

Connected Newark

An assessment and strategy for making Newark a leader in connecting city services to citizens, businesses, and the community.

June, 2020

ESI ECONSULT SOLUTIONS INC.
economics | strategy | insight

Introduction

New Jersey Institute of Technology (NJIT) in partnership with the City of Newark and Invest Newark engaged Econsult Solutions to craft a connected city plan for Newark, New Jersey. By becoming a connected city, Newark will leverage smart technologies to further interconnect the local government and its citizens. The Connected Newark plan will serve as a framework for future policy and investment as Newark progresses along its connected city journey.

Newark is working to achieve economic, environmental, and social sustainability. With the growth of urbanization, cities are struggling to balance growing populations, increasing expenditures, shrinking housing supplies, depreciating infrastructure, and environmental concerns while competing with other cities to secure investments, jobs, and talent. Now more than ever, cities must turn to rapidly improving technologies to implement the best solutions for their residents.

The Connected Newark Plan prioritizes opportunities, draws on best practices, and defines implementation steps to help Newark realize its full potential. The plan reflects the values of Newark and its alignment with Mayor Baraka's strategic goals for the city. The Connected Newark Plan provides a business case for adopting connected city strategies through smart technologies to help shape the future of Newark.



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Process

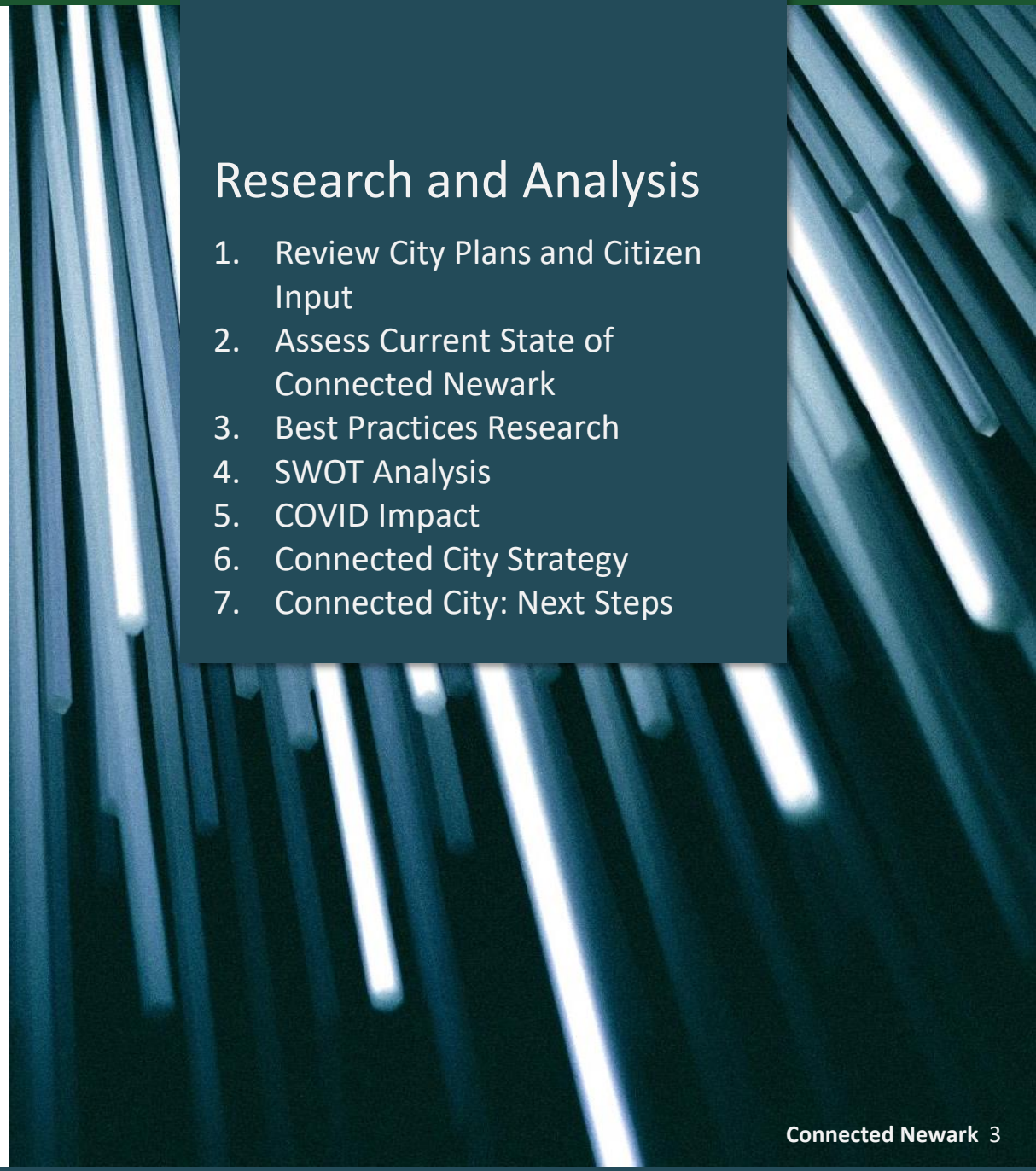
This project began in late winter of 2020 and ESI's research and analysis continued through the spring and into the early summer.

ESI worked closely with NJIT, Invest Newark, the City IT director and Mayor's senior staff to review current City plans and strategies, and to also understand resident concerns through the 2019 Call to Collaboration process. With that information, ESI mapped city goals, IT priorities and citizen priorities.

The City, led by the IT Director, completed ESI's Hyperconnected City Index survey. ESI then analyzed those results and assessed Newark's performance on the four pillars of a hyperconnected city – technology, data, cybersecurity, and connected citizens. Newark was then compared to the 100 global cities surveyed by ESI in 2019 to understand where Newark ranks as a hyperconnected city. Based on those results and city priorities and goals, ESI identified a set of best practices from global cities that could inform Newark's connected city efforts.

Combining all of this information, ESI undertook a SWOT analysis and a review of COVID responses undertaken by the City. Those then informed a four-part plan for future City action.

ESI shared those findings at a meeting with the Mayor, President Bloom, Invest Newark leadership, City staff leadership, and NJIT leadership to review prior to providing this final report.



Research and Analysis

1. Review City Plans and Citizen Input
2. Assess Current State of Connected Newark
3. Best Practices Research
4. SWOT Analysis
5. COVID Impact
6. Connected City Strategy
7. Connected City: Next Steps

Acknowledgements

Econsult Solutions wants to thank the following for their contributions:

City of Newark

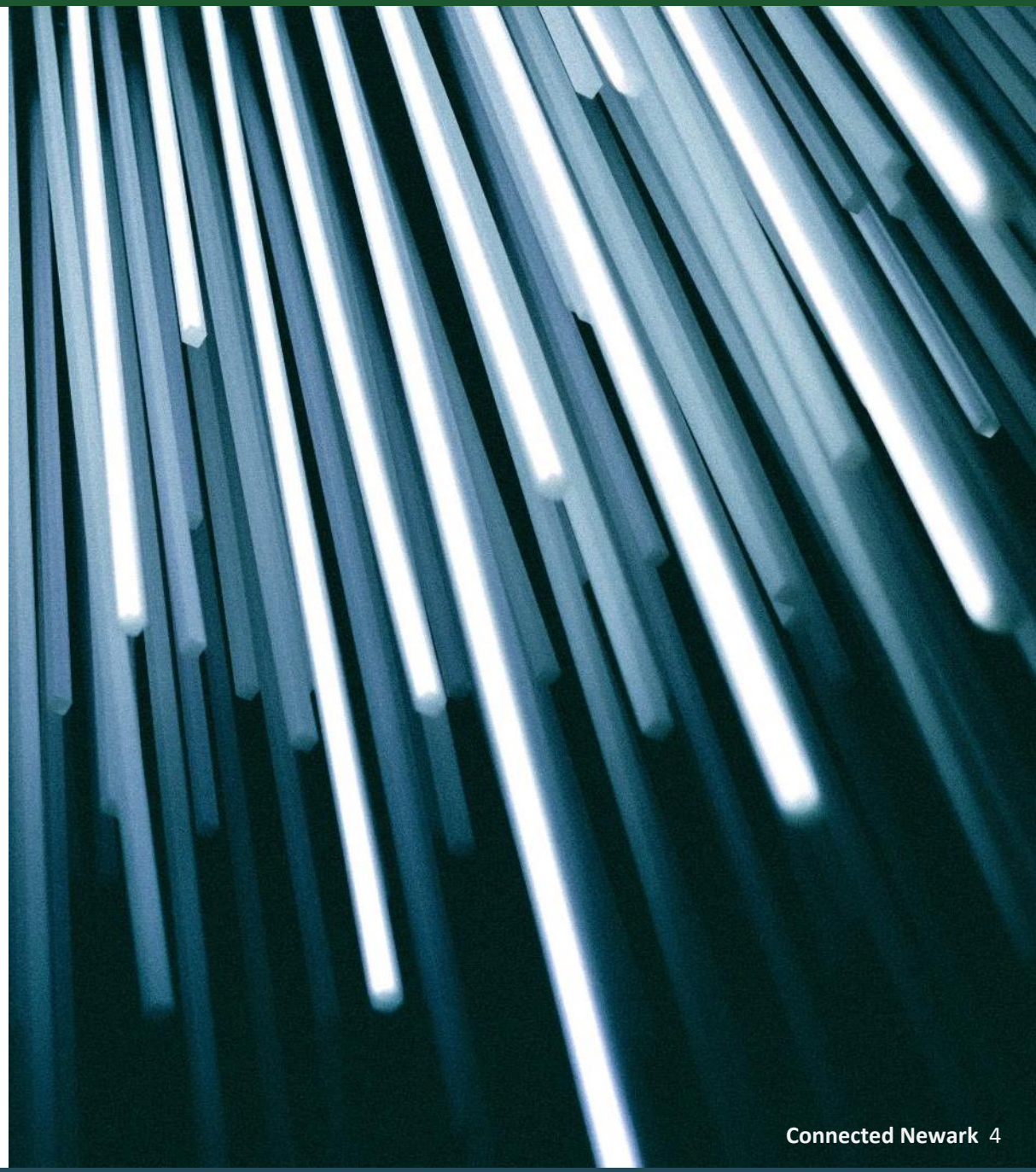
- Mayor Ras J. Baraka
- Natasha Rogers, Chief Operations Officer
- Steven Emanuel, OIT Director
- Sherronda Carroll, Interim OIT Director
- Eric Pennington, Business Administrator
- Shoshanna Page, Sr. Policy Advisor and Communications Strategist

Invest Newark

- Bernel Hall, President and CEO
- Ladell Robbins, Chief Financial Officer and Chief Investment Officer
- Vaness Quijano, SVP of Business Development

New Jersey Institute of Technology

- President Joel Bloom
- Angela Garretson, Chief External Affairs Officer
- Donald Sebastian, Sr. VP for Technology and Business Development
- Kamalika Sandell, Vice Provost and Chief Information Officer
- Mike Van ter Sluiss, Director, Innovation Services, NJII



Goals and Priorities

Mayor Baraka's Strategic Goals
2019 Call to Citizen Collaboration
Newark Office of Information Technology

Mayor Baraka's Strategic Goals

Mayor Baraka's Mission Statement Objectives for the City of Newark outlines areas in which focused action will occur to create an *empowered, safer, educated, equitable,* and *collaborative city*.

Empowered City of Newark	Safer City	Educated City	Equitable City	Collaborative City
Enabling residents and youth to change their futures as well as the lives of their family	Employing information-based strategies and community collaboration with law enforcement to reduce crime in the City	Dedicating resources to create pipelines to life-long learning and success for residents of all ages	Promoting prosperity, healthy lifestyles and access to quality housing among residents by working with the private sector and local institutions	Extending partnerships across residents, schools, local government, businesses and organizations to achieve positive change

Newark Citizen Research: 2019 Call to Collaboration

In June of 2019, Newark held its first Call to Collaboration, a two-day meeting that brought together over 300 people from community organizations, schools, environmental groups, local government, and the Newark business community to have an action-oriented dialogue about issues concerning Newark.

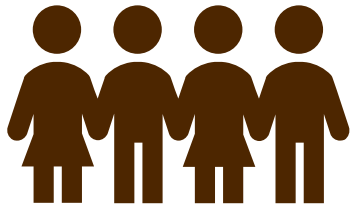
Reminiscent of the Mayor's strategic goals, citizens voiced their desires for the city to become more connected, safe, upwardly-mobile, and supportive of creators.

- A common strategy repeated throughout sessions was the creation of a social platform to connect residents to opportunities, resources, local government, and fellow community members.
- Residents mentioned wanting better professional and workforce development opportunities.
- Additionally, residents voiced their support for the entrepreneurial and artistic communities in Newark and advocated for better resources to enable their success.



2019 Call to Collaboration

Priorities and Strategies



Newark Youth

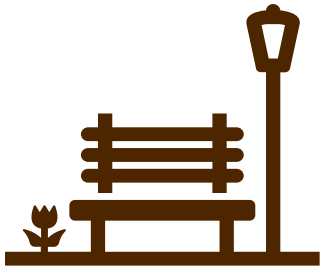
- Increase school attendance
- Improve safety for children and teens
- Increase student power and engagement with the community
- Increase professional and workforce development opportunities for youth



City Brand, Identity, and Cohesiveness

- Foster community connectivity and community pride
- Involve residents in efforts to keep our City clean
- Improve communication between communities and local government
- Increase youth activity in the community and civic participation
- Increase volunteering engagement and participation
- Increase voter participation from younger generations in local and national elections

Priorities and Strategies



City Services and Infrastructure

- Promote bicycling and build infrastructure for biker safety
- Implement community-based public safety interventions
- Decrease gun violence
- Promote environmental sustainability
- Raise awareness of differently-abled persons and develop assistance initiatives



Economic Development & Entrepreneurship

- Create careers pathways to improve upward mobility
- Encourage the creation of small businesses and support entrepreneurs
- Encourage and build the tech entrepreneurship community
- Involve local universities, like NJIT, in the Newark Community
- Prevent and counter brain drain
- Understand the health effects of smart technologies

Newark IT Priorities: 2019-2020

The Newark Office of Information Technology (OIT) established 2019-2020 High-Level Goals to advance the City's technological capabilities. The OIT team outlined objectives, challenges, benefits, and action items for each goal. These goals were centered around Mayor Baraka's Mission Statement Objectives and intended to serve the Department, the City, and Newark's communities.

Modernized City Website

OIT aims to establish a program for the modernization, improvement, and implementation of world-class communications through website capabilities. The city websites are principal communication channels and must be kept to date to preserve Newark's image. The City must have a flexible, interactive communication platform to provide data necessary to meet government access and transparency goals.

Smart Policing

OIT intends to support the technology modernization and creation of on-demand analytics for the Newark Police Division (NPD). A comprehensive, analytic dashboard will assist the NPD in tracking, evaluating, and communicating key performance metrics. The NPD modernization will create a solid foundation for accurate reporting, allowing citizens to access critical information about public safety and improving public trust.

Newark Fiber Network

OIT plans to advance and expand the Newark Fiber program by fully defining Newark Fiber, assessing all completed activity, and developing a formalized plan. A more robust Newark Fiber program will further connect residents, increase the inclusivity of the network, and potentially serve as a source of revenue for Newark.

LinkNWK Kiosks

In an extension of Newark Fiber revitalization, OIT aims to reestablish a formal direction for the LinkNWK Kiosk program implementation. LinkNWK kiosks provide fast and secure, public Wi-Fi along with phone calling, device charging, and city resource capabilities. LinkNWK kiosks connect residents to the City, providing Newark communities the digital services needed for the 21st century.

Mapping Citizen Priorities to Mayor's Goals

Empowered City of Newark

- Increase student power and engagement with the community
- Foster community connectivity and community pride
- Create Longstanding Spaces for Artists
- Promote bicycling and build infrastructure for biker safety

Safer City

- Implement community-based public safety interventions
- Decrease gun violence
- Improve the safety for children and teens
- Promote environmental sustainability
- Involve residents in efforts to keep our city clean

Educated City

- Increase school attendance
- Prevent and counter brain drain
- Involve local universities, like NJIT, in the Newark Community
- Understand the health effects of smart technologies

Equitable City

- Create career pathways to improve upward mobility
- Increase professional and workforce development opportunities for youth
- Encourage the creation of small businesses and support entrepreneurs
- Encourage and build the tech entrepreneurship community
- Raise awareness of differently-abled persons and develop assistance initiatives

Collaborative City

- Improve communication between communities and local government
- Increase youth activity in the community and civic participation
- Increase volunteer engagement and participation
- Increase voter participation from younger generations in local and national elections

Mapping IT Priorities to Mayor's Goals

	Empowered City of Newark	Safer City	Educated City	Equitable City	Collaborative City
Modernized City Website		✓	✓		✓
Smart Policing	✓	✓	✓		✓
Newark Fiber Network	✓		✓	✓	✓
Link Newark Kiosks	✓		✓	✓	✓

Mapping IT Priorities to Citizen Priorities

Modernized City Website

- Improve communication between local government and our citizens
- Create a platform for connecting communities, organizations and citizens
- Promote civil engagement, volunteer and educational opportunities

Smart Policing

- Create a central hub of public safety information
- Increase public safety in Newark for all residents
- Track and report statistical information on crime and violence in Newark

Newark Fiber Network

- Inspire collaboration by expanding network capabilities to residents
- Increase entrepreneurship by providing fiber connections to start-ups

LinkNWK Kiosks

- Inspire collaboration by providing secure Wi-Fi and nationwide calling
- Assist and Empower Differently-Abled Persons providing kiosks built to ADA standards

Current State of Connected Newark

Hyperconnected Cities Index
Assessment
Resident Connection and Access

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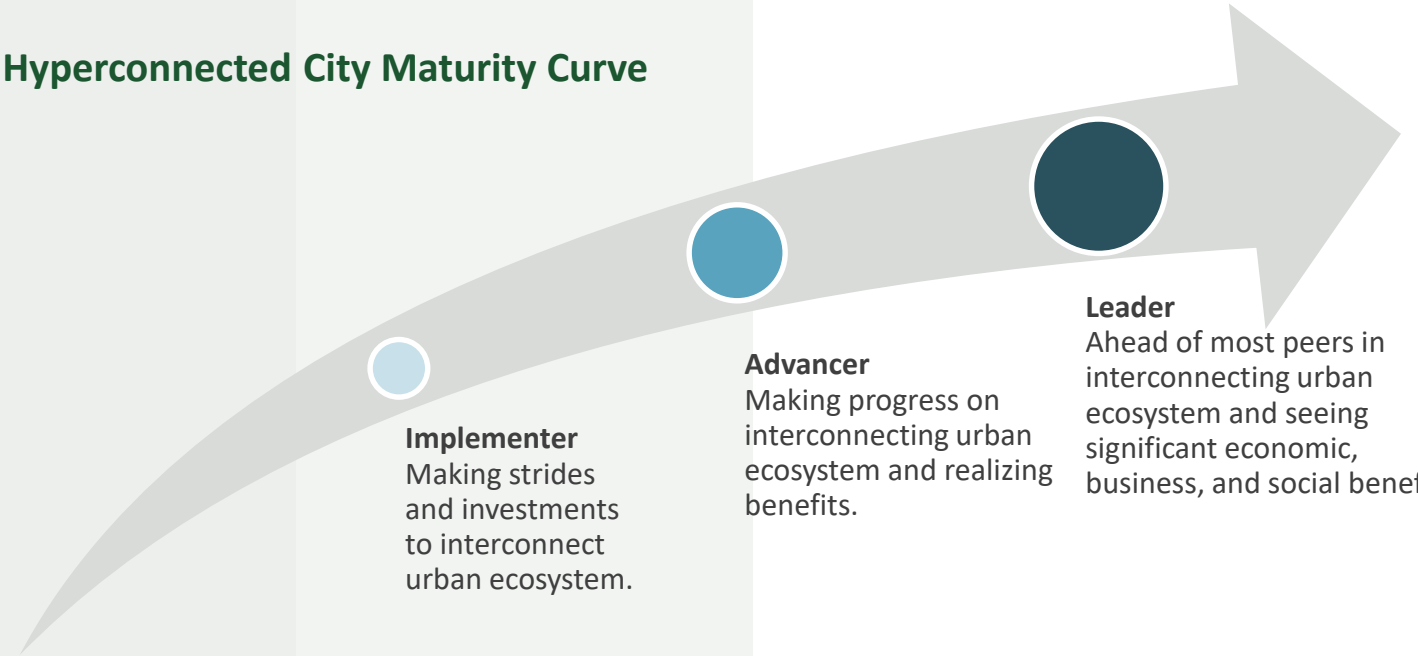
Hyperconnected Cities Index

Hyperconnected cites unlock the greatest economic, business, and social value by leveraging technology to transform and securely interconnect key areas of their urban ecosystems, including citizens. Measuring the use of smart technology is not enough. To create the Hyperconnected Cities Index, we looked at four pillars of city transformation: technology, data and analytics, cybersecurity, and connected citizens. Since our focus was on "connected" cities, the index varies from others that measure a city's use of smart technologies.

Three Stages of Building a Hyperconnected City

To underpin each of the four pillars, our economists used data from several survey questions, calculating a score for each, and then normalizing and combining them to arrive at a pillar score. We then aggregated the pillar scores into an overall index score. Based on these scores, we stratified the cities into three categories: implementer, advancer, and leader.

Hyperconnected City Maturity Curve



Implementer
Making strides and investments to interconnect urban ecosystem.

Advancer
Making progress on interconnecting urban ecosystem and realizing benefits.

Leader
Ahead of most peers in interconnecting urban ecosystem and seeing significant economic, business, and social benefits.

Current State of Connected Newark

Self-assessment of current connectivity: ESI ThoughtLab Hyperconnected City Index **ranks Newark in the 60th percentile** of 100 global smart cities on the ESITL Hyperconnected Cities Index (Based on City of Newark and 100 global city responses to ESI TL Hyperconnected Cities Survey and publicly available data).

Top 10% in connected citizens

50th percentile in cybersecurity

80th percentile in data use and monetization

90th percentile in IT use and infrastructure

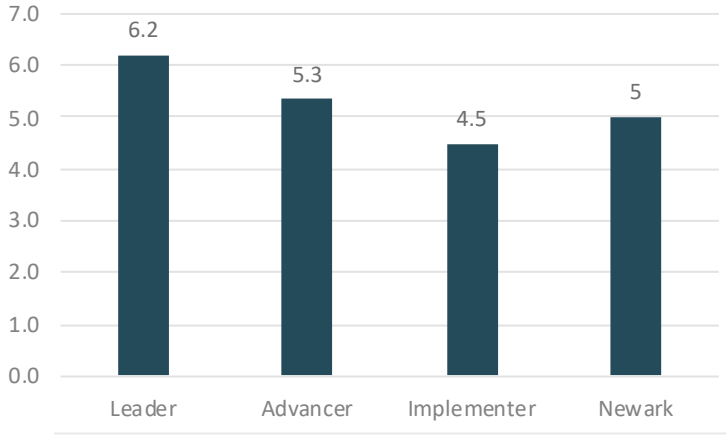


Technology

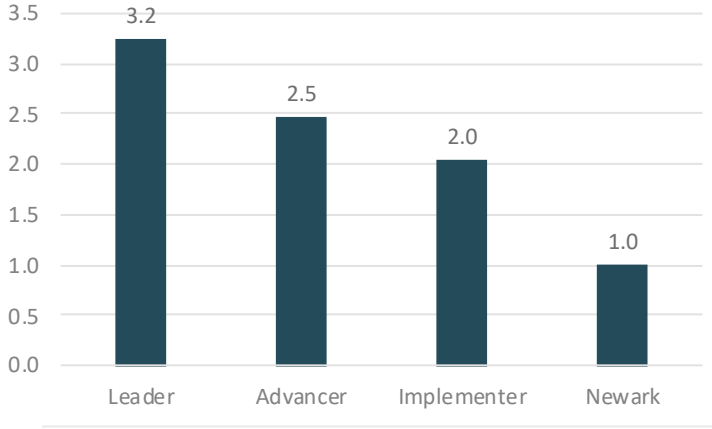
Newark is lagging Leaders, Advancers, and Implementers in its approach to technology, scoring 96th overall in that category.

- Newark is ahead of the average Implementer City and is on par with average Advancer city in terms of the number of different IT infrastructure technologies the city is implementing.
- Newark is in the beginning stage for IT and telecommunications infrastructure maturity, while the average Leader city is between maturing and leading and the average Advancer city is between developing and maturing.
- Newark is trailing Leaders and Advancers in its approach to the use of technology. Areas that Newark may want to consider include:
  - Complying with international standards and best practices
  - Providing adequate resources
  - Creating an innovation hub to promote the adoption of advanced technologies

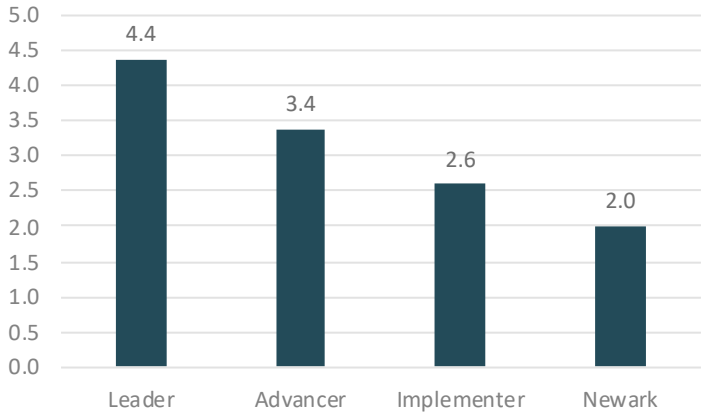
Digital technologies leveraged to support city operations

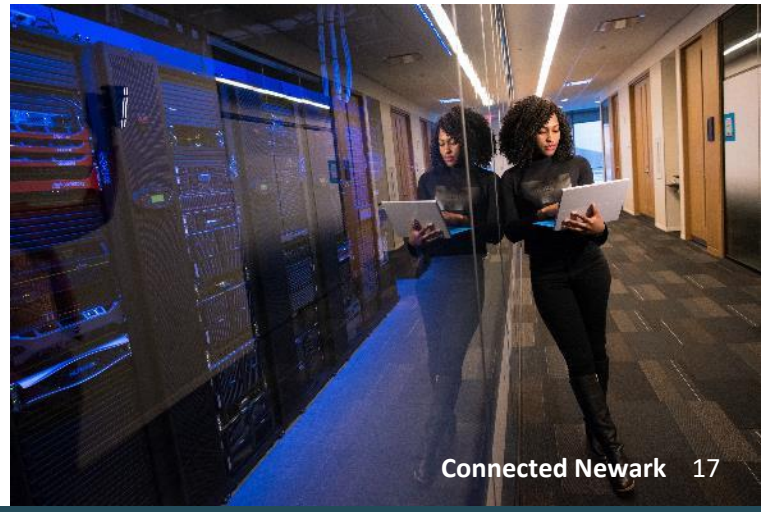


City's maturity stage in implementing and leveraging technology



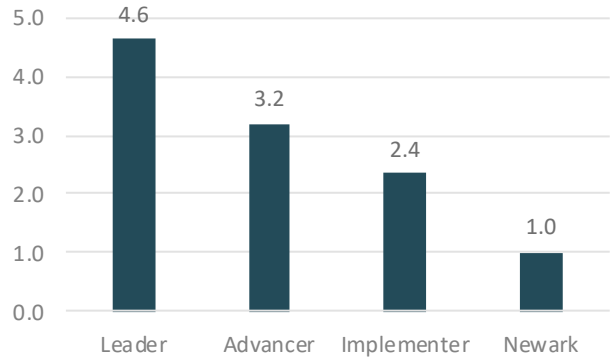
Advancement in city's approach to technology use and digital innovation



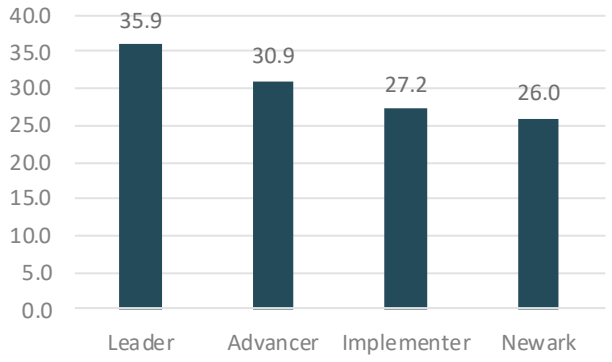


Data

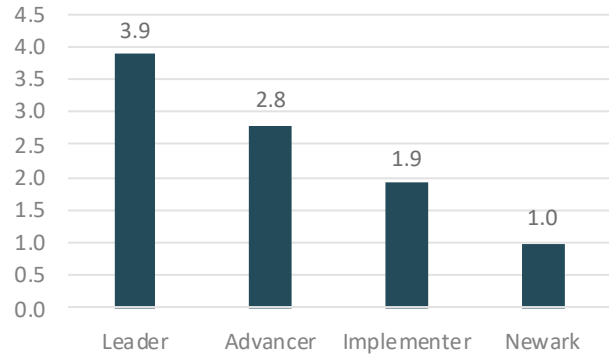
Advancement in approach to data gathering and management



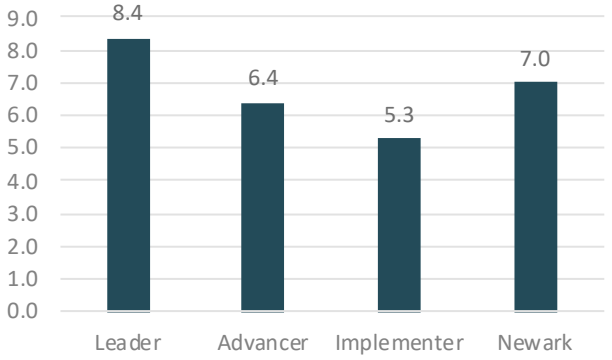
City's maturity stage in the use of data and data analytics



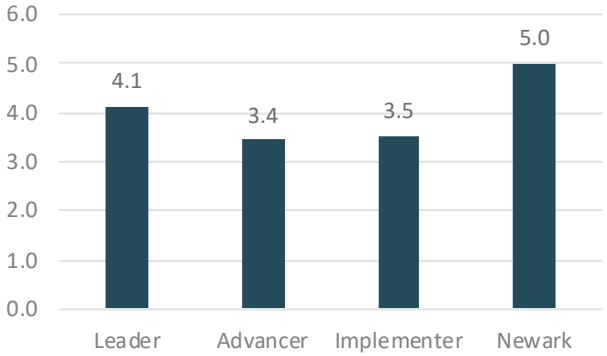
Digital technologies leveraged to support city operations



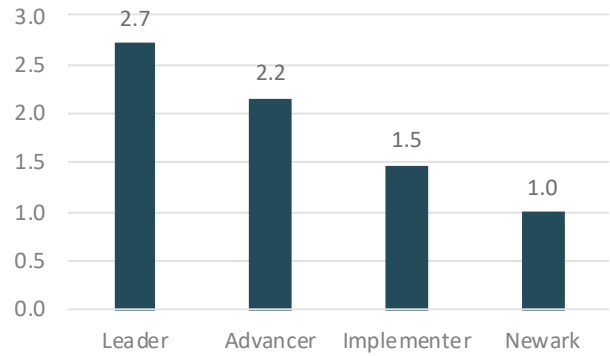
Types of data collected to drive smart city initiatives



Areas in which your city is using advanced data and analytics to gain insights and improve performance



City's maturity stage in using and managing data



Data

Newark is lagging Leaders, Advancers, and Implementers in its approach to data, scoring 88th overall in Data & Analytics.

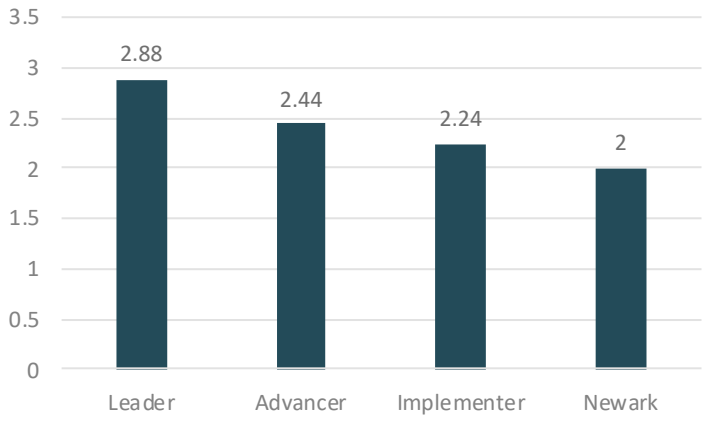
- The areas that Newark may want to consider include:
  - Implementing a data management system that integrates data across departments
  - Establishing a written data policy to ensure the proper use of data
  - Working with outside entities to gather data
  - Having a flexible data policy to keep up with changing technologies
- The City is ahead of the average Advancer and Implementer cities in terms of the number of different types of data used.
- The City is behind in its maturity in using data to gain insights and unlock value. Areas for improvement include:
  - Managing data
  - Monetizing data
  - Predicting trends and extracting value from the data
- The City is on par with the Leaders in the areas of collecting data, making data accessible, and protecting data.
- Newark is ahead of the average Leader, Advancer, and Implementer cities in the number of areas where they use data and advanced analytics.
- Newark is behind the average Leader, Advancer, and Implementer cities in the number of advanced data analytics technologies used. Advanced technologies that the city may want to consider include:
  - Artificial Intelligence
  - Biometrics
  - Blockchain
  - Citywide data management system
  - Chatbots and digital assistants

Cybersecurity

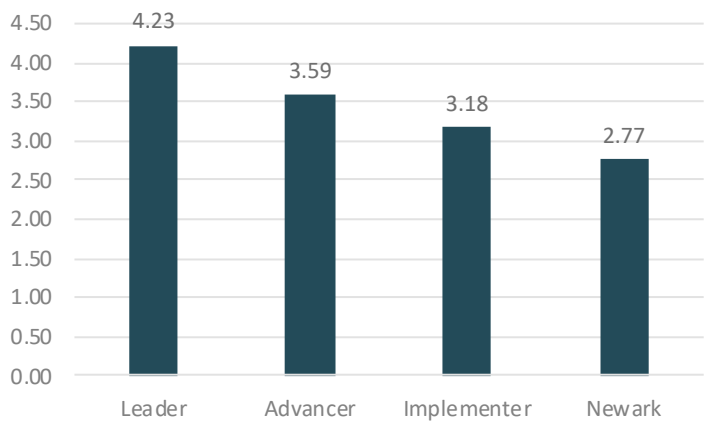
Newark is pretty much on par with other cities in terms of its maturity in the area of digital and physical security, having scored 54th overall in Cybersecurity.

- The City is more prepared than the average implementer city in terms of being prepared for cybersecurity and is only slightly lagging the average Advancer city.
- Across the key cybersecurity areas of identify, protect, detect, respond, and recover, Newark is between beginning and developing.
- The City is lagging the leaders across all areas of cybersecurity, and the one area where the City appears to be the most behind and would help to improve its ranking is in the area of detecting cybersecurity attacks.

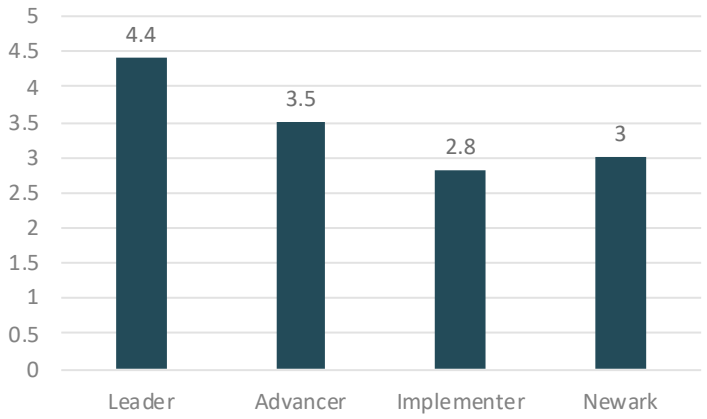
Average smart city maturity across the urban ecosystem



City progress in preparing for and preventing cyberattacks



City preparedness for cyberattacks



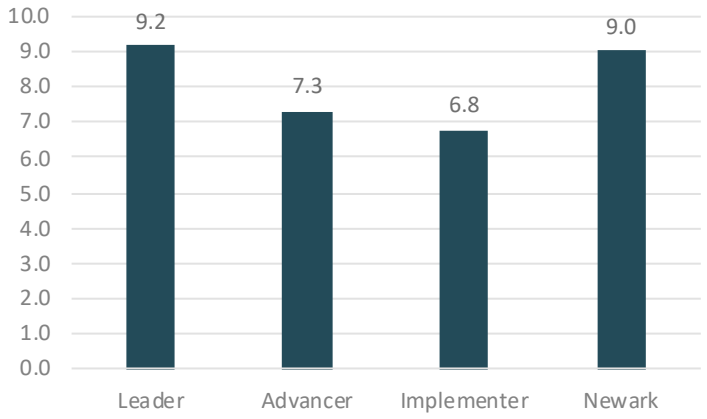


Connected Citizens

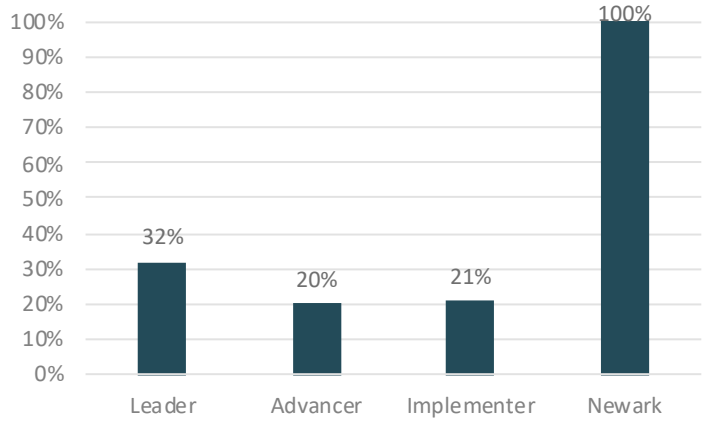
Based on the survey responses, Newark is a Leader across all areas of citizen engagement, having scored 8th overall in the Connected Citizen category.

- Newark is ahead of the average Advancers and Implementers in its approach to citizen engagement. To catch up with the Leaders, the city may want to consider:
  - Undertaking an audit of the different social groups that may be in danger of exclusion from digital transformation.
  - Actively engaging stakeholders in smart city initiatives.
- Newark is one of a few cities that have a CCXO.
- While the City is on par with the average Leader in terms of the number of methods used for citizen engagement, there are a few additional methods Newark may want to consider:
  - 24-hour call center
  - Citizen satisfaction surveys
  - Online chatrooms

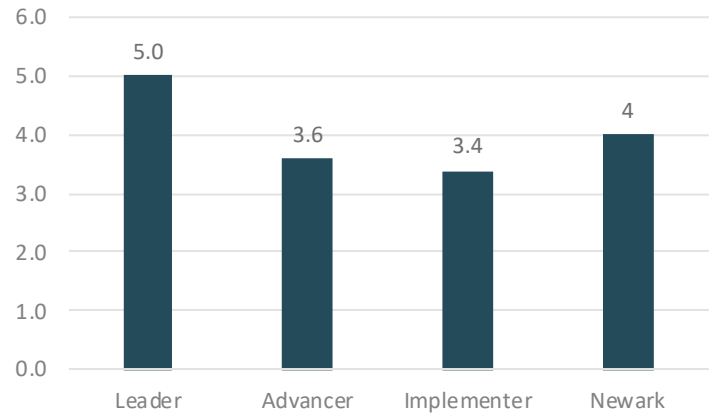
Methods currently in use for citizen engagement strategies



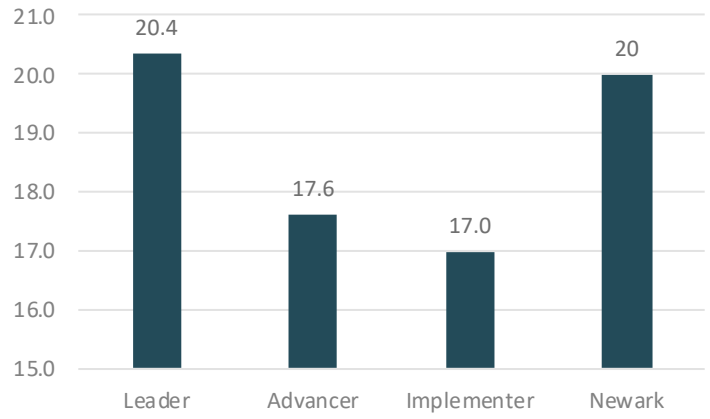
Cities having an official dedicated to citizen engagement



City's advancement in citizen engagement



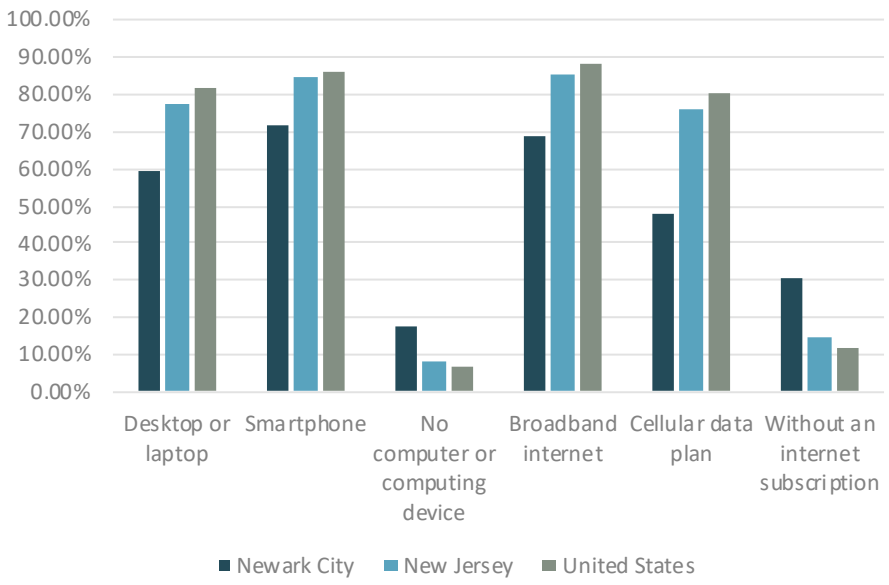
Citywide familiarity with smart city activities



Resident Connection and Access

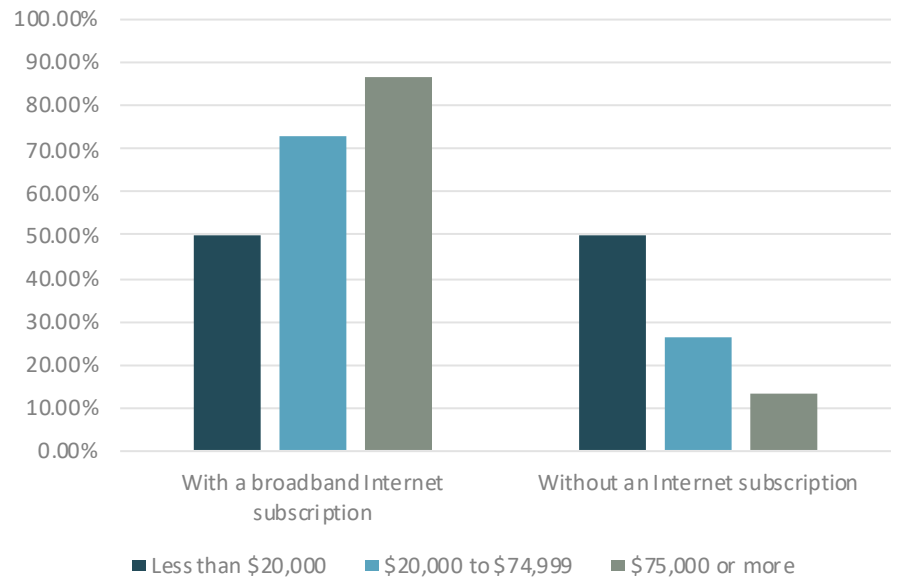
Newark residents lag behind the state and the country in terms of internet connection and access to computing devices. Newark households have fewer computing devices and internet subscriptions per household than households in New Jersey and the United States.

Computers Access and Internet Subscriptions by Percent of Total Households, 2018



The low and moderate-income households comprise a high percentage of households without any type of internet connection in Newark; half of all households making less than $20,000 per year are without internet.

Newark Households Type of Internet Subscription by Household Income, 2018



While Newark is a leader in leveraging technologies for citizen engagement, there seems to be a disconnect between the methods of engagement and their adoption in the Newark community. During the Call to Collaboration, citizens expressed their desire for:

- Improved communication between communities and local government
- Better connections with students, alumni, community organizations, and residents
- Greater promotion of workforce development opportunities
- Increased awareness about community and city services
- Promotion of the Newark Thrives! Youth program locator

Newark Fiber in Action

Newark Fiber is connecting local companies to high-speed internet at the fraction of the cost of national competitors. Newark Fiber currently offers Gigabit and 10 Gigabit internet connections to commercial buildings and apartment buildings, with plans to provide connections to individual households.



165 Halsey

The 1.2 million SF data center, home to about 60 data communications companies and 20+ fortune 500 companies, is connected to the Newark Fiber network. The building is equipped with fiber optic cables, routers, networking gear, and computer servers, allowing for unparalleled, high-speed connectivity at a fraction of the cost.



Gateway Buildings

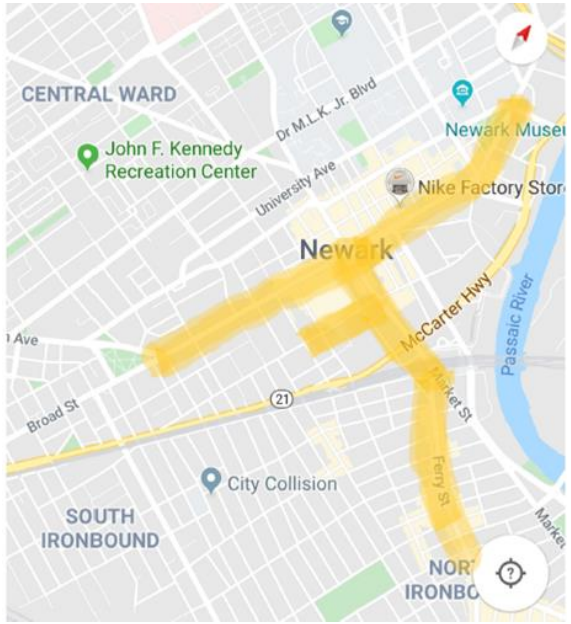
Gateway One, Two, and Four are the three triangulation points of the Newark "Firebolt" Wi-Fi network, deploying a multi-gigabit internet feed from each access point. Tenants in the buildings can connect to Newark Fiber by GigXero, the fastest internet in the region.

The Future of Fiber

- Newark is proactively installing miles of "dark fiber" (unused fiber optic cables) and empty fiber optic conduits to prepare for future demand.
- Mayor Ras Baraka announced that Newark's fiber-optic network will remain net neutral to nurture the City's growing tech scene despite the Federal Communication Commission's ruling to end net neutrality.
- Investing in data infrastructure gives Newark a competitive advantage for attracting new businesses and establishing Newark as an emerging technology hub.

The Newark Advantage

- Newark has been recognized for its advantageous positioning since being selected as a finalist for Amazon's second headquarter location.
- Newark is a low-cost location for companies with the benefits of its proximity to New York City.
- Newark fosters a diverse and highly talented workforce through regional colleges and universities.
- Newark's robust mass transit system connects passengers across New Jersey and the New York area.
- Newark's internet infrastructure provides the fastest, free Wi-Fi in the county.



High-level map of the current fiber structure

Connected City Strategy

SWOT Analysis
Impact of COVID-19 Crisis
Strategic Plan Goals and Strategies

- Citizen Centered
- Innovation Hub
- Universal High-Speed Connections
- Focus on Resilience

Case Studies

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Connected Newark SWOT Analysis

Strengths
- Tech strategy in alignment with Mayor and citizen goals
- Focus on citizen services and connections
- Advanced cybersecurity strategy
- Building blocks of high-speed connectivity with fiber and kiosks
- Use of cloud infrastructure provided resilience in crisis

Weaknesses
- City broadband and Wi-Fi connectivity are still limited
- No specific capital budget for smart city investments
- Have not fully quantified benefits of connected Newark investments
- PC based systems will need to be made more mobile to allow for WAH

Opportunities
- Expand and better connect to and from existing assets like fiber, kiosks to support education, entrepreneurship, civic engagement
- Build on COVID emergency actions (digital payments, WAH, etc.) to create new ways of doing business
- Better engage and raise citizen awareness of new initiatives
- Leverage COVID-19 grants and funding to increase connections and build out digital infrastructure

Threats
- COVID-19 related funding shortfalls (public and private) for new technology investments
- Plans for technology investments in competition with basic needs
- Advertising model supporting innovation assets like kiosks likely to be challenging
- Citizen backlash to new tech innovations (see Toronto)
- Corporate and institutional partners facing their own financial challenges

The Impact of the COVID-19 Crisis



Technology

- Transitioned well to a mostly virtual environment, using Zoom, Teams, Office 365 and VPN
- Workforce handled WAH well – good investment in QuickBase and VPN
- Limited preparation for alternate work endpoints (laptops/tablets)
- Accessing shared drives and printers through enterprise network remote access

Connected Citizens

- Good connectivity to citizens and other levels of government
- Live Facebook broadcast, 311 call center, and Newark Connect app kept citizens informed
- Some citizen services, even if accessed online, pointed to business workflows modified due to closed offices

Cybersecurity

- Recent cyber investments have paid off to allow for careful, watch mode
- Work technology plans from both ends – make City systems secure but accessible from everywhere, and building workforce capabilities to have the assets needed to securely work, anywhere
- All revenue collections solutions will be paired to an online payment process

Data Management

- Existing cloud and SAAS environments functioned well and supported business processes
- All improvements/upgrades to systems will have confirmed cloud capabilities
- But, need more SaaS, cloud-based solutions to limit need to be on premises

Strategic Plan: Vision, Goals and Strategies

Vision: A Connected Newark is a resilient city that leverages and utilizes technology to engage citizens, create a more inclusive economy, and improve government performance.

Strategies:

- **Take a citizen-centric approach** by actively engaging citizens in the planning and development of smart connection initiatives, to ensure that city programs are reaching those most in need.
- **Expand internet connections** by extending affordable broadband access to the entire city, building on existing fiber and future 5g connections, to ensure that all citizens, businesses, and organizations are able to easily access the internet to learn, work, and engage with the City.
- **Create a City Innovation Hub** to support and promote Newark's smart city investment strategies, connecting, coordinating, and promoting city and private initiatives to both improve technology efficiency and to boost the economy.
- **Build on lessons learned during the COVID-19 crisis** to create a more resilient city technology system that better manages and leverages the data that the city collects, increases the flexibility and mobility of city systems, and ensures service continuity under a wide range of circumstances.

Citizen Centered



Take a citizen-centric approach
Actively engage citizens in the planning and development of smart connection initiatives, to ensure that City programs are reaching those most in need.

Expand awareness
Newark is already a leader in the depth and breadth of its citizen focused technology efforts. However, the Call for Collaboration demonstrated a lack of awareness of existing City efforts and initiatives.

Build on COVID-19 success
The City was forced to more fully utilize its digital assets during the COVID-19 crisis. Undertake an assessment of success and failure in City connections and make appropriate investments and fixes to systems and structures.

Go all-in
Other leading cities have created 24-hour call centers, regularly survey their citizens, and actively engage citizens in smart city planning and strategy.

Citizens as customers in Tel Aviv

Local governments can and should play an integral role in the development and growth of a smart city. A key component of this success is the positioning of residents as central to the city government's function and design. Hyperconnected cities like Tel Aviv are using smart new strategies for engaging and building trust among residents.

We spoke with Zohar Sharon, Tel Aviv's Chief Knowledge Officer, to understand the story of smart technology within Tel Aviv's City Hall and its impact on resident satisfaction overall. We identified three major elements of Tel Aviv's success as a smart city: a citizen-centric focus, knowledge management, and data-driven digital pushes.

More than a decade ago, Tel Aviv started thinking about information management and inefficiencies in its organizational structure. The city's governmental departments were siloed, with each department responsible for its own knowledge, data management, and public information. As Tel Aviv's Chief Knowledge Officer, Zohar Sharon, described, "when you are managing a public organization, you have so many silos, so many departments, so many units, so many managers, so many workers, and when you want to talk about and provide a citizen-centric approach, you have a problem. Because each one of these departments is working with its own staff, its own target audience."

One primary challenge that the City identified was the design of its website. Similar to the departments themselves, the City's website was segregated by department, making it clunky and difficult for residents to navigate.

With a shift in perspective, the City was able to build an entirely new website, this time with the focus on the customer, or citizen. A crucial piece of this transition was getting City Hall employees to think like citizens again. Working across departments to identify necessary information from the perspective of the citizen, the City was able to create a citizen-centric, integrated website able to anticipate all of its customers' needs.



> "One of the phrases that is very popular in Tel Aviv is 'What is the customer's story?' Think about it. We are a public organization. We are talking about our citizens as customers. […] You have to teach the workers, the people who are giving service, that this person who is sitting here is not a citizen, he's a customer.
>
> - Zohar Sharon, Chief Knowledge Officer, Tel Aviv

Citizens as customers in Tel Aviv

Knowledge management

Another element of getting the right information to the right customer in Tel Aviv involves knowledge management. Similar to the City's website, the City's information call center, like 311 in the United States, was managed by individual departments, making responses individualized rather than standardized, increasing confusion for the citizen caller.

The City, with its new citizen-centric focus, built a series of code scripts in order to automate the call center responses and institutionalize knowledge within the departments.

This public knowledge is maintained by a group of volunteer knowledge champions within city government. "The knowledge champions are workers from all of the departments. They are putting information into the knowledge management system and for digital and for the website, from their department. But they are doing it in addition to their job," says Sharon.

The knowledge champions are essential to the management and dissemination of accurate, timely, and standardized public information in Tel Aviv.

Digital push not pull

With all of these improvements to City communications, City officials were shocked to find, in a series of public focus groups, that residents were still dissatisfied with City Hall. They identified a major driver of this dissatisfaction coming from pull communications (i.e., residents needing to seek out information on their own). As a result of these findings, the city established DigiTel, or the Digital Residents' Club–a loyalty club for the residents of Tel Aviv.

A resident registered with DigiTel now gets push notifications personalized to their specific needs by sharing limited personal data. The city uses residents' geographic and demographic information to send tailored push alerts to the public, for anything from street construction to daycare registration information.

These city-wide shifts to smart technology and data-driven public outreach have engaged Tel Aviv's residents and have strengthened trust in City Hall.

> The ROI is in the satisfaction level of the residents. Our model is built on building a better life in the City and increasing the satisfaction level of the residents.
>
> - Liora Shechter, Chief Information Officer, Tel Aviv

DigiTel Users by the Numbers in Tel Aviv

200K registered DigiTel users	**300-400** knowledge champions
4,000 311 call scripts	**>70%** of citizens using DigiTel

> [Digital pushes are] a huge benefit for [citizens]. They're saying 'wow, City Hall is thinking about me and my family. Not just getting taxes from me. But my taxes now are giving me something huge, and I understand why I am paying.'
>
> - Zohar Sharon, Chief Knowledge Officer, Tel Aviv

Universal High-speed Connections



Expand Newark's internet connectivity by extending affordable broadband access to the entire City.



Set an ambitious goal – all Newark residents will have access to affordable high-speed internet access.



Build on existing fiber and future 5g connections, to ensure that all citizens, businesses and organizations can easily access the internet to learn, work, and engage with the City.



Leverage stimulus dollars and infrastructure funding to complete the fiber system.



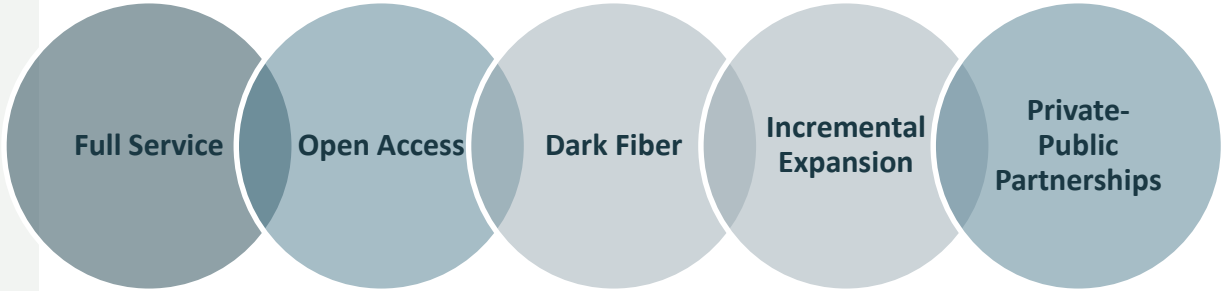
Create incentives and partnerships for private IOT and internet providers to create and leverage the connections.

Universal Connections Implementation

Map	Conduct	Enable	Create	Identify
Map existing system and inventory current fiber connections, hotspots and private connections to identify gaps in services.	Conduct gap analysis and work with schools and employers to better understand gaps and needs that were identified during LAH and WAH experiences in COVID-19 crisis.	Build out core infrastructure needed to enable universal connections, leveraging state and federal infrastructure support.	Create incentives for private provision and support of affordable internet service, with goal of free high-speed access for all Newark residents.	Identify hardware and training needs and work with vendors and higher ed institutions to meet community economic and educational needs.

Municipal Fiber Networks

Local communities are investing in municipal fiber networks to provide citizens and businesses with quality broadband at low costs, sparking regional innovation, and jumpstarting economic development. Local governments follow different approaches to implementing fiber networks in the face of challenges such as management and large upfront costs.



Utah's Open Access Network

A consortium of 16 Utah cities formed the Utah Telecommunications Open Infrastructure Agency Network (UTOPIA) to build municipal fiber infrastructures and lease the fiber to local ISPs that compete for subscribers on a common, subsidized infrastructure. The $7.2 million bond needed to finance the project was secured by using resident sales tax pledges as collateral. Subscribing residents pay approximately $65 for 250-megabit internet, of which $35 goes to the service provider and $30 goes to UTOPIA to recoup costs. The consortium cites used their collective bond ratings and taxing authority to secure a low-interest rate.

The competition from the open-access network has improved local services, brought more jobs to the Utah communities, has increased property values, and provides equitable and inexpensive access to high-speed internet and services.

Chattanooga's Full-Service Fiber Network

Chattanooga, TN acts as the internet service provider (ISP), delivering internet directly to households and businesses through the public Electric Power Board of Chattanooga (EPB). The city loaned the funding needed to EPB and all profits generated by EPB go to loan repayment. In 2009, EPB received a $111 million grant from the Department of Energy which helped complete its 10-year deployment in less than 3 years.

The mission of the broadband project was to spur economic development and create a local tech scene. Chattanooga succeeds in their pursuit; an independent study found that the EBD network directly led to the creation of 2,800-5,200 jobs and earned the city close to $1 billion.



Municipal Fiber Networks

Amsterdam's Private-Public Partnership

Amsterdam, Netherlands's Citynet fiber network is controlled by Glasvezelnet Amsterdam CV (GNA), a public-private partnership. Investors, including the Amsterdam municipality, each invested a third of the money needed for funding and debt service in exchange for a stake in the company.

Amsterdam removed the natural monopoly that arises from private fiber networks and benefits from the cost savings of running City institutions on the network. The City has become a hub for information communications technology (ICT) and has attracted large companies such as Cisco.

Santa Monica's Incremental Expansion

Santa Monica, CA's Information System's Department runs City Net, the municipal fiber network. City Net deployed the fiber infrastructure to key public organizations and then expanded the networks to large businesses by leasing dark fiber. To meet the needs of smaller firms, City Net connected to a carrier hotel and developed a model for connecting subscribers where businesses cover the installation costs of expanding the network and in return, receive better rates. Eventually, City Net offered lit services to residents by bundling subscribers for ISPs.

The goal of the project was to save the money spent on leasing lines from private providers. The initial $530,000 fiber investment resulted in a savings of $700,000 annually and profits were reinvested in expanding the network to business and residents.



Stockholm's Dark Fiber

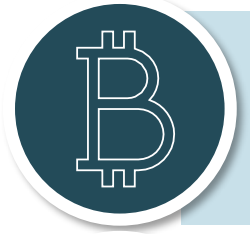
Stockholm, Sweden's municipality-owned Stokab built fiber capability throughout the city and leases the infrastructure to ISPs who are responsible for activating and running the network. The City of Stockholm owns Stokab through a holding company which was only directly financed by taxpayer money to cover incorporation fees. The network was financed by loans backed by the city.

Stokab started in 1994 and started to see positive cash flows by 1998. The city leverages the connectivity to launch e-services, increase the efficiency of services, and reduce public services costs. Stockholm has become a tech-hub, praised for its state-of-the-art telecom infrastructure and its business-friendly environment.

Create a City Innovation Hub



Most leading smart cities have created something like a city innovation hub, which serves as the coordinator of smart city initiatives and its interaction with private companies seeking to work with and in the city on smart solutions.



Newark has an opportunity to create a unique public-private-institutional model with the City, Invest Newark, NJIT, and private entrepreneurs.



The Hub Provides Two Functions

1 Conduit and connector for engaging private providers and the city government, identifying problems and opportunities where an innovative solution can provide value to the government and the City.

2 Economic development engine, by providing a venue or incubator function for growing and developing companies and helps reduce the risk for the private partner in their engagement with the City.



This is a great opportunity for Newark to serve as a test ground for new solutions, leveraging its location within the NY metro area but its smaller, more manageable size.

Innovation Hub Implementation

Plan

Create a planning team, starting with Mayor's office, OIT, NJIT, and Invest Newark, to build out the Innovation Hub model, with a focus on leadership, initial funding model, and long-term financial stability.

Engage

Engage private providers for feedback and input into the model, to identify potential obstacles and barriers, as well as the incentives for companies to participate.

Create

Create an entrepreneurs' forum focused on encouraging and supporting Newark-born companies with incubator-like programming and workspaces.

Focus

Focus efforts on companies that can help support other elements of the Connected Newark Strategy including increased citizen connections, data management and security, and economic opportunity.

Building Innovative Smart Cities

Local governments must be involved in facilitating innovation to build a more efficient, streamlined, and connected city. However, this involvement can take many forms. Whether achieved through embedded innovation-focused organizations, public-private partnerships, or alternative methods, forming an innovation hub requires know-how and an open mind to the paths that other successful cities have taken.

Embedded Innovation

Boston's Mayor's Office of New Urban Mechanics (MONUM), a department located in City Hall, was formed in 2010 and serves as the city's "Research and Design Lab". They cover issues including civic engagement, racial equity, city infrastructure, and education. MONUM works through experimentation; they ask a question, identify a need, sometimes partner with a private sector actor, and run an experiment. If the experiment works and looks promising, they partner with local government departments to make it a permanent service. Building Smart Streets, connecting citizens to their city through widely-used apps, and even building infrastructure for autonomous cars are only a handful of the projects MONUM has undertaken.

Public-Private Partnerships

Pittsburgh's city government works closely with private companies to experiment with novel and creative ways to improve city life. PGH Lab, an initiative of the Department of Innovation and Performance, connects the City government with promising startups in the private sector. PGH Lab's programs run annually, the first of which began in August 2016. Startups apply to PGH Lab for a four-month pilot project which "tests beta-stage products and services to address a civic cause". Projects are chosen based on several criteria, including their degree of innovation and feasibility, as well as the potential benefits to the City and its citizens. PGH Lab connects successful proposers with government resources, mentors, and alumni networks to implement their ideas.



Data-Driven Innovation

New and exciting technologies that expand the scope of data gathering and analysis available to cities are valuable, and sometimes critical, to implementing innovative urban initiatives. For example, The City of Boston works with Verizon to collect anonymous traffic data through sensors and cameras at important intersections and uses this information to design smarter, safer streets for pedestrians and vehicles alike. Furthermore, partnerships between research institutions and local governments, like the Urban Center for Computation and Data (UrbanCCD) and the City of Chicago, have led to the development of wide-reaching databases with accessible information on city living. UrbanCCD's partnerships have also led to the creation of powerful tools, like Array of Things (AoT), a network of interactive, modular sensor boxes that collect real-time data on a city's environment, infrastructure, and activity for public use.

Focus on Resilience

Build on COVID Lessons

Build on lessons learned during the COVID-19 crisis to create a more resilient city technology system.

Data Management

Create a city data management system and strategy to better manage and leverage the data that the City collects.

Value of Data

Understand the value of city data and develop strategies to utilize and monetize the system to help fund Connected Newark initiatives

Service Continuity

Increase the flexibility and mobility of city systems to ensure service continuity under a wide range of circumstances.

Learning from Las Vegas

An Innovative Approach to Partnering Through Pilots

Instead of issuing traditional RFPs, Las Vegas has established a pilot system in which companies work with the City to develop products that meet its needs. An innovation district in the downtown area serves as a testing ground for these projects. By establishing a working relationship early in the process, the municipality and participating companies jointly benefit from a product that ultimately serves the needs of both and offers new approaches to universal problems.

A park safety pilot application

Tracking park activity with remote sensors

Traditional park patrol models are based on the idea that random patrol schedules deter criminal activity by making it difficult for wrongdoers to predict where and when patrols will take place. While this is the case, data about which parks are most actively used will help the parks' agency maintain a stronger, more targeted presence at those locations, rather than expending resources at parks that are less frequently visited.

Remote optical and auditory sensors allow officers to monitor multiple locations simultaneously, rather than having to follow a typical random patrol model. In addition to its safety benefits to the public and to officers, this system can support park maintenance by identifying areas of attention for trash removal and facility cleaning, based on which sites are mostly actively used and when.

To ensure data privacy and develop a more complete picture of conditions, the pilot program is experimenting with infrared technology (rather than traditional imaging) as well as sound monitors to detect elevated voices, glass breakage, and potential gunshots.



A mutually-rewarding partnership

Las Vegas's pilot projects allow the City to make data-driven decisions rather than relying on perceived need. By developing partnerships with tech companies early in the process, the municipality can play a more active role in developing smart city solutions.

Closer collaboration benefits partners as well. By allowing them to work through issues as part of an iterative process, these companies can gain experience working with a city government.

Las Vegas also hopes that such partnerships will allow it to continue to attract companies to the area and to build a technology-ready workforce, developing local talent to serve future demand.

Learning from Las Vegas

Improving Safety Through Wrong-way Driving Detection

Rather than investing in safety improvements only after collisions have occurred, Las Vegas has deployed a driving detection pilot that collects information about near collisions associated with wrong-way driving. It then can proactively invest in interventions that will discourage this behavior.

Launched in August 2019 through a partnership with NTT and Dell, this pilot program has already revealed higher levels of wrong-way driving than was anticipated, with incidents reaching 30 to 40 cars per week. This has led to a decision to increase signage on one-way streets as an initial measure, one that has made a difference but not resolved the problem entirely.

Because the technology in place uses sensors to capture more detailed information than has been available in the past, the City can make changes to prevent traffic accidents before they occur, including signage, road striping, and signalized intersections. As it continues to collect data, the municipality will be able to learn more about which types of intervention are the most effective in preventing wrong-way driving.

Wrong-way driving is of particular concern because it is associated with much higher fatality rates than crashes as a whole. In addition, 60% of wrong-way drivers involved in fatal collisions show signs of alcohol impairment, either through testing of blood alcohol levels or officer assessment.

The avoidance of even one of these fatal crashes can generate the following savings:

- ✓ **$902 in emergency services costs;**
- ✓ **$11,317 in medical costs;**
- ✓ **$5,720 in congestion costs;**
- ✓ **$11,212 in property damage;**
- ✓ **And, most importantly, the loss of a life, aggregating to a total of nearly $1.4 million in costs to society.**

> You're making capital purchase decisions based on **actionable data, not on a gut feel,** not because you just had one accident last week, but based on a multitude of data that you've collected to make a solid decision.
>
> - Michael Sherwood, CIO of Las Vegas



In the United States, there are about **360 deaths** associated with wrong-way driving crashes **each year**.



Wrong-way driving crashes have a **fatality rate of at least 12x (and up to 70x)** that of automobile crashes as a whole.

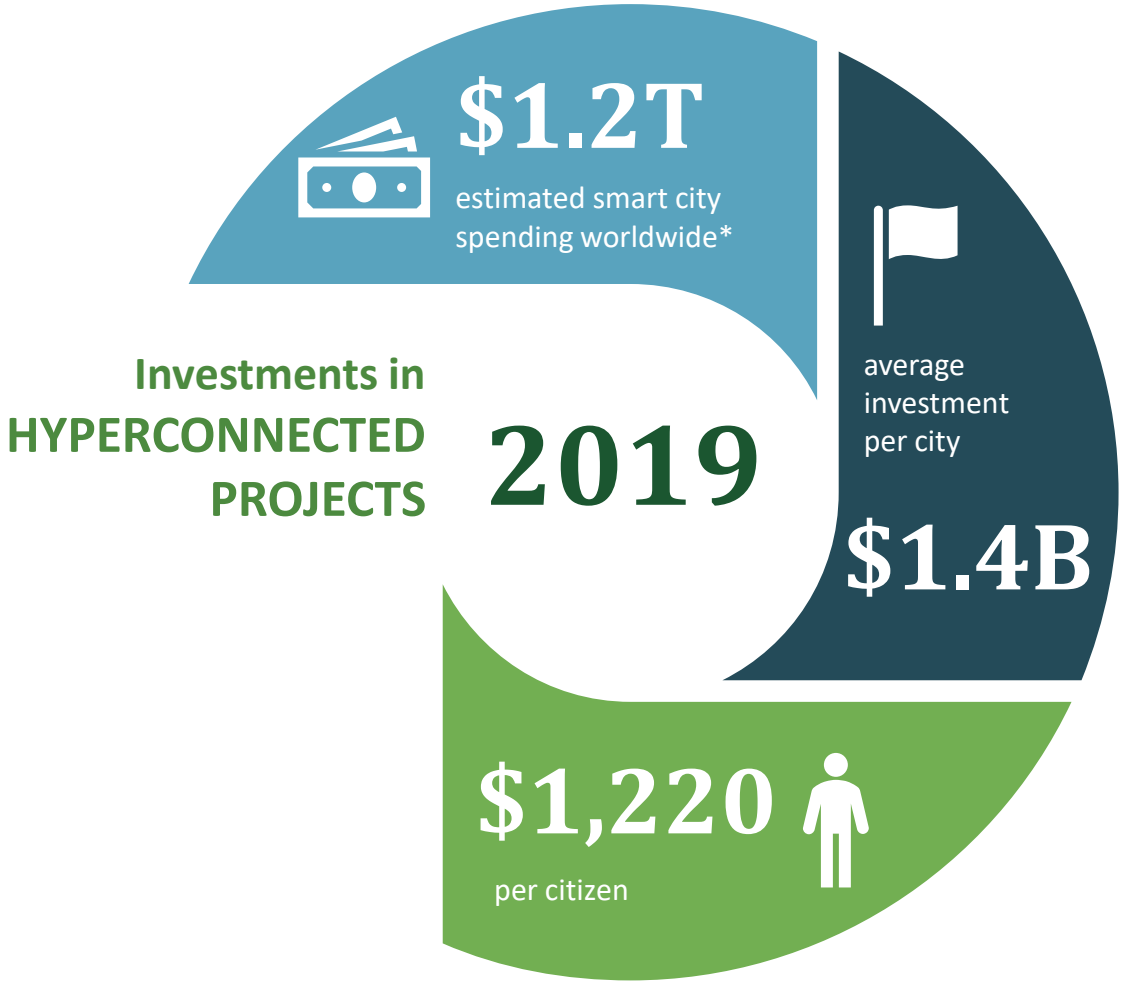
ROI of Connectivity

As we enter the Fourth Industrial Revolution, becoming a smart city is no longer enough.

To unlock the full economic, social, and business value from technology, cities need to morph into hyperconnected urban centers. Such cities use the latest technologies to transform and interconnect key areas of their ecosystem—from roads to cars, buildings to energy grids, and street lighting to police departments. Equally important, they interlink and engage government, business, academia, and people, and even other cities. By aligning urban assets and players, city leaders can fuel a virtuous cycle of economic, business, and social gains.

The hyperconnected multiplier effect

According to ESI ThoughtLab research, the average return on investments in connected initiatives ranges from 3% to 4%. As cities become more interlinked, their ROI grows: cities just starting out realize a lower return than those further along. Implementers see a return of 1.8%, while advancers gain 2.6% and hyperconnected leaders get a 5% boost. These percentages can translate into huge dollar amounts. The average city can unlock $45 million in returns—which range from $19.6 million for implementers to $40 million for advancers and $83 million for hyperconnected leaders. This is on top of the sizable social, quality of life, health, and environmental benefits. Technavio estimates that the worldwide market for smart city project investment is $1.2 trillion, so if all cities move to become hyperconnected, they could generate a return of $40 billion, with the impact increasing to as high as $60 billion if all cities were to become hyperconnected leaders.



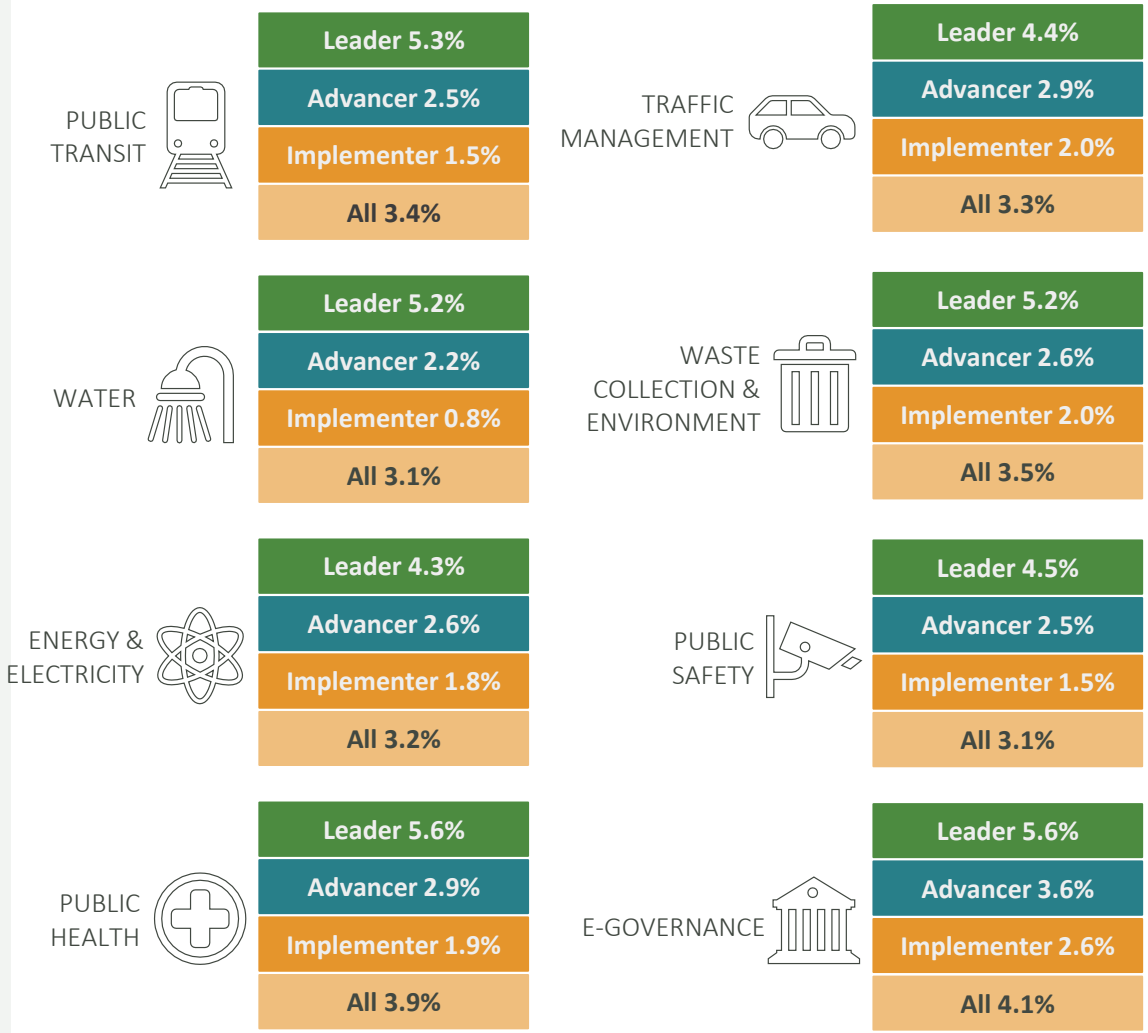
Connected Cities Boost ROI Across Urban Areas

Hyperconnected cities generate returns from their investments through quantifiable economic, social, and environmental benefits.

2-3x increase in ROI as cities move from implementers to leaders

43% of cities that would invest in a project with only social benefits

38% of cities gain intangible benefits that are not in ROI measurements



Hyperconnected Streetlights

Georgia Power is Expanding the State's Smart LED Lighting Network

One of the core foundational elements for many cities looking to transition into a smart city is the adoption of hyperconnected streetlights. At base level, these streetlights are equipped with LED lights with the ability to communicate through a centralized network, allowing cities to monitor the individual characteristics (luminosity, color, energy usage) of each streetlight, which leads to major energy costs savings. Beyond this, however, these connected streetlights serve as the backbone of smart city infrastructure, providing the base infrastructure for 5G and IoT technologies.

Providing the baseline for smart city infrastructure

Georgia Power is the primary provider of electricity in Georgia and has the largest penetration of LEDs of any utility company in the world. Altogether, Georgia Power operates a system of nearly 500,000 LEDs, of which 300,000 are connected to an internal control system.

The internal controls allow Georgia Power to monitor each individual LED, providing the company with precise readings of different characteristics of each diode, including luminosity and color. These smart streetlights also can auto-adjust their energy usage based on integrated motion sensors.

Beyond providing advanced lighting capabilities to cities, hyperconnected streetlights work well in conjunction with other technology because the lighting system is already centrally connected. This allows the streetlights to act as a type of hyperconnected mount for an array of different peripheral attachments such as 5G antennas, motion and environmental sensors, and integrated camera surveillance and monitoring systems.

Justin Harmond, the Operations Manager of Lighting & Smart Services at Georgia Power, emphasizes the importance of working towards a hyperconnected system: "We've been in the smart city space for a long time now, just with the connected lighting. ***That's the baseline for a smart city."***



Over **35** separate cities surrounding the Atlanta metro area have replaced their old streetlights with connected LEDs



Georgia Power has the largest penetration of LEDs of any single utility in the world



More than just a Lightbulb

Georgia Power's connected system of streetlights allows various municipal governments throughout the state to establish the core smart city functionalities:

The linkage of the streetlights to a central system allows Georgia Power to immediately diagnose and respond to a problem any individual unit might have.

Georgia Power acts as "a real estate company for [their] poles", allowing telecoms to set up 4G and 5G infrastructure, thereby providing the backbone for many smart city technologies.

SiteView, a camera system which can be embedded into the streetlight, allows municipalities to monitor and detect crime.

Georgia Power plans to include intelligent nodes in their poles. These nodes would help to provide a variety of services including real-time emergency response, collection of traffic patterns for transportation planners, and provision of smart parking functionality through a consumer app.

Harmond explains that while switching from incandescent bulbs to LEDs saves money on energy costs, the increased capital costs largely offset those savings. However, since Georgia Power's LEDs are connected, the utility can closely monitor each set of diodes and quickly diagnose any problems as they arise.

The ability to monitor each set of LEDs in the system also allows for nearly complete control of asset management.

Georgia Power knows the exact location of each of their connected LEDs. Harmond provides an example: "Say a car hits a pole in the middle of the night, a distribution crew could change it out and not put the light back up. We would then be billing [the city] for more lights than they have. Thanks to connected lighting, we now know when lights are not reporting back in so we can reduce billing errors which were previously caught by inspections. We also know exactly where every light is so these costly inspections have been drastically reduced." In this way, smart streetlights not only increase energy efficiency and enable future technology deployment, they also create management efficiencies for the utility and City alike.

Smart Lighting by the numbers At Georgia Power

1M
network of regulated and unregulated lights

60%
of LEDs connected to a central monitoring system

$3.7M
annual savings on electricity

90%
less energy used than standard incandescent bulbs

Cities in the Atlanta Metro Area use hyperconnected streetlights to detect crime in real time

In 2017, Brookhaven, a suburb northeast of Atlanta, became the first municipality to install SiteView, a surveillance system embedded into the existing connected lighting infrastructure. SiteView includes a connected system of cameras and license plate readers (LPRs) that allow local law enforcement to better detect and deter crime.

Since adapting SiteView, 44 LPRs have read over 57 million tags, helping Brookhaven police identify over 25,000 stolen vehicles and over 400,000 cars with suspended vehicle registrations. SiteView has also helped locate 8,600 wanted persons and, in January 2019, was crucial to an undercover investigation looking into child exploitation and computer crimes, in which police arrested 21 people in a span of five days.

Beyond typical law enforcement applications, SiteView is also used by homeowners' associations to monitor people entering and leaving their subdivision.



Connected City: Next Steps

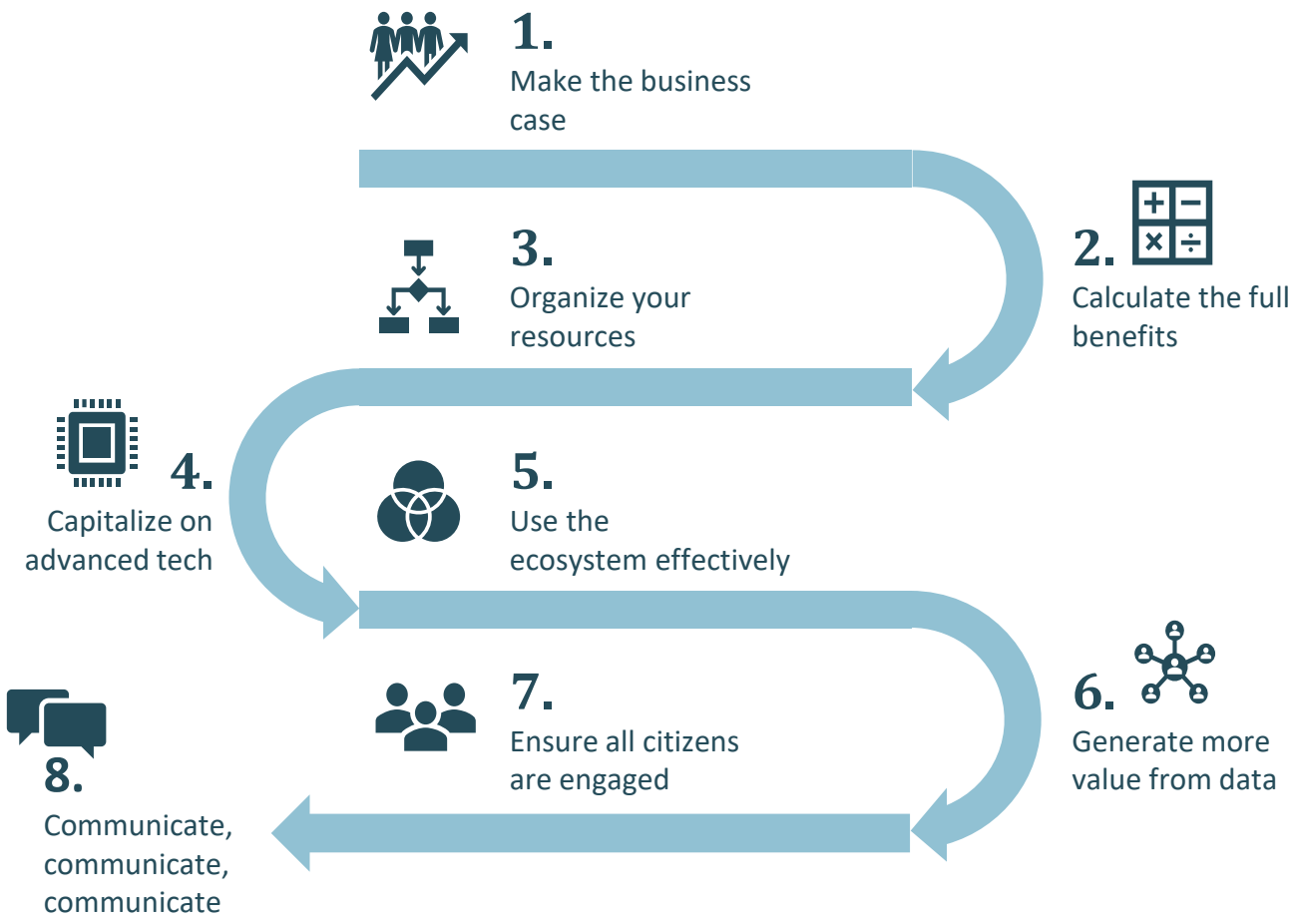
Roadmap to Hyperconnectivity
ROI of Connected Initiatives
Funding Smart City Initiatives

ESI ECONSULT SOLUTIONS INC.
economics | strategy | insight

The roadmap that leaders follow

Becoming a connected city requires a clear roadmap based on eight best practices followed by leaders as determined by ESI research of 100 cities around the world:

1. **Make the business case**, and continuously monitor performance, analyzing ROI systematically with the right metrics.
2. **Calculate the full benefits** to the City and residents, including societal, business, economic, and environmental benefits.
3. **Organize your resources**, with a largely centralized department, and use both internal and external staff to operate Newark's connected city programs.
4. **Capitalize on advanced technologies**—particularly various forms of AI—but bear in mind the importance of cybersecurity.
5. **Use the ecosystem effectively**, partnering with business and academia, but keeping crucial development and implementation tasks in-house.
6. **Generate more value from data** by gathering, integrating, and monetizing it, but in a responsible way, and sharing it with stakeholders as appropriate.
7. **Ensure all citizens are engaged and connected**, seeking input from stakeholders, and reaching out to disadvantaged populations.
8. **Communicate, communicate, communicate.** Tell your story – over and over again.



A Newark implementation roadmap

Recommendation	Description	Responsible	Process	Tangible Action Items
Establish Newark Innovation Hub	Public-private partnership platform to accelerate the development of new smart city applications and businesses in Newark. Big picture goals – establish Newark as a leading center in the development of smart city technologies and companies and impact the quality of City services and sustainability.	Led by NJII, in partnership with Office of Strategy Innovation and Investment and Invest Newark	• Identify working team from NJII to buildout business plan for Innovation Hub platform • Identify city department and community organization champions to work with on innovation strategies • Establish data ownership and governance regulations to allow for partnerships with private businesses and entrepreneurs.	• Establish office and accelerator space in key communities and neighborhoods to support Innovation Hub activities, with free or greatly reduced rent for small businesses and community organization efforts supported by market-rate rents by larger partners. • Identify potential private partners willing to engage early in the development and support of the Innovation Hub. Examples could include NTT Data, Panasonic, Cambridge Innovation Center.
Create Citizen Advisory Committee	City builds on its excellent citizen engagement efforts to create a Citizen Advisory Committee to provide input on Connected City strategies and serve as a connection to community groups and leadership.	Citizen Advisory Committee will be convened by the Office of Strategy, Innovation and Investment. Partner with NJII on training and workforce strategies.	• Create internal city leadership team under guidance of OSII, including key departments. • Invite key community partners to nominate representatives for advisory committee • Convene first meeting of advisory committee by end of 2020. • Establish schedule for bi-annual meetings	• Increase awareness of current City technology efforts • Review, assess, and upgrade Newark Connect App with citizen input, particularly in light of use during COVID crisis. Focus on 2-way communication with Citizens and community groups • Establish outreach and promotion plan to increase citizen use and adoption of Newark Connect App • Build strategies for utilizing expanded access (due to COVID) of Chromebooks for family computer literacy and workforce training.

A Newark implementation roadmap

Recommendation	Description	Responsible	Process	Tangible Action Items

Universal, Affordable High-Speed Access for Newark residents	Building on the existing Newark Fiber, Kiosks, and efforts undertaken during the COVID crisis, complete the fiber network by EOY 2022 to ensure affordable high-speed access for all Newark residents and businesses.
	
	Use revenue from private fiber access to support citizen access and Innovation Hub activities.
		Invest Newark will continue to lead the high-speed expansion efforts, partnering with the City, the State, and private internet and wireless providers.	• Invest Newark and NJII work to identify potential funding strategies to complete funding network
			• Develop immediate funding strategies (CARES act funding, state and federal stimulus, philanthropy partners) to find $3 million to build out fiber network.
			• Develop long-term sustainability model to support funding strategies, including license payments from 5g and cable companies, airport Wi-Fi-like advertising model and others
			• Develop an internet masterplan that is focused on closing the digital divide
			• Undertake an inventory of micro assets (roof tops, closets, rooms, telephone poles) that can be made available to the private sector.
				• Short term – work with local internet/cable/phone companies and philanthropy to provide affordable internet access to all neighborhoods, with key access points in community centers and government buildings
				• Long-term – identify funding strategy to build out fiber. Options:
				  • Set up a municipal broadband authority
				  • Bond against future revenue growth
				  • Wi-Fi Airport advertising model
				  • Lease fiber to private users
				  • Issue an RFI to the private sector for creative ways to use the micro assets to provide low-cost internet to low-income residents

Newark Connected Pilot Program	Build out a pilot project process, guided by Citizen Advisory Committee and Innovation Hub leadership to select and review pilots	Led by Office of Strategy Innovation and Investment, with support from Innovation Hub team	• Work with Citizen Advisory Committee and city department champions to identify city needs and opportunities for new technology investments
			• Work with Invest Newark and NJEDA to identify potential partners
			• Develop revenue and intellectual property sharing model to provide for sustainable revenue streams and support of initiatives.
				• Develop a promotion strategy for engaging smart city vendors to partner with Newark on pilot projects, highlighting current successful programs and interest in future
				• Draft a call for partners and pilot projects to jumpstart new partnerships and investments.
				• Identify 3 pilot projects to be in place by 2022. Potential early focus areas:
				  ○ Digital payment technologies
				  ○ Connected streetlights

Funding For Smart City Initiatives

There are a variety of different funding options for cities looking to jumpstart Smart City initiatives.

- **Public Grants –** Many public sector grant opportunities are available for city governments looking to improve their municipality. For example, Pittsburgh has secured funding from the USDOT's yearly "Smart City Challenge", providing up to $40 million to the city with the most comprehensive and feasible plan to combine technology and transport. NSF grants can also be a viable public funding option, especially if city projects are developed in conjunction with universities and other research institutions.
- **Departmental Budgets –** Collaborating on Smart City Initiatives with related city departments provides opportunities to use already appropriated budgets to help fund innovative projects to improve city life. Boston's MONUM, for example, works closely with established departments to carry out its projects effectively.
- **Private Sector Funding –** MONUM and UrbanCCD have been able to secure funding for their projects from donors and foundations interested in and willing to invest in public projects.
- **Mix and Match –** Many Smart City initiatives combine different funding methods to achieve their goals.



Connected Newark, a *Hyperconnected Cities Study,* was completed by Econsult Solutions. To learn more, visit econsultsolutions.com.

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