

U.S. CA-Chordant Smart Cities Benefits Index

Which cities benefit from Smart City
Technology? A look at the Top-50

EXECUTIVE SUMMARY — OCTOBER 2017

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SMART CITIES BENEFITS INDEX

U.S. CA-Chordant Smart Cities Benefits INDEX: The Top-50 Smart Cities based on Efficiency & Potential

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This report was prepared for InterDigital by Compass Intelligence, LLC in partnership with The Silent Intelligence.

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INTRODUCTION

The CA-Chordant Smart Cities Benefits Index is the first comprehensive study designed to examine the relative potential benefits of Smart City technology in America's major metropolitan areas. It goes beyond a static snapshot of current municipal efforts by providing a meta-analysis of U.S. cities' relative capacities for smart city innovation now, and into the future.

The goal of this Index and analysis is to equip public officials, community leaders, and corporate executives with a quantitative perspective of which cities are positioned to benefit from smart cities and why, thereby allowing them to drive both targeted and broad-based improvements. The Index also aims to enhance multi-sectoral collaboration within and across cities to accelerate project piloting, adoption, and best-practices.

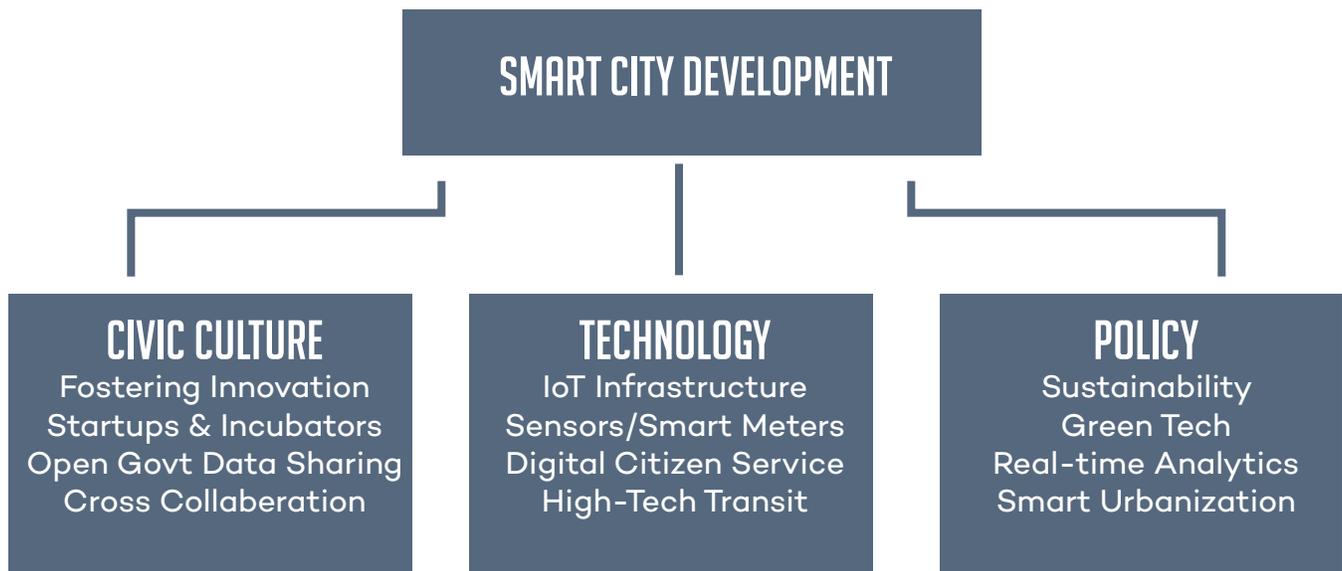
In the historical context of urban planning, smart city development is a nascent, rapidly changing endeavor. Therefore, it is worth quickly exploring some of the key definitions and qualities of a smart city, since they also have implications for internal city planning, budget prioritization, and project planning.

The Smart Cities Index

Combining public data with a proprietary algorithm to identify the top-50 cities in America that are best positioned to capture the benefits of smart city development.



A smart city is open, high-tech, eco-friendly, responsive, and innovative, supporting its citizens with optimized public services and enhanced connectivity, both socially and technologically.



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Many factors are driving the need for broad-based smart city developments—here are some of them:



87% of the U.S. population will live in cities by 2050.

For the first time since the 1920s, cities are growing faster than suburbs. By 2050, there will be 350M Americans living in cities — 28% more than there were in 2014.¹



5X the number of connected devices in 2050 as there are today.

All eyes are on the Internet of Things (IoT) for a reason. With the exponential rise of connected devices and sensors, what cities can and should measure is changing quickly.²



72% of cities outperformed their national economies' GDP growth.

But variance within and across countries is high. Output per worker in San Jose is 2x that of Buffalo, NY. Companies and talent are more mobile than ever, seeking out cities, globally, that design symbiotic urban experiences and infrastructure. By many measures, the U.S. is falling behind.⁵



70% of cities are already impacted by climate change, and nearly all are at risk.

As extreme events become the new normal, the ability to endure natural disasters and rapidly respond to health and security issues is critical.⁴



70% of global CO2 emissions come from large cities, which also consume 2/3 of the world's energy.

Scientists estimate that humanity has a decade, likely less, to act on climate change, meaning mayors are positioned to lead.³



39 U.S. cities had to open data portals in 2013; with zero just a few years prior.

Open access to data coupled with responsive, service-oriented city administration characterizes citizens' expectations within the context of new urbanism.⁶

METHODOLOGY

Compass Intelligence (www.compassintel.com) researched and developed the CA-Chordant Smart Cities Benefits Index, analyzing several key metrics across publicly-available datasets, rankings, financial records, and demographic indicators. It then deepened data collection with internal research and third-party resources. Where applicable, these metrics were scored, weighted, and tallied. All variables were then integrated into a final score per city, ranked high to low, creating the final index for the top-50 cities.

To develop the initial unranked list of 50 cities, Compass Intelligence compiled and evaluated over 1,000 news articles, reports, and research papers. This research included a review of current smart city projects, historical listings of city rankings, participation in the US Department of Transportation Smart City Challenge, and other related sources to provide intelligence around smart city readiness and potential return on investment (ROI).

Five categories of data were collected and evaluated by Compass Intelligence, providing the underlying foundation for this research and the Index: (i) City Demographics, (ii) City Spend & Infrastructure, (iii) Business Economy, (iv) Education and (v) Other.

Additional details about the various metrics for each category are included below, along with the primary data sources. Whenever possible the most recent data was captured.

CITY DEMOGRAPHICS

- Population
- Square Miles
- Population Density
- Housing Units
- Real Personal Income
- Median Household Income

BUSINESS ECONOMY

- Number of Companies
- International Trade
- Job Opportunity
- Economic Diversity
- Startup Growth

CITY SPEND & INFRASTRUCTURE

- City Budget
- Spend per Citizen
- Autos per Household
- Public Spend Efficiency
- Green & Sustainability Programs
- Avg. Annual Transportation Costs

EDUCATION

- Top Education Rank
- Education Attainment

OTHER

- USDOT Smart City Challenge
- Fastest Growing Cities

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Data used to create this ranking were collected from the U.S. Census Bureau, Bureau of Labor Statistics, The Encyclopedia of American Politics, U.S. City Open Data Census, Global Trade Staff, International Trade Administration, Kauffman Organization, Wallet Hub, American Community Survey 2011-2015, The Housing and Transportation (H+T®) Affordability Index U.S Bureau of Economic Analysis, Department of Transportation, Compass Intelligence. Note: The USDOT Smart Cities Challenge only applied to mid-size cities. According to DOT, “Mid-sized city were with a population between approximately 200,000 and 850,000 people within city limits as of the 2010 Census” was the eligibility criteria. This was accounted for and adjusted accordingly in the Index scoring process.

In terms of interpreting the Index ranking, cities with higher Index scores are better positioned to directly benefit from smart city technologies through cost savings, improved efficiencies, enhanced city services on smart city initiatives and other key benefits. As is the case with nearly all models or algorithms related to complex topics, such as urban development, Compass Intelligence had to make a number of assumptions while compiling and analyzing its research across these five data categories, as well as when interpreting the implications of the Index scoring.

Here are the city-related assumptions Compass Intelligence made in its analysis: (i) cities with higher populations and population densities increase traffic congestion and the need for automation, (ii) larger city budgets increase capacity for smart city investments (note: average IT budget for US cities is 7-13% of total budget), (iii) cities that actively foster business and economic growth are more likely to adopt smart city technologies, (iv) cities with growing job markets and economies are more likely to leverage smart city technology for business and government innovation, (v) economic growth and diversity, along with a robust startup community, drive the early adoption of scalable smart city solutions, (vi) populations with higher household and real incomes provide higher tax revenues for future smart city investments, and (vii) cities with more higher education institutions and populations with higher educational attainment are early adopters of smart city solutions.



“Our absolute conviction is that Smart City technology can benefit every single city in the world, but it’s useful to look at where those benefits will be felt most strongly. A ranking like the CA-Chordant Smart City Benefits Index should catch the attention of public officials, as they hold the responsibility for making their cities and regions competitive as homes for both people and businesses. It’s critical that they start thinking today about how Smart City technology can shape the future.”

– Jim Nolan, EVP, Chordant at Interdigital

TOP-50 CITIES

The CA-Chordant Smart Cities Benefits Index

According to the U.S. Census Bureau, there were 19,354 ‘incorporated places’ in 2013. While the Top-50 Index only represents a fraction of the total number of cities in the United States, they account for a major portion of the U.S. urban environment and investment. For example, the top-50 cities from the Index have a combined annual budget of \$177B. The average IT budget of U.S. cities is approximately 7-13% of their total budgets, meaning the Top-50 spends between \$12-22 billion annually on tech-driven services and processes.⁷

In comparison, U.S. cities spent approximately \$52B on technology in 2016, an increase of 2.5% from the year prior, while the federal government spent \$89.8B with a 1.5% increase.⁸ If the forecasts for information and communications (ICT) market are any indicator, cities in the U.S. and around the world will be spending a larger percentage of their budgets on ICT, especially as demand for smart city development accelerates.

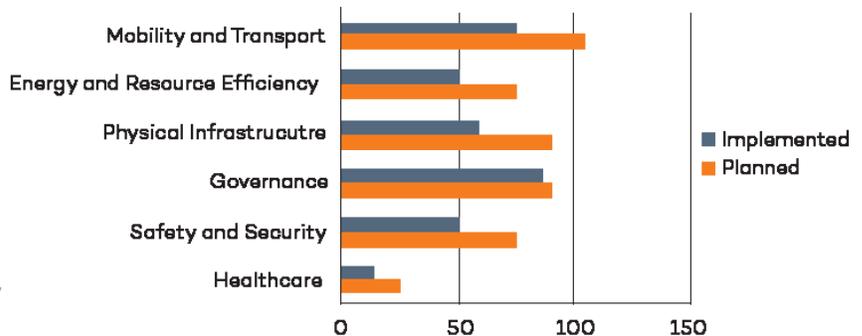
This is already reflected in municipal spending trends. Smart city spending was only 0.7% of U.S. city IT budgets in 2005; by 2015 that number increased to 4.1%; by 2025 it is projected to be 7.5%.⁸ There was also a significant increase in the number of planned versus implemented projects from 2015-2017,

U.S. SMART CITIES ICT MARKET



Sources: Compass Intelligence & The United States Conference of Mayors, 2016 Smart Cities Survey⁹

U.S. SMART CITY PROJECTS, 2015-2017



particularly in mobility and transportation, energy and resource efficiency, physical infrastructure, safety and security. of planned versus implemented projects from 2015-2017, particularly in mobility and transportation, energy and resource efficiency, physical infrastructure, and safety and security.

Interestingly, 64% of U.S. city IT decision makers reported that they were experiencing more pressure to improve city services than they were to reduce program costs—a reminder to the public and private sector alike that the ultimate and sometime illusive ROI in smart city development is citizen satisfaction. As Jesse Berst, chairman of the Smart City Council puts it, “There really is a triple bottom line with

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smart cities. It's about social equity, the environment and profits.”⁸

In terms of overall Index results, tech hub Boston tops the list of potential Smart City beneficiaries, but it's more traditionally industrial cities including Chicago, Atlanta and Philadelphia that follow close behind, ahead of Austin in fifth place.

Only four of the top-10 cities – Boston, Austin, Seattle and San Diego – are typically seen as major tech hubs, while cities with a more traditional mix of industries (Chicago, Atlanta, Philadelphia, New York, Phoenix and Kansas City) dominated the top ten.

There were also some surprises: Cleveland, which is typically not associated with lists of high-tech cities and rankings, came in 12th ahead of tech giants San Jose and San Francisco, while Minneapolis, one of the larger metro areas in the United States, came in at the bottom ten of the Index.

With a population of 99,660, the smallest city to make the list was Roanoke, Virginia; at the other

“ IoT holds huge promises for the public sector, especially as it relates to Smart Cities technology. We are seeing an uptick in the adoption of Smart Cities practices. The efficiencies, conveniences and analytics that come from Smart Cities technology is something communities can use to help improve their transportation, infrastructure and services to ultimately enrich the lives of their citizens.”

– Rahim Bhatia, Senior Vice President and General Manager, Developer Products, CA Technologies

50 CITIES AVERAGES

Population: 1M

Square Miles: 214

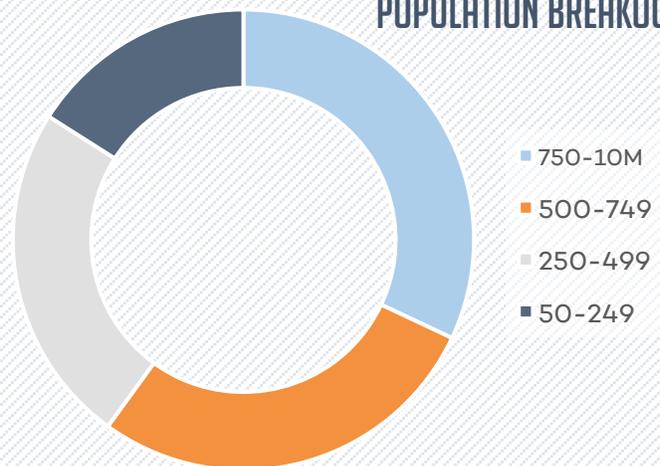
Median Household Income: \$46.5k

City Budget: \$3.5B

Number of Companies: 112k

DOT Smart Cities Participants: 20%

POPULATION BREAKOUT



SMART CITIES BENEFITS INDEX

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1	Boston, MA	67.1	26	Nashville, TN	49.2
2	Chicago, IL	64.2	27	Detroit, MO	47.6
3	Atlanta, GA	61.9	28	St. Louis, MO	46.7
4	Philadelphia, PA	60.5	29	Pittsburgh, PA	46.5
5	Austin, TX	59.5	30	Orlando, FL	46.3
6	San Diego, CA	58.9	31	Milwaukee, WI	46.2
7	Seattle, WA	58.1	32	Miami, FL	45.3
8	New York, NY	57.7	33	Oklahoma City, OK	45.1
9	Phoenix, AZ	56.9	34	San Antonio, TX	45.0
10	Kansas City, MO	56.1	35	Virginia Beach, VA	44.3
11	Portland, OR	56.0	36	Louisville, KY	44.1
12	Cleveland, OH	55.7	37	Fresno, CA	43.4
13	Los Angeles, CA	55.4	38	Raleigh, NC	43.4
14	Washington DC	55.2	39	New Orleans, LA	41.4
15	San Jose, CA	54.8	40	Richmond, VA	41.0
16	San Francisco, CA	54.0	41	Minneapolis, MN	40.8
17	Dallas, TX	53.9	42	Sacramento, CA	38.7
18	Columbus, OH	53.8	43	Hartford, CT	35.6
19	Las Vegas, NV	53.4	44	Birmingham, AL	33.2
20	Denver, CO	53.1	45	Salt Lake City, UT	31.3
21	Indianapolis, IN	52.7	46	Tucson, AZ	30.7
22	Baltimore, MD	52.2	47	Provo, UT	28.2
23	Houston, TX	52.2	48	Jackson, MS	28.0
24	Charlotte, NC	51.6	49	Columbus, OH	26.7
25	Memphis, TN	50.6	50	Roanoke, VA	19.1

end of the spectrum was Los Angeles with a population of 9.8M. At \$73M, New York had the largest city budget and highest spend per citizen in 2016. Meanwhile, New Orleans, Miami, Philadelphia, Cleveland, and Dallas had best public spend efficiency rankings. San Francisco, San Jose, San Diego, Washington DC, and Portland were ranked the greenest.

KEY FINDINGS, TRENDS, AND ANALYSIS

FINDINGS

As early adopters, U.S. cities and municipalities are embracing smart city technology and initiatives at varying scales and levels of development. More advanced cities have formed committees, departments, and earmarked budgets dedicated exclusively to deploying smart city projects. Simultaneously, cities are evaluating better ways to leverage resources across departments and key city services, all with the goal of implementing and scaling cross-functional initiatives help their cities become more sustainable, innovative, open, and service-oriented. While smart city developments will benefit communities of all sizes, we anticipate that larger cities will utilize automation, IoT, and smart city technologies at a faster pace and with a more structured, open approach. Given that the U.S. Smart Cities market is at an early-adopter phase, most projects are still in the pilot project stage, or are being implemented in silos,

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single government departments, or isolated agencies. There is less collaboration and cross-government coordination when it comes to budget, planning, and smart city strategy.

TRENDS

In order to progress to the next stage of development, the still nascent U.S. Smart Cities market will require both government and commercial vendors to collaborate for project funding, planning, and implementation. This will continue to be the case until financial savings, community benefits, and clear returns on investment emerge from domestic pilot projects and comparable, mature initiatives from around the world. In addition, there will be a need for network and end-point management, platform selection and management, security, data storage and backup, cloud communications, integration, interoperability, and more.

ANALYSIS

TOP-5, POPULATION: 750,000 - 10 MILLION

CITY	RANK	SCORE	POP.
Chicago, IL	2	64.2	2,704,958
Philadelphia, PA	4	60.5	1,567,872
Austin, TX	5	59.5	947,890
San Diego, CA	6	58.9	1,406,630
New York, NY	8	57.7	8,537,673

TOP-5, POPULATION: 500,000 - 749,000

CITY	RANK	SCORE	POP.
Boston, MA	1	67.1	673,184
Seattle, WA	7	58.1	704,352
Portland, OR	11	56.0	639,863
Washington DC	14	55.2	681,170
Denver, CO	17	53.9	693,060

TOP-5, POPULATION: 250,000 - 499,000

CITY	RANK	SCORE	POP.
Atlanta, GA	3	61.9	472,522
Kansas City, MO	10	56.1	481,420
Cleveland, OH	12	55.7	385,809
St. Louis, MO	28	46.7	311,404
Pittsburgh, PA	29	46.5	303,625

TOP-5, POPULATION: 50,000 - 249,000

CITY	RANK	SCORE	POP.
Grand Rapids, MI	37	43.4	196,445
Richmond, VA	40	41.0	223,170
Hartford, CT	43	35.6	123,243
Birmingham, AL	44	33.2	212,157
Salt Lake City, UT	45	31.3	193,744

KEY METRICS: SIDE BY SIDE AVERAGES OF THE TOP 5 & TOP 50 CITIES

METRIC	YEAR	AVERAGES		TOP-5 VS. TOP-50		
		TOP-50	TOP 5	DELTA	IMPACT*	%
Real Personal Income	2013	\$156,008.42	\$272,610	\$116,602	Direct ↑	75%
Public Spend Efficiency Rank	2016	36	13	-23.14	Inverse ↓	63%
Housing Units	2016	379,497	617,908	238,411	Direct ↑	63%
Population	2016	1,043,778	1,423,311	517,411	Direct ↑	57%
Population Density (per square mile)	2016	5,139	7,294	2,449	Direct ↑	51%
Spend Per Citizen	2016	\$3,639	\$2,597	-\$1,042	Inverse ↓	29%
Number of Companies	2012	111,814	139,022	27,207	Direct ↑	24%
Fastest Growing Cities	2016	288	356	68	Inverse ↓	24%
Int'l Trade (In \$ billions)	2015	\$24.58	\$29.40	\$4.82	Direct ↑	20%
City Budget (In \$ Billions)	2015	\$3.50	\$4.00	\$0.50	Direct ↑	14%
Economic Diversity Rank	2016	268	304	36	Inverse ↓	14%
Autos Per Household	2015	1.6	1.4	-0.2	Inverse ↓	12%
USDOT Smart Cities Challenge Participant	2017	68%	60%	-8%	Direct ↑	12%
Education Rank (MSA)	2017	54	58	4	Inverse ↓	8%
Median Household Income	2010	\$46,477	\$49,868	\$3,391	Direct ↑	7%
Rate of Startup Growth	2016	64%	60%	-4%	Direct ↑	6%
Average Annual Transportation Costs	2015	\$11,271	\$10,589	-\$683	Inverse ↓	6%
Square Miles	2010	214	204	-10	Inverse ↓	5%
Green & Sustainability Rank	2016	49	47	-1.4	Inverse ↓	3%
Job Opportunity Rank	2017	70	71	1	Inverse ↓	1.0%
Education Attainment, 5-Year Estimate	2011-15	84.4%	85.2%	0.8%	Direct ↑	0.9%

* Note that impact is either direct or inverse, meaning that as a direct metric increases, so too do the potential smart city benefits; conversely, as an inverse metric decreases, so too do the potential smart city benefits.

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When comparing some of the averages among the Top-50 across many of the key metrics provide interesting results, especially when put side-by-side to those of the Top-5 (see next page). For example, the top 5 cities spend approximately \$2,600 per citizen annually, which is 30% less than the Top-50 Index average. This serves as a strong indicator as to why the top-5 cities rank 13th on average for public spend efficiency, while the rest of the Index averages 36th. Real personal income shows the strongest differentiation between the top-50 and top-5 and likely stems from overall economic vitality and productivity, including more companies and international trade.

The Top-5 cities are significantly larger in population and higher in density as well, 57% and 51% respectively.

The Index provides some key indicators and insights into the characteristics of cities positioned to lead in smart city development. The 10 metrics that showed the greatest differences in terms of averages between the Top-50 and the Top-5 were:

1. Real Personal Income
2. Public Spend Efficiency
3. # of Housing Units
4. Population
5. Population Density
6. Spend Per Citizen
7. Number of Companies
8. City Growth Rate
9. International Trade
10. City Budget

Some counter-intuitive results emerged as well. For example, the top-5 cities, on average, are growing slower than the top-50. Additionally, they are spending less per citizen; not more.

In addition to the overall Top-5, Compass Intelligence also created top-5 groupings based on city population. Some additional big city standouts were San Diego and New York. In the next category, Seattle, Portland, Washington D.C. and Denver. Then Kansas City, Cleveland, St. Louis, and Pittsburgh. Lastly, among the smallest city grouping, Grand Rapids, Richmond, Hartford, Birmingham, and Salt Lake City.

In the next section, the snapshots of some of the initiatives underway in the Top-5 and notable cities from the Index provide a glimpse into the ever-increasing ways in which cities can embrace smart city development.



SMART CITY HIGHLIGHTS

- **Mayor's Office of New Urban Mechanics (MONUM)**
- **Smart City Playbook, 2016**
- **Smart Streets** leveraging cameras and sensors to learn more about how its citizens interact with city streets and is part of the Vision Zero Initiative
- **Hubway** bike share system
- **Autonomous vehicles**
Cambridge-based NuTonomy started testing self-driving cars in 2016, in select areas of Boston.
- **Wicked Free Wifi** Outdoor network
- **BOS:311 App** for non-emergency issues
- **ParkBoston** mobile-phone parking payment

Source: Built In Boston, 5 public projects turning Boston into a "smart city"

1. BOSTON, MA.

Index Score: 67.1
Population: 673,184
Size: 90 square miles
Annual Budget: \$2.7M
Annual Spend per Citizen: \$4,011

At 90 square miles, Boston is by far the smallest of the top-5 cities and has considerable population density. It also has the highest density of universities and students in the United States, with an economy focused on life sciences, finance, consulting and information technology.¹⁰ In terms of sustainability, it has the highest rank of the Top-5 as well as the least cars per household.

Boston's Strengths Compared to Top-50 Index Averages

- 74% higher Real Personal Income
- 13th in nation for Green & Sustainability Rank
- 58% smaller in terms of Square Miles
- 55% higher Population Density
- 38% fewer Cars Per Household

Where Boston Can Improve Compared to Top-50 Index Averages

- 477th for Economic Diversity Rank, average Top-50 ranking is 268th
- 56th in Public Spend Efficiency Ranking, average Top-50 ranking is 36th
- 47% fewer companies
- Ranked 405th Fastest Growing City in U.S., average Top-50 ranking is 288th
- 71st in terms of Education Rank, average Top-50 ranking is 54th

On December 09, 2016, the Boston Mayor's Office of New Urban Mechanics (MONUM) issued a Request for Information on Smart City and IoT projects that would benefit its citizenry.¹¹ MONUM received 104 submissions from 85 vendors¹², so keep an eye for the amazing new smart city developments that will emerge from Boston over the next few years.



SMART CITY HIGHLIGHTS

- **Department of Innovation & Technology Chief Data Officer,** Tom Schenk
- **Open Data Policy & Portal,** launched in 2010 and has well over 900 datasets open to the public.
- **Chi Hack Night,** weekly night to convene and converse about civic technology, and drove major improvements in the Chicago Park District
- **1871** converted building turned city Tech Hub
- **Array of Things (AoT),** 500 sensors throughout the city providing open-source data to the community, in partnerships with Argonne National Laboratory and the University of Chicago

Source: Chicago Tribune, Invest in Smart Technology for a Smarter City

2. CHICAGO, IL

Index Score: 64.2
Population: 2.7M
Size: 234 square miles
Annual Budget: \$7.3M
Annual Spend per Citizen: \$2,699

While Chicago was off the charts on several of its the key strengths compared to the Top-50 Index average, it was also significantly behind on some the key, heavily weighted items, particularly those related to economy.

Chicago's Strengths Compared to Top-50 Index Averages

- 214% more Housing Units
- 199% higher Population
- 189% higher Personal Income
- 160% higher Number of Companies
- 139% greater Population Density
- 26% less Spend Per Citizen

Where Chicago Can Improve Compared to Top-50 Index Averages

- Ranked 474th Fastest Growing City in U.S., average Top-50 ranking is 288th
- Ranked 108th for Job Opportunity, average Top-50 ranking is 70th
- 25% less Startup Growth
- 9% larger in Square Miles

Forecasts show that smart city investments could bring as many as 90k jobs and \$14B in economic growth to Chicago.¹³ With plans to replace replace 270,000 streetlights by 2021 in partnership with SilverSpring Networks, Telensa, Philips, and GE, one can see how these initiatives might scale.¹⁴



SMART CITY HIGHLIGHTS

- **City Chief Information Officer,** Samir Saini
- **Renew Atlanta Bond** passed Summer 2015
- **SmartATL**, Executive Director, Kirk Talbott, and funded by above bond measure
- **Autonomous Vehicle Pilot**, the city in partnership with Georgia Tech
- **Partnership with Waze**, to decrease congestion after I-85 collapsed in March 2017
- **Uses TM Forum's Benchmark Model**, which drives peer-to-peer learning across hundreds of members using common language and measurements, allowing cities to assess their "as-is" situation and articulate their future "to-be" goal.

Source: ZDNet, See how Atlanta is transforming itself into a smart city

3. ATLANTA, GA

Index Score: 64.2
Population: 2.7M
Size: 234 square miles
Annual Budget: \$7.3M
Annual Spend per Citizen: \$2,699

While Atlanta demonstrates some financial constraints with respect to its budget and overall economic diversity, its citizens exhibit a greater level of disposable income coupled with a high public spending efficiency that allows the city to accomplish a lot with a tight budget. Part of what makes cities smart is their ability to do more good with less resources. Atlanta is already on track in this respect.

Atlanta's Strengths Compared to Top-50 Index Averages

- Ranked 25th for Job Opportunity, average Top-50 ranking is 70th
- 58% greater Real Personal Income
- 21st in Public Spend Efficiency Ranking
- 37% smaller in Square Miles
- 12% higher Median Household Income
- 69% less Spend Per Citizen

Where Atlanta Can Improve Compared to Top-50 Index Averages

- 85% less city budget
- 511th among fastest growing cities in the U.S., average Top-50 ranking is 288th
- Ranked 85th for Green & Sustainable Initiatives, average Top-50 ranking is 49th
- 406th for Economic Diversity, average Top-50 ranking is 268th

In 2016, Atlanta's Smart Corridor project became the epicenter for autonomous car, connectivity solution testing, and scaling IoT management tools. It was funded with a voter-approved \$250M infrastructure bond passed and a \$300M special purpose sales tax.¹⁵ Atlanta has also launched a dedicated website to showcase overall objectives, strategy, projects, and plans called SmartATL, and it can be found at <http://smartatl.atlantaga.gov/>.¹⁶



SMART CITY HIGHLIGHTS

- **Office of Innovation & Technology**
- **Chief Information Officer,** Charles Brennan
- **Citywide Institutional Broadband Network** with Comcast is a 15-yr project slated to double the cities bandwidth at no additional cost
- **Winner of ‘Smart Cities Readiness Workshop’**
- **Philly311**, multi-channel citizen service platform
- **Smart City Roadmap** is a collaborative effort that spans 5 municipal organizations: the Office of Innovation and Technology, the Office of the Chief Administrative Officer, the Philadelphia Water Department, the Department of Streets, and the Office of Sustainability.

Sources: StateScoop, Four cities say connectivity is key in 2017 smart city projects; TechTarget, IoT Agenda, Smart cities market: 3 factors to think about before going to town.

4. PHILADELPHIA, PA

Index Score: 60.5
Population: 1.57M
Size: 143 square miles
Annual Budget: \$4.5K
Annual Spend per Citizen: \$2,870

Philadelphia attained very high marks on heavily ranked metrics of the Index, especially its second-place ranking for Public Spend Efficiency, bested only by New Orleans. Additionally, Philadelphia benefits significantly from a large, dense population with a significant disposable income and abundant housing, characteristics which far outweighed its economic challenges.

Philadelphia's Strengths Compared to Top-50 Index Averages

- 127% higher Population Density
- 92% higher Real Personal Income
- Ranked 2nd for Public Spend Efficiency, highest of the Top-5
- 77% more Housing Units
- 73% larger Population
- 21% less Spend Per Citizen

Where Philadelphia Can Improve Compared to Top-50 Index Averages

- 129th in Job Opportunity Ranking, average Top-50 ranking is 70th
- 390th for Economic Diversity Ranking, average Top-50 ranking is 268th
- 414th among fastest growing U.S. cities, average Top-50 ranking is 288th
- 7% fewer Companies

In addition to its Smart City Roadmap, Philadelphia has also already joined the MetroLab Network, in partnership with Drexel University and the University of Pennsylvania's Institute for Urban Research. The city's willingness to collaborate across departments and sectors is a significant asset to its positioning as a future Smart City.¹⁷



SMART CITY HIGHLIGHTS

- **Communications and Technology Management and Innovation**
- **Office Chief Innovation Officer,** Kerry O'Connor
- **Smart City Strategic Roadmap** passed by Austin City Council in November 2016
- **Austin Cityup** a nonprofit public-private consortium supporting the use of technology for urban progress. It has 70 member organizations including Amazon, AT&T, Cisco, Dell, HP, Hitachi, IBM, Intel, Microsoft, the City of Austin, Capital Metro, University of Texas to name a few.
- **Capmetro App** for multimodal trip-planning in partnership with Bytemark and HaCon
- **B-Cycle Bikeshare Program**

Source: Austin Business Journal, Austin reinventing itself into a Smart City

5. AUSTIN, TX

Index Score: 59.5
Population: 947,890
Size: 305 square miles
Annual Budget: \$3.5K
Annual Spend per Citizen: \$3,692

In 2015, over five years, Austin's population had ballooned by 20%.¹⁸ As a result, in addition to being one of America's fastest-growing cities, it also has been creating a great deal of job opportunities and fostering economic diversity as an emerging tech powerhouse in the South. Moreover, it is also spending its money efficiently in terms of public expenditure, while also staying focused on sustainability goals. On the other hand, these advantages are counterbalanced by low geographic concentration, with a low population density and more automobiles per household than the Top-50 Index average.

Austin's Strengths Compared to Top-50 Index Averages

- 26th Fastest Growing City, average Top-50 ranking is 288th
- 22nd for Job Opportunities, average Top-50 ranking is 70th
- 16th for Public Spend Efficiency, average Top-50 ranking is 36th
- 26th for Sustainability, average Top-50 ranking is 49th
- 151st for Economic Diversity, average Top-50 ranking is 268th

Where Austin Can Improve Compared to Top-50 Index Averages

- 43% more Square Miles
- 40% lower Real Personal Income
- 36% lower Population Density
- 23% more Autos Per Household
- 66th in Education, average Top-50 ranking is 54th

In 2016 Austin was one of five inaugural global cities to participate in the Bloomberg Aspen Initiative on Cities and Autonomous Vehicles, alongside Buenos Aires, Los Angeles, Paris, and Nashville. The accolades continued, as Austin was the only city that reached the final round in both the 2016 U.S. Department of Transportation Smart City Challenge and the 2017 the Smart City Council challenge. While Austin did not win either, it will surely make major strides soon, especially as it finalizes its Smart City Strategic Roadmap.¹⁹

OTHER NOTABLE SMART CITY PROJECTS & INITIATIVES

While there are thousands of potential projects across the remaining 45 cities from the Index, here are a few of the standouts.

POPULATION GROWTH & PUBLIC-PRIVATE PARTNERSHIPS

ENVISION CHARLOTTE

Charlotte, North Carolina (ranked 24th on the Index) was the 10th fastest growing city in the U.S. in 2016. As the nation's second largest banking center after New York, Charlotte is home to many major corporate headquarters—Citi, Ally Financial, JPMorgan Chase, and Wells Fargo. Rapid corporate expansion in Charlotte has driven population growth as well. To put this fast-changing city on a path toward sustainable development, the community formed a non-profit public private partnership called Envision Charlotte. Duke Energy, Cisco, and Charlotte Center City Partners joined the city to coordinate efforts between civic and corporate leaders. One of the program's first targets was energy consumption in commercial buildings. By late 2015 it had already reduced energy consumption in participating buildings by over 8%, saving more than \$10M. Moreover, Duke Energy benefited from a commercial spin-off from the joint effort, called Smart Energy in Offices (SEiO). The partnership structure has become so successful that it is now a national model, Envision America, with 10 other cities signed on: Jackson, MS (48th on the Index).²⁰

MANAGING BUDGET CONSTRAINTS

JACKSON USES DATA TO GOVERN

Between 2013-2014, Jackson, Mississippi had four different mayors. The incoming mayor, Tony Haber inherited the pieces of these erratic, frequent leadership changes as well as a shaky annual budget. In Yaber's State of the City Address his administration committed to using data to govern. Jackson then participated in What Cities Work, a program that helps 100 mid-sized cities leverage data and best-practices to enhance services and operations. Jackson's newly created Office of Performance and Innovation partnered with the Center for Government Excellence (GovEx) at Johns Hopkins University to create a performance analytics system. On Nov 18, 2015, the city had its first bi-weekly performance analytics meeting, called JackStat. One of city's goals was to reduce blight. In 2014, the Planning and Development Dept. only took action on five non-compliant properties. Using JackStat, the city deemed

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200 lots as “menaces to the public” and demolished 107 vacant houses. It also saved \$535,792 in FY2015 and \$101,469 in FY2016 by issuing property owners official notices to take care of their assets.²¹ The following year, when the city faced the twin challenges of reducing the budget without laying off employees, the city leaned on GovEx and JackStat again, this time putting its budget alongside comparable cities to hone in on disproportionate spending. Low performing senior and child-care centers were rolled into higher performing ones, and a similar process was carried out for staff positions in underperforming programs. Each department data coordinator also received training on Tableau software to continue the use of actionable data.²²

UPGRADING LEGACY HARDWARE

NEW YORK CITY’S NEW KIOSKS, “LINKS”

In addition to rolling out new smart lighting, many cities around the country are replacing aging payphones. On this front, New York City (ranked 8th on the Index) is leading the way with cutting-edge kiosks it calls Links.²³ The new LinkNYC gigabit communications network provides citizens at each Link station with free services such as high-speed Wi-Fi, phone calls to anywhere in the country, a tablet for maps and city services, and device charging. Financing for this project was structured so that it comes at no cost to taxpayers. The city plans to install 7,500+ Links across the five boroughs.²⁴

TRAFFIC CONGESTION MANAGEMENT

LA & MOBILE APP PROVIDERS: THE TWO-WAY FLOW OF DATA

Los Angeles (13th on the Index) is notorious for its traffic. To support and protect its millions of commuters, Los Angeles has partnered with app providers to provide a two-way exchange of data. The city shares road closures, emergency responses, and other traffic-related data with app providers to reduce congestion and increase safety. In exchange, the city benefits from crowd-sourced data from 1.5M users, because app providers (e.g. Waze) then share real-time reports to the city’s emergency management, police, fire, transportation, street services, sanitation, and other departments.²⁵

THE PURSUIT OF SUSTAINABILITY

SAN DIEGO’S AMBITIOUS TARGETS

In its Climate Action Plan, San Diego (ranked 6th on the Index) aims to reduce its emissions in 2035 by 25% from 1990 levels, while also achieving 100% renewable energy consumption that same year. By 2040, the city plans to go zero-waste. To keep pace, the city is busy launching projects and partnerships. San Diego’s building stock, for example, accounts for 40% of its emissions, so this year it signed on with the 2030 District with the goal of a 50% reduction in the energy, water and transportation emissions associated with commercial buildings. In partnership with GE, the city will install 3,200 LED, smart-sensor lights that measure traffic patterns, parking availability, and even gunshots with real-time nodes, all while also reducing energy consumption by 60%. The city is also working with MetroLab Network

and the University of California San Diego (UCSD), home of a cutting-edge micro grid pilot, to design the neighborhoods of the future. Lastly, the city's famed Balboa Park is home to a Solar-to-Battery EV charging station that leverages onsite storage to reduce power variations on the grid.²⁶



“Most local governments are aware of only 3% of the various interventions being applied around the world. For example, eco-friendly, traffic-decongesting bike-sharing programs have virtually no downsides, yet have been adopted in fewer than 30% of the world’s largest cities.”

– Jason Anderson, Bloomberg Philanthropies

25 Interview with Jacques Chirazi, CleanTech Program Manager, City of San Diego

SUMMARY AND KEY RECOMMENDATIONS

The CA-Chordant Smart Cities Benefits Index was developed by analyzing 21 city-specific metrics across 5 categories in order to identify which cities in the United States are best positioned to capture the potential benefits of smart city development. The Index goes beyond solely identifying how smart a city is today, by also analyzing how well a city is positioned to embrace, implement, and scale smart city solutions in the future. Essentially, the Index functions as an indicator for the top-50 cities in the U.S. with the highest potential return on investment and expected efficiency factors for smart city development.

As smart city technologies continue to emerge, evolve, and mature, it is important to keep in mind the other half of the Smart City equation: city leadership. A rapidly changing world and the incredible potential benefits it can bring also requires well-informed, visionary community leaders and city administrators. As the opportunities for smart city solutions increase, so too will citizens' expectations. Leaders and managers will have to stretch their capacity to keep up with the pace of change.

Below are a few key recommendations for city and community leaders.

MARKET DRIVERS

- Foster New Business Growth
- Improve Quality of Life
- Increased Production
- Improve Citizen Safety
- Reduce Congestion and Pollution
- Economic Efficiency
- Automate Infrastructure

RECOMMENDATION 1: Smart city development is as much an organizational challenge as it is technological

With advancements in ICT, collecting data is becoming increasingly easier for cities aspiring to become smarter. The hard part is actually acting on the data technology provides, which usually requires pretty robust, dynamic organizational capacity. By measuring and analyzing data for strategic priorities that are defined ahead of time, it is much easier to sustain commitments and drive results. Amidst all of the technologies, existing and new, this chain of logic can act as a north star for community leaders pursuing smart city development, regardless of the size or location of their city. Take-away: Set Strategic Priorities First, Define Problems, Capture Targeted Data, Then Drive Solutions

RECOMMENDATION 2: U.S. Cities are unique in their characteristics, meaning smart city solutions are not one-size-fits-all

What works well for a city of one million people may not work well with 50 thousand people. That said, there is still incredible value in looking to peers for best practices. At times this recommendation will not apply, but only when a solution in one city is truly a viable solution in another. For the most part, the best way to identify

best practices and tap into inspiration is to look at a similar cohort of cities. For example, when Jackson, Mississippi's mayor and GovEx partnered to balance budget, they looked at similar cities. Moreover, one of the first things Jackson did was join the What Cities Work initiative, which is a network of 100 mid-size cities. Take-away: Inspiration for smart city projects can come from anywhere; best practices and refined operations come from similar cities tackling similar problems in scope and scale.

RECOMMENDATION 3: Form collaborations across city departments and strategic partnerships across sectors

More advanced and ambitious smart city projects will typically require significant coordination across municipal departments. The formation of cross-functional leadership positions, working groups, and agencies will accelerate the identification of problems and the implementation of solutions. Moreover, cities are not in this alone. Partnering with universities and other knowledge centers, local or beyond, is a common pathway to success. Ask around for networks such as What Works Cities and collaborators such as GovEx. Lastly, the formation of public-private partnerships will be key to establishing trust in and scalability of vendor relationships. The still nascent U.S. Smart Cities market requires both government and commercial vendors to collaborate for project funding, planning, and implementation. This will be the case until financial savings, community benefits, and clear returns on investment emerge from domestic pilot projects and comparable, mature initiatives from around the world. Take-away: Collaborate. Articulate and share your problems with peers. Ask around for solutions already in the works.

RECOMMENDATION 4: Cities will save money and accelerate smart city deployments by selecting open-ended, standards-based solutions

This recommendation is positioned at the intersection point of the last three recommendations. The ability to unleash the potential of human talent, inter-organizational collaboration, and city-to-city learning is made vastly easier and more efficient by a standards-based approach. For example, with respect to IoT development, open standards have the potential to accelerate IoT adoption by 27% and reduce related deployment costs by 30%.²⁷ This is especially true for the long-term development of smart city programs, since many of the future areas of value will either a) result from the integration of existing unconnected systems, allowing program managers to discover value in new data mash-ups—something that standards-based solutions make easier—or b) involve the integration of several smart city systems, since most major cities bring together multiple municipal, county and state authorities, requiring a standards for simplified data sharing. Take-away: Build the foundation to scale effectively. Since much of smart city development has its origins in data management, a standards-based approach will provide both immediate and long-term benefits.

RECOMMENDATION 5: How to move up the Smart Cities Benefits Index?

Cities who are seeking to move up the benefits index can do so by focusing on the key metrics that can be modified and may be dynamic in nature. These include metrics specific to creating economic growth, activities focused around startup development and innovation creation, fostering university and government collaboration, and creating an organizational structure and priorities listing of key smart city projects and plans. Outside of the organizational changes, appointing a head of smart city planning to coordinate across city/municipal departments and agencies will be vital to experience impactful benefits. Lastly, working closely with key technology vendors who specialize in automation, IoT, connected solutions, and combine that with a deep understanding of municipal budgets and allocation, will further benefit a city who is looking to become leading edge in smart cities.

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