serious crashes (including 6 fatalities) related to AV's. Self-driving car statistics indicate that Uber's self-driving cars need the most human intervention and are lagging Google, GM, Toyota and Mercedes-Benz technology capabilities.*

[19] Pew Research Center, Americans' attitudes towards driverless vehicle, 2017

10d **Smart Parking Systems** 	Even if the city does not plan on charging for parking, smart parking solutions can provide significant benefits. Technologies that can help the city provide the location of an empty parking space (manage inventory), manage how long a car has been parked (for planning or enforcement purposes), monitor safety of the parking facility, collect payments (if applicable in the future), manage handicapped spaces (enforcement) and more would be a valuable technology to deploy. As part of the 2019 Bond program, parking structures in Old Town are slated to be built ($20.9M). The City should deploy a smart parking pilot on these structures and/or other places in Old Town to improve the retail and visitor experience and increase the walkability. The pilot would allow all parties to learn and deploy at scale later. There are various types of smart parking software technologies that make up a complete end-to-end solution. These include vehicle detection sensors, cameras with automated vehicle license plate recognition capabilities, smart parking meters, smart payment for parking, digital signage and navigation apps for parking assistance.
	Technical Insights: According to IoT Analytics, 11% of public parking spaces globally (on-street and off-street) are now "smart"[20]. This figure is expected to increase to 16% by 2023. Smart parking systems use smartphones and other sensing devices to manage space inventory. The technology relies on the use of cameras/optical sensors, specialized technologies at the entrances or gates of parking structures, sensors embedded in the pavement of individual parking spaces, etc. to make smart parking a reality. For most cities, much of the traffic is caused by people (in vehicles) searching for parking spaces. The parking system technologies should continue to advance (artificial intelligence, machine learning, computer vision, etc.) and will be able to help consumers find spaces even more efficiently.

[20] IOT Analytics, Smart Cities Report Series: Smart Parking 2019-2023, 2018

11. Continue Digital Transformation

11a **Digital Citizen Services**  ENABLING	Scottsdale currently allows registered users to pay water, sewer, solid waste and other (general) bills on the e-services website. As more payment platforms become available (like specialized Xpress-pay, PayIt, etc. or general PayPal, Square, etc.) the city should adopt additional payment models to meet the needs of its citizens. It is important for all sites within the city domain to maintain security certificates to encourage trust between the citizen and the city. Services such as Parks and Recreation general waiver and reservation forms or the Community Development System (CDS) for permitting, could be made fully electronic to allow processing. The city should continue to find ways to provide digital services to its citizens as the shift to more modern and convenient platforms will occur in the most progressive cities. This has become especially evident during the recent "virtualization" and sheltering in place dynamics due to the COVID-19 pandemic. Citizens are seeing more access to services through the internet and especially their mobile device.
	Technical Insights: A recent study by Visa research estimated that increasing digital payments across 100 cities could result in total direct net benefits of $470 billion per year, in addition to spurring economic growth and improving wages and productivity. Scottsdale can benefit from electronic payments by faster processing, payment data and the use of cloud technology to better manage and account for payment streams versus city service delivery. Payment systems can be tied to smart transit solutions, advanced metering infrastructure (AMI), court fees and other aspects of city operations and citizen services. This platform would also provide access to more methods for some of Scottsdale residents that need electronic payment options the most. Digital payments and digital citizen services reflect a modern view of the lives of its mobile device equipped citizens and their consumer preferences.

11b **Expand Mobile Engagement Platform**  ENABLING	Enhanced citizen and government engagement can take shape through the development and use of either a city mobile application (app) or mobile optimized websites. Scottsdale already has mobile optimized websites and should consider expanding the functionality, including a text-enabled engagement for broader citizen access. Being a mobile-friendly, engaged city is important to digitally engaged citizens that use their phone for modern life necessities. Additionally, there are benefits for an enhanced mobile app strategy for cities like Scottsdale that rely heavily on tourism ($3.1 billion annual economic impact). People use their mobile phones for many essential activities, especially while traveling. Scottsdale hosted an estimated 4.6 million domestic overnight visitors, 1.7 million international overnight visitors and 4.5 million domestic day trip visitors in 2018[21]. An enhanced web-based mobile city app could provide a multi-lingual wayfinding platform that allows businesses, citizens and tourists to engage with each other. Due to its mobile web nature, it can be both cost effective while still taking full advantage of the various onboard applications on a user's smartphone. An app would also promote digital inclusiveness and help build a community for all ages. At the time of this report, Scottsdale has had initial conversations with ASU and the State of Arizona about a possible state-wide app with city-specific services. The City should continue the pursuit of these opportunities.
	Technical Insights: The average consumer spends 4.6 hours per day on their mobile device[22]. It is the one thing most people will not leave home without. A city app could provide services such as parking payment, wayfinding, licensing (pet, hunting, etc.), utility bill payment, public transit pass (and payment), permits, 311 issues and more. Additionally, many of Scottsdale's top visitor activities (shopping, upscale dining, night clubs, visiting historic sites and landmarks, swimming, visiting state parks, museums, casinos, hiking and golf) would benefit from a mobile app strategy. According to research, the top app functions that citizens want are: 311 reports, emergency notifications, business questions answered, spatial based triggers (location based messages/alerts), things to do, local event info, contact info for city offices and access to city resources. The most important thing to understand is that if Scottsdale builds a city app, maintaining updated content is critical. Whatever features are implemented (311 report, garbage schedule, or local events), if the content is outdated or irrelevant, citizens will not use it and Scottsdale will not gain a consistent user base. This can be done by pulling data from the already regularly updated website.

[21] Scottsdaleaz.gov, Tourism Study – Visitor Statistics, 2018
[22] eMarketer, US Time Spent with Mobile 2019, 2019

12. Optical Sensors/Camera Systems

12 **Smart Public Safety – Optical Sensors and Surveillance**  IMPACTING	Public security is a growing problem for cities worldwide and Scottsdale is no different. Scottsdale crime rate (2,394 per 100K people) is lower than Phoenix (4,225 per 100K), the State of Arizona (3,152 per 100K) and the national average (2,580 per 100K). The City should evaluate its public safety needs and consider implementing optical sensors/camera systems for public surveillance to help reduce crime, increase prosecution rates and ultimately help keep Scottsdale safe. Surveillance cameras takes on many forms. They can be in the form of traditional CCTV camera systems (modernized with cloud-based storage, infrared and high definition video) to modern optical sensors that do not capture images as much as they capture information optically, creating "data." Research estimates indicate that the presence of police-monitored cameras is associated with a reduction in crime of about 16% -20% in treated areas of the city[23]. Through optical sensors that can feed data driven analysis platforms powered by algorithms, this impact can be even greater. The same optical sensors also can capture other valuable data such as people counting, bicycles in use, etc. further enhancing ROI.
	Technical Insights: Cheaper technology, coupled with a bigger and faster data pipeline means that more cities can afford smart surveillance using a wide variety of technologies. It should be noted that the effect of police monitoring on crime could potentially work through deterrence, and crime may be displaced to unmonitored areas. The largest and most consistent effects of surveillance is in parking areas. Smart surveillance/optical sensors play a significant role in interpreting people's actions, tracking objects (cars, packages, etc.) and interpret the context of location, movement and other information using algorithms to create event triggers and actions. This data also can be used for planning which can feed into real-time crime centers, predictive policing and integrated public safety suites. This fusion of data with other data can be a powerful crime reduction platform. Notable: As of September 2019, Phoenix and 11 other Arizona police departments are among more than 400 in the U.S. that have partnered with video-doorbell maker Ring to connect authorities with local homeowners who use the company's technology. Scottsdale may want to consider joining this initiative and adopt a policy that allows access.

[23] ResearchGate, Public Area CCTV and Crime Prevention: An Updated Systematic Review and Meta-Analysis, 2019

Scottsdale Strategic Goal Alignment

This Scottsdale Smart City Strategic Roadmap is designed to complement the mission and vision of City leadership. Figure 8 shows the recommendations scored against the City Strategic Goals and are marked accordingly when the recommendation addresses a Strategic Goal.

Figure 8: Smart City Recommendation Alignment to City of Scottsdale's Strategic Goals

SMART CITY RECOMMENDATION ALIGNMENT TO CITY OF SCOTTSDALE'S STRATEGIC GOALS

	VALUE SCOTTSDALE'S UNIQUE LIFESTYLE AND CHARACTER	SUPPORT ECONOMIC VITALITY	ENHANCE NEIGHBORHOODS	PRESERVE MEANINGFUL OPEN SPACE	SEEK SUSTAINABILITY	ADVANCE TRANSPORTATION
Connectivity (4G, 4G+)	✓	✓	✓		✓	✓
Connectivity (5G) Next Gen	✓	✓	✓		✓	✓
Small Cell Densification	✓	✓	✓		✓	✓
FirstNet		✓	✓		✓	✓
Smart Data Policy and Mindset	✓	✓	✓		✓	✓
Data Business Model w/ Platform	✓	✓	✓	✓	✓	✓
Smart City Communication Plan		✓	✓	✓		
Smart Urban Planning Policies	✓	✓		✓	✓	✓
Digital Citizen Services	✓	✓	✓		✓	
Economic Development Strategies		✓	✓			✓
City App		✓	✓	✓	✓	✓
Traffic Data Services	✓	✓			✓	✓
Intelligent Traffic Signals	✓	✓			✓	✓
Autonomous Vehicle Policies	✓	✓	✓	✓	✓	✓
Public Safety Optical Sensors		✓	✓	✓	✓	
Smart Multi-Sensor Nodes	✓	✓	✓	✓	✓	✓
Gunshot Detection (Next Gen)			✓	✓		
Smart Streetlights	✓		✓	✓	✓	✓
Smart Water Meters (AMR and AMI)		✓	✓		✓	
Smart Parking Systems	✓	✓		✓	✓	✓

Smart City Financing Models

Funding Models

Public-Private Partnerships (P3)

Increasingly, smart city programs are greatly enhanced by strong public-private partnerships (P3). The wide variety of multiple stakeholders and the significant capital investment required provides a unique opportunity to align city goals with the private sector marketplace.

Engaging the private sector in meaningful conversations is the first step. Private partners are interested in multiple factors, including but not limited to: research and development (R&D) of new Internet of Things (IoT) driven products and services, opportunities to conduct demonstration pilots that lead to procurement, supporting a community for strategic business goals, continuing to demonstrate thought leadership in the smart city space or creating a partnership with a long term vision that allows multiple revenue opportunities to contractually occur.

These partnerships have matured in the past few years, but opportunities still exist with both new market entrants and legacy technology providers across every sector. Often, the "funding" comes in the form of soft dollar or in-kind contributions that can still positively affect a city's balance sheet.

Note: Proof of concept pilots can also provide unique funding opportunities in which the technology can be demonstrated with the intent that the city testing the technology will likely purchase. There is a financial risk management aspect to this model, that while it doesn't necessarily finance it, it does provide a risk-managed approach to procurement.

Data Monetization

With the introduction of GDPR and heightened concerns about privacy, data monetization still exists but with a much many more constraints. Cities still have the opportunity to monetize de-identified aggregate data. This is strategy is best supported with a data platform and proper privacy disclosures. It's important to emphasize that the data ownership remains a hot topic and is evolving both legislatively and in the minds of the public.

Self-funding Pools Based on Expense Reduction

Scottsdale will benefit from the usefulness of the data produced, which can help the city make better decisions that will help lower operational costs. This can result in substantial savings and when coupled against existing, previously allocated budgets, financial surpluses may be created that can be re-directed if allowed.

Performance Based Financing Models

The financial model of an “Energy Service Company (ESCO)” Model has been around for more than two decades but in limited forms. Increasingly, as the smart technologies become more mature and the impact to cost savings becomes more “trusted” by the financial markets, more opportunities exist in certain situations to create a financial model that is externally funded by third party partners and uses cost savings, rebates or a combination of other financial benefits to fund a project from inception through operations.

Many of these business models focus on opportunities for costs savings with advanced technologies positively impacting building energy and consumption efficiency (boilers, chillers, energy systems, physical infrastructure, automation controls), LED lighting systems (new or upgrade opportunities), smart waste streams, solar/wind energy (cost savings and rebates), EV charging systems (cost saving and incentives), water meter replacement using advanced meters (cost savings, consumption reduction), school buildings (interior and exterior lights, building envelope, energy and water) and more.

Typical operating cost savings achieved is in the 20-40% range across various asset or functional service categories. This cost savings can be used to finance ESCO structures and typically require 15-20-year contracting vehicles. These contracts often have other requirements, such as allowable manufacturers, due to the financial underwriting requirements which require the underlying asset provider to have strong underlying credit (balance sheet) to instill confidence in the third-party financiers.

At the time of this roadmap being produced, Scottsdale is preparing to release a Request for Qualifications (RFQ) for the selection of energy firms to handle future energy savings performance contracts.

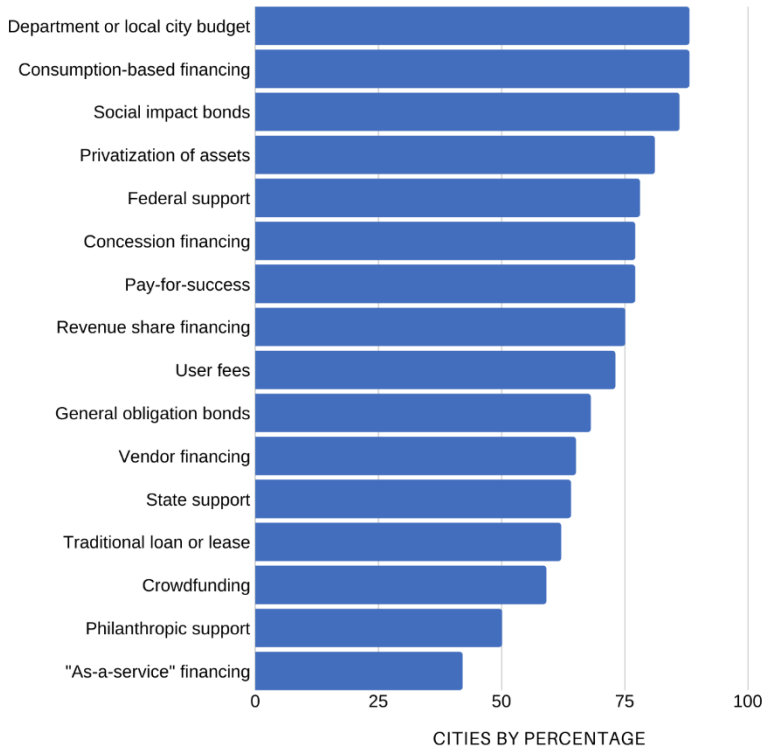
Grants (Federal, State, Regional and Niche Institutional)

Grants opportunities are regularly issued to catalyze certain types of smart city related activities. These activities often correspond to specific strategic initiatives of the sponsor to help promote their goals. Examples of these goals include but are not limited to: transportation and mobility improvement, IoT data use cases that can develop valuable insights for communities, social issues (such as aging, isolation, health, digital divide, equity, inclusiveness) that need attention which can be promoted in partnership with smart city efforts.

Grant sources can be local, regional or federal. Often groups like the U.S. Department of Transportation, Federal Transit Administration, Arizona Department of Transportation, U.S. Ignite, National Science Foundation, United States Environmental Protection Agency, National Institute of Standards and Technology and more.

Examples of additional smart and connected city financing models by percentage of cities, and then by focus area, are shown in the next two charts from ESI THOUGHTLAB.

CITIES USING THE FOLLOWING FUNDING MECHANISMS



Source: ESI THOUGHTLAB Building a Hyperconnected City - November 2019

FUNDING SOLUTIONS BY URBAN FOCUS AREA

Transportation

Consumption-based financing	44%
Department or local city budget	42%
Federal support	40%
Revenue share financing	36%
Concession financing	33%

Public Safety

Federal support	43%
Consumption-based financing	42%
Department or local city budget	41%
Privatization of assets	37%
Social impact bonds	35%

Energy and Water

Consumption-based financing	47%
Pay-for-success	43%
Department or local city budget	40%
Privatization of assets	39%
User fees	34%

Governance

Department or local city budget	44%
Consumption-based financing	40%
User fees	39%
Federal support	38%
Concession financing	29%

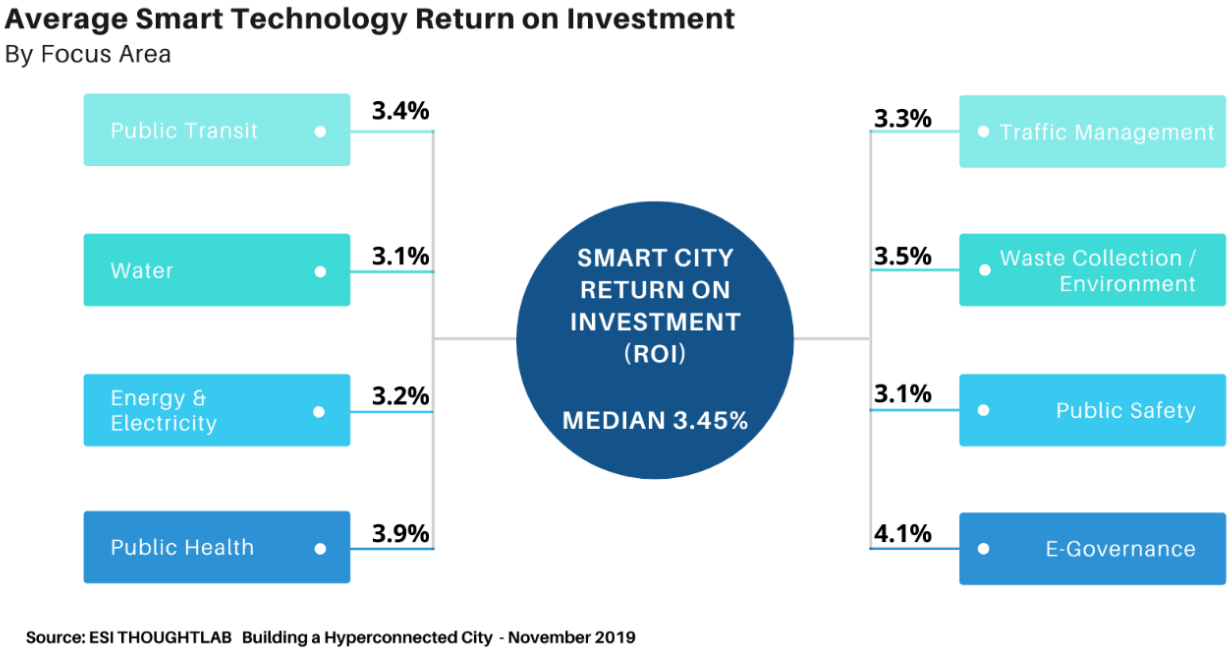
Environment

Department or local city budget	47%
Consumption-based financing	41%
Social impact bonds	38%
Federal support	35%
Concession financing	32%

Source: ESI THOUGHTLAB Building a Hyperconnected City - November 2019

According to research by ESI THOUGHTLAB, in which cities reported estimates for the average return on investment for connected (smart) technology initiatives, the average range was from 3% to 4% ROI[24] and is shown in Figure 9.

Figure 9: Average Smart Technology Return on Investment



[24] ESI THOUGHTLAB, Building a Hyperconnected City, 2019

Activating Scottsdale's Smart City (Prioritization)

1. **Review the Scottsdale Smart City Strategic Roadmap**
    a. Refer to Figure 10: Prioritization Scoring and Figure 11: Smart City Quadrant (Impact v. Effort) to identify the most important projects to focus on
        i. Develop a thorough understanding of its meaning, relevance to Scottsdale's goals and provide an education to stakeholders that may not be familiar with the concept of smart city or its necessity to address urbanization.

    Note to reader: The Prioritization Scoring ranking does not indicate a linear path to implementation as is the case for smart city platforms. Many projects can and should be implemented simultaneously. The ranking indicates a tiered ranking of priority indicating projects or activities to be done in parallel

2. **Identify the people that need to be involved in the execution of Strategic Roadmap**
    a. Create a master planning group (if desired) - Identify City of Scottsdale employees, regional partners and any additional human resources (consultants, contract labor, specialized experts, private sector partners, etc.) with a focus on the overall execution of the plan
        i. Confirm the most important technologies, initiatives or objectives to act on now, to deliver either "quick wins" or a long-term impact
    b. Project based group - Identify City of Scottsdale employees, regional partners and any additional human resources (consultants, contract labor, specialized experts, private sector partners, etc.) with a focus on the specific execution of the identified project
        i. Confirm the most important technologies, initiatives or objectives to act on now, to deliver either "quick wins" or a long-term impact

3. **Determine the requirements necessary to move each project forward**
    a. People – Do we have the right skills, time and ability to manage the project?
        i. Activate a smart city advisory committee that involves the citizens of Scottsdale
    b. Project Plan
        i. Do we understand everything necessary to advance the project into an operational state?
        ii. Do we have a project manager available to manage the project?
    c. Policy
        i. Do we need any policies to be created, revised or clarified?
            1. Foundational - if needed (new or revised)
            2. Enabling (new or revised) for specific regulatory compliance - if needed
    d. Communications
        i. Create and activate the initial communication strategy to inform all stakeholders of the launch of the master plan and/or each individual project
    e. Procurement

i. Process
    1. Do we have a good technical understanding of the functional requirements of the technology to begin the procurement process?
    2. Is the technology available? If so, what is the maturity of the technology by type, vendor and prior success?
    3. Determine if an RFP, RFQ or RFI is necessary for procurement
        a. Develop a pilot (proof of concept) if the technology is still emerging
ii. Manage the procurement to include technology and vendor due diligence

f. Financing
    i. Determine the financing requirements and the options available, based on the technology, use case and overall deployment model
    ii. Seek out the best financing options, if needed
        1. Consider public-private partnerships if necessary

4. **Manage each individual project as part of an integrated smart city program**
    a. Create and activate a communication strategy that keeps all stakeholders informed
    b. Look at long-term staffing requirements
5. **Manage each project until completion**
    a. Understand that the technology landscape is dynamic, evolving and ever-changing. Each project, however, must be completed (as originally planned is applicable, or modified if needed to optimize results) to deliver its intended ROI and ensure long term project support from senior leadership and residents alike

Ongoing activities for success:

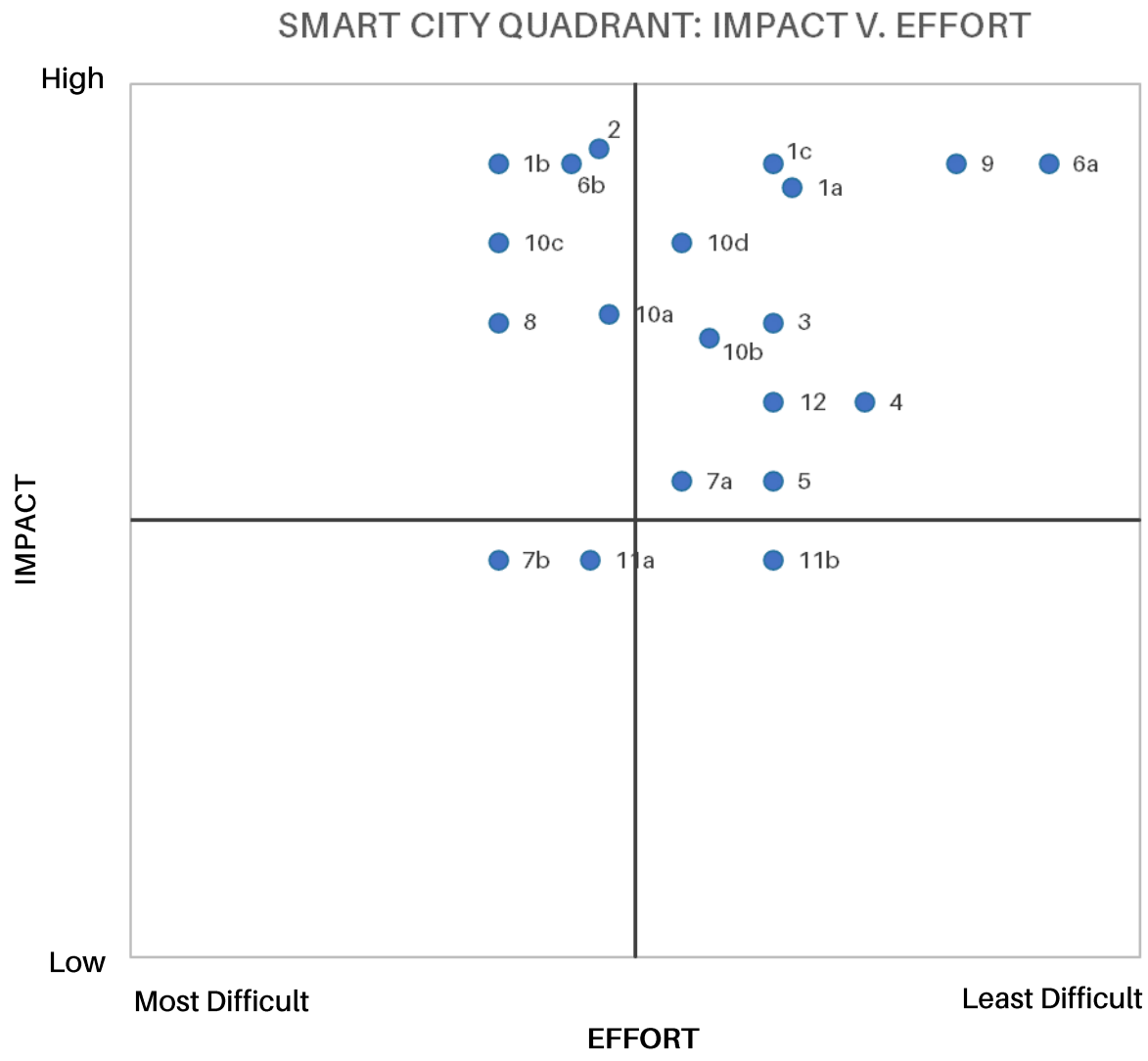
6. **Engage the community**
    a. To develop a bi-lateral exchange of information, education and trust to make sure Scottsdale's smart city plan keeps the human-centric focus in view, it will be critical to engage the community along the way in various methods
7. **Evaluate financial resources on a regular basis relevant to the selected technology solutions**
    a. Identify gaps in funding, enhancements to ROI and prospective inter-department collaboration opportunities that result in self-funding opportunities
8. **Begin a procurement strategy**
    a. Where there are funds, begin a procurement strategy that manages the risk while seeking enhanced ROI and ensures foundational technology is in place
    b. Where insufficient funds exist for desired technology, develop alternative strategies that include P3s, performance-based models, grant support, data monetization or any combination of these
9. **Create a smart city platform procurement model**
    a. Develop a procurement model that encourages the private sector to "self-organize" and take on as much of the risk (financial, ROI attainment, technology performance, interoperability, etc.) as possible for asset classes that have more mature technology or underlying systems and subsystems
10. **Enlist the help of qualified experts, industry partners, potential regional collaborators and others as soon as able to develop micro-strategies to execute this roadmap**

Figure 10: Prioritization Scoring

SCOTTSDALE SMART CITY STRATEGIC ROADMAP - PRIORITIZATION SCORING

		Scoring Points	10 - Most citizens	10 - Most Important	10 - Least Difficult	10 - Revenue + Addt'l	10 - Highly Aligned	10 - Advanced	
			7 - Underserved	7 - Highly Important	5 - Average	5 - Some Revenue	5 - Somewhat Aligned	7 - Market Scale	
			5 - Citizen services	5 - Somewhat Important	1 -Most Difficult	1 - None	1 - Not Directly Aligned	5 - Emerging/ Testing	
			1 - Recreational	1 - Low Importance				1 - Ideation	
		Weighting	30%	22%	15%	12%	10%	8%	Weighted Score
	Opportunities	Ranking	Citizen Value/Impact	Importance	Difficulty to Deploy	Revenue Generation	Supports Goals of City	Technology Maturity	
1c	Small Cell Densification (Where Applicable)	1	10	8	7	5	9	10	8.11
6a	Create a Comprehensive Smart City Data Policy and Management Mindset	1	10	10	10	1	9	5	8.12
1a	Connectivity (4G, 4G+)	1	10	10	5	4	9	9	8.05
1b	Connectivity (5G) - Next Generation	1	10	10	5	4	9	8	7.97
6b	Develop a Smart City Data Business Model with a Supporting Platform	2	10	7	5	5	10	8	7.53
10c	Autonomous Vehicle Policies	3	9	8	4	5	10	5	7.06
9	Create a Smart City Communication Strategy and Plan	3	10	6	9	1	5	8	6.93
3	Smart Multi-Sensor Nodes	4	8	6	7	3	10	7	6.69
2	FirstNet	4	10	7	5	1	7	7	6.67
10b	Intelligent Traffic Signals (ITS)	5	8	8	5	1	7	10	6.53
10a	Smart Traffic Data Services (TDS)	5	8	8	5	1	7	9	6.45
4	Smart Urban Planning Policies	6	7	5	8	3	9	7	6.22
11b	Expand Mobile Engagement Platform	7	5	7	7	3	9	10	6.15
8	Smart Water Meters / Advanced Metering Infrastructure (AMI)	7	8	6	4	5	5	8	6.06
5	Modern Smart Economic Development Strategies	8	6	5	7	5	5	10	5.85
12	Smart Public Safety - Optical Sensors/Surveillance	9	7	5	7	1	7	7	5.63
10d	Smart Parking Systems	9	9	2	6	1	9	5	5.46
7b	Smart Streetlights	9	5	6	4	5	9	7	5.48
11b	Digital Citizen Services	10	5	5	5	5	7	7	5.21
7a	Gunshot Detection (Next Generation)	11	6	3	6	1	3	9	4.5

Figure 11: Smart City Quadrant: Impact v. Effort



Legend:

1a	Connectivity (4G, 4G+)
1b	Connectivity (5G) - Next Generation
1c	Small Cell Densification
2	FirstNet
3	Smart Multi-Sensor Nodes
4	Smart Urban Planning Policies
5	Smart Economic Development Strategies
6a	Comprehensive Smart City Data Policy and Management Mindset
6b	Smart City Data Business Model with a Supporting Platform
7a	Gunshot Detection (Next Generation)
7b	Smart Streetlights
8	Smart Water Meters / Advanced Metering Infrastructure or Similar Platforms (AMR or AMA)
9	Create a Smart City Communication Plan
10a	Smart Traffic Data Services
10b	Intelligent Traffic Signals
10c	Autonomous Vehicle Policies
10d	Smart Parking Systems
11a	Digital Citizen Services
11b	Expand Mobile Engagement Platform
12	Smart Public Safety - Optical Sensors / Surveillance

Supporting Information

The Citizen Voice

Building a Smart City in Scottsdale: A Citizen Innovator Workshop

On Wednesday, December 11, 2019, Scottsdale and Think Big Partners hosted “Building a Smarter Scottsdale: A Citizen Innovator Workshop” at the Mustang Library from 5:15-7:45pm. Of the 88 registered attendees, more than 50 people attended which consisted of residents, businesses, workers and other interested parties of Scottsdale.

The audience helped define what “smart city” means to them. Later, the audience was asked to cast votes on the top topics to discuss for the remaining duration of the workshop. The topic choices (some added by the audience) were as follows. The topics with the most votes that became discussion themes are in bold font.

- **Transportation and Mobility**
- **Environment/Sustainability**
- **Quality of Life**
- Public Safety
- Energy
- Water
- Education
- Health effects of Wireless Radiation
- Community for All Ages
- Jobs and Workforce
- Housing
- Downtown
- Communications
- Cybersecurity

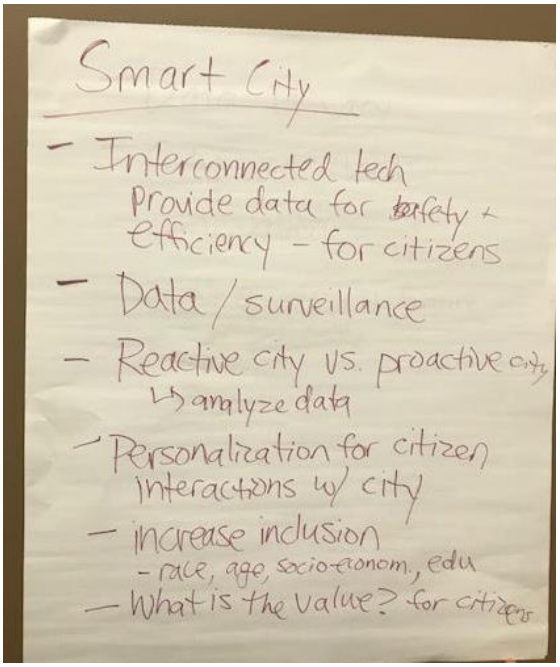


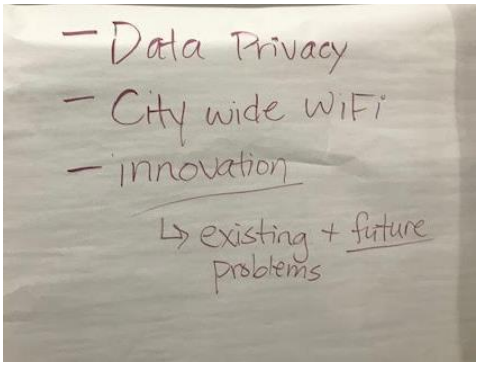
Photos of speakers and participants in the Building a Smarter Scottsdale: A Citizen Innovator Workshop.

Key Workshop Findings

The purpose of this Citizen Innovator Workshop was to use design thinking to explore what the challenges are that citizens, businesses and workers of Scottsdale are experiencing in their daily lives. Furthermore, it was used to better understand the real root of each problem. An additional overlay that one participant pointed out was to consider what problems may not exist today but will in the future.

Prior to starting the education portion of the event, participants were asked to share what they thought a smart city was. The answers were recorded (see pictures below) to show the sentiment and understanding of what a smart city is. It's worth noting that "data" showed up twice, but generally the audience considered a smart city to be one that increases efficiency, personalization, inclusion, proactiveness and innovation which are all positive sentiments.





Note pages from the workshop.

After a brief education which included an overview of smart city market, global trends and examples of technology, participants voted live on the topics for discussion that evening. The top voted topics were transportation and mobility, quality of life and environment and sustainability.

Highlights of the topical discussions are available in an additional separate document, *Citizen Workshop Observations*.

Scottsdale Smart City Strategic Roadmap Workshop

An additional session was held on Wednesday, February 19, 2020 at the Scottsdale Community Design Studio from 6:30-8:30pm to solicit feedback from select community members. This group of local stakeholders included boards and commissions members, volunteers and project sponsors to elicit feedback on the progress of the roadmap priorities and direction. Of the 80 registered participants, more than 55 people attended consisting of residents, businesses and other key stakeholders of the community.

The workshop engaged the audience in smart city education, interactive exercises, small group discussions and digital polling. The audience was assigned to small group tables and over the course of the evening a series of discussions for the following four focus areas was held:

1. Transportation and Mobility
2. The Role of Data
3. Natural Resources - Environment and Sustainability
4. Quality of Life

For each topic, the small groups discussed “how might implementing smart city technology under this focus area impact Scottsdale positively or negatively?” The findings, comments and feedback from the small group discussions were reviewed, considered and with some being incorporated into this smart city strategic roadmap.

Participants met in the Community Design Studio. Brent Stockwell, Assistant City Manager, addresses the audience.

Herb Sih, Think Big Partners conducts program education.

Various small group discussions engaged residents and businesses of the City of Scottsdale in the smart city discussion.

Key Workshop Findings

Each small group discussion was prompted with an explanation of the foundational, enabling and impacting technologies that might be implemented to address issues within each focus area. Participants were asked to discuss the positive and negative impacts of each technology with their facilitator and small group. Hundreds of well-thought out comments were made, recorded and reviewed to help shape the vision of this roadmap. After each discussion, participants filled out a digital poll via their mobile device.

A sampling of the most common comments and results of the digital poll are available in an additional separate document, *Citizen Workshop Observations*.

Scottsdale Smart City Young Citizens Session

As it is commonly said, the youth are the future. For Scottsdale to better dive into understanding the voice of the future, a gathering of high school students was coordinated to discuss smart city topics in Scottsdale. On February 19, 2020, fifteen students voluntarily gathered at the Scottsdale Community Design Studio with the help of the Mayor's Youth Council and the Scottsdale Unified School District leadership group.

Young Scottsdale citizens gather at the Community Design Studio.

The students were asked to first fill out a survey, that was used to guide discussion points. The students were very open, inquisitive and honest about their reactions to the smart city topics. When asked, "who learned something today?" every student raised their hand. Students expressed their gratitude towards the City to be involved in the conversation, and one student said, "I'm so proud to live in a community that asks me about what I think."

Generally, students came into the workshop, unclear about what "smart city" meant, but 100% of them said they considered "smart city" to be a positive thing. They left having a better understanding of what "smart city" is, what is important to them and their peers, and how Scottsdale is working to improve.

Key Workshop Findings

The survey asked students to rate various topics on the importance to them on a scale of 0 to 10 (0 being Not Important at All and 10 being Most Important). Of the eight presented topics, three topics rose to the top: public safety, gun control and environment (clean air/water), see Figure 12 and 13 on Scottsdale Young Citizens. Other comments and discussion throughout gave deeper insight into Scottsdale as a city and helped shape the recommendations in this roadmap.

Figure 12: Scottsdale Young Citizens, Median Rating

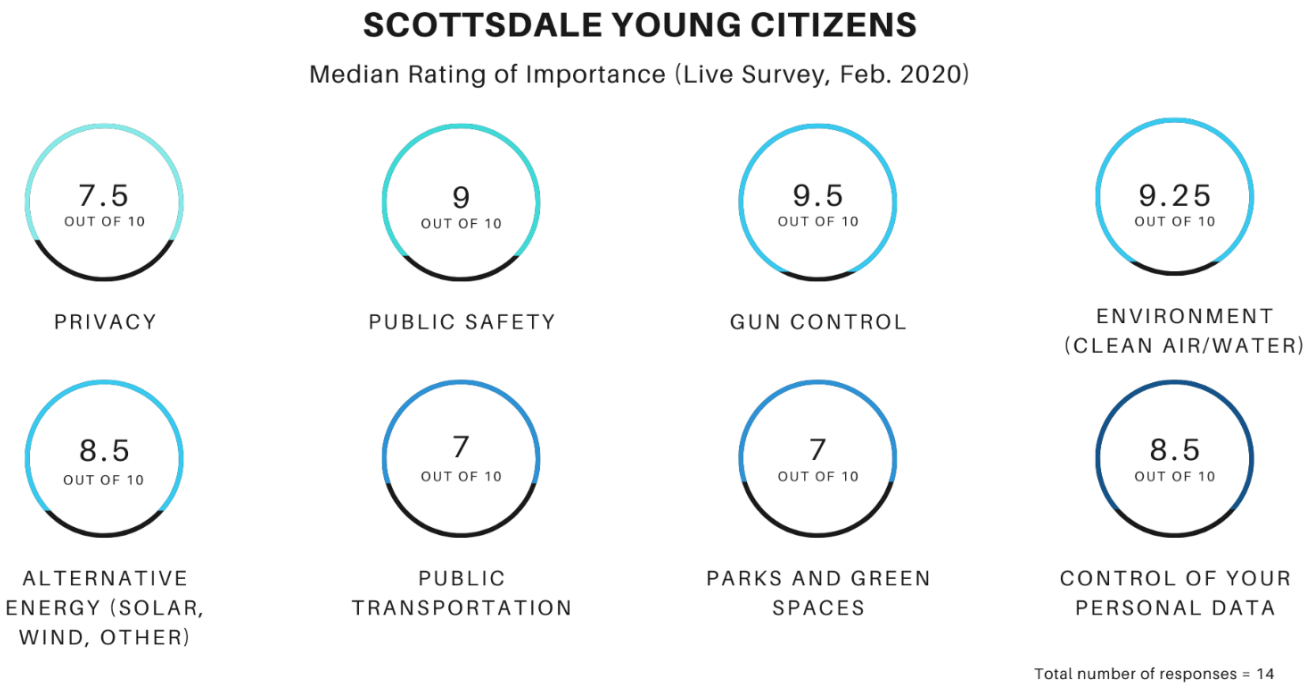
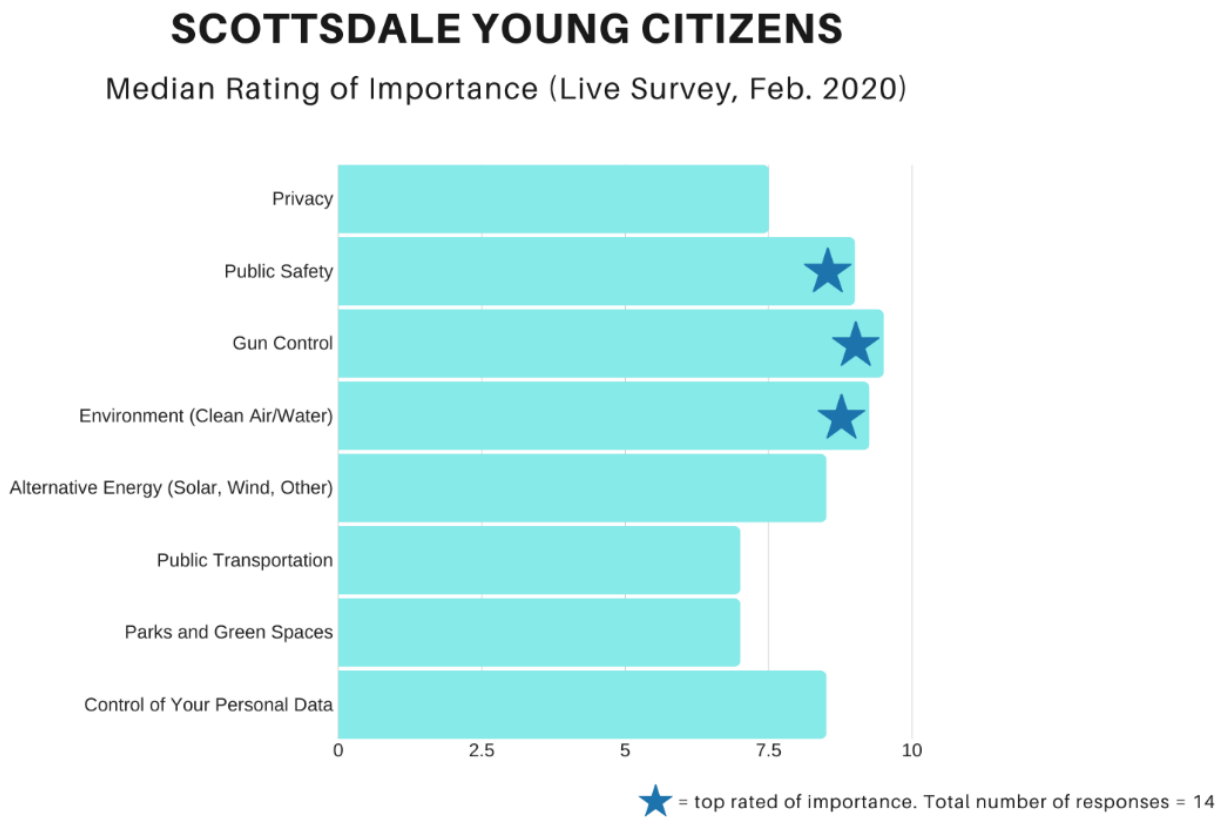


Figure 13: Scottsdale Young Citizens, Top Rated Topics



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