Strategic Opportunity Analysis of the Global Smart City Market
Smart City Market is Likely to be Worth a Cumulative $1.565 Trillion by 2020
What is Smart City?

Smart cities are cities built on ‘Smart’ and ‘Intelligent’ solutions and technology that will lead to the adoption of at least 5 of the 8 following smart parameters—smart energy, smart building, smart mobility, smart healthcare, smart infrastructure, smart technology, smart governance and smart education, smart citizen.

Note: Smart Security is included as a part of Smart Infrastructure segment in this illustration.

Source: Frost & Sullivan
## Key Parameters that will Define a Smart City in 2020

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart energy</td>
<td>Smart energy uses digital technology through advanced meter infrastructure (AMI), distribution grid management, and high-voltage transmission systems, as well as for demand response for the intelligent and integrated transmission and distribution of power.</td>
</tr>
<tr>
<td>Smart building</td>
<td>Smart buildings are green, energy efficient, and intelligent, with advanced automated infrastructure that controls and manages aspects such as lighting and temperature, security, and energy consumption independently or with minimal human intervention.</td>
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<tr>
<td>Smart mobility</td>
<td>Smart mobility enables intelligent mobility through the use of innovative and integrated technologies and solutions, such as low emission cars and multimodal transport systems.</td>
</tr>
<tr>
<td>Smart technology</td>
<td>Smart technology will connect the home, office, mobile phone, and car on a single wireless IT platform. Smart technology includes adoption of a smart grid system, smart home solutions, a high-speed broadband connection, and roll-out of 4G technology.</td>
</tr>
<tr>
<td>Smart healthcare</td>
<td>Smart healthcare is the use of eHealth and mHealth systems and intelligent and connected medical devices. It also involves the implementation of policies that encourage health, wellness, and well-being for its citizens, in addition to health monitoring and diagnostics as opposed to treatment.</td>
</tr>
<tr>
<td>Smart infrastructure</td>
<td>Smart infrastructure includes intelligent and automated systems that manage, communicate with, and integrate into different types of intelligent infrastructure, such as energy grids, transportation networks, water and waste management systems, and telecommunications.</td>
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<tr>
<td>Smart governance and smart education</td>
<td>Smart governance and smart education includes policies and digital services from the government that help and support the adoption of green and intelligent solutions through incentives, subsidies, or other promotions.</td>
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<tr>
<td>Smart security</td>
<td>Smart security includes technology and solutions such as video surveillance, public safety LTE, and managed security services that are designed to protect people, property, and information.</td>
</tr>
<tr>
<td>Smart citizens</td>
<td>Smart citizens possess interest in embracing smart and green solutions in daily activities. More citizen proactivity is expected in adopting smart concepts and smart products, including lifestyle choices.</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
Understanding the Difference Between Smart City and Sustainable City

**Smart City**

- Smart cities are cities built on ‘Smart’ and ‘Intelligent’ solutions and technology that will lead to adoption of at least 5 of the 8 following smart parameters.
- As of 2011, there is no smart city; however, 26 smart cities are expected by 2025. Smart ‘projects’ within a city have been excluded in this count, as they do not apply to an entire city.

**Sustainable City**

- Sustainable cities are cities that are built on eco-friendly basis. These may not necessarily include ‘intelligent’ systems but are built more on an energy-efficient or environment-friendly objective.
- 92 sustainable cities are expected by 2025.

Image Source: Dreamstime
Source: Frost & Sullivan
A smart product is characterized by an intelligent sensing technology that is increasingly being integrated with Internet technologies, thereby allowing the product to react to and communicate with the changing environment around it. This leads to optimal operations and improvement in efficiency.

Image Source: Dreamstime and Connected Digital World
Source: Frost & Sullivan
### Key Parameters that will Define a Smart City in 2020

#### Smart Energy: Digital Management of Energy
- Smart grids
- Smart meters
- Intelligent energy storage

#### Smart Buildings: Automated Intelligent Buildings
- Building Automation
- Intelligent Buildings: Advanced HVAC, Lighting Equipment

#### Smart Mobility: Intelligent Mobility
- Advanced traffic management system (ATMS)
- Parking management
- ITS-enabled transportation pricing system

#### Smart Technology*: Seamless Connectivity
- 4G connectivity
- Super broadband
- Free Wi-Fi
- 1Gbps download speeds

#### Smart Infrastructure: Digital Management of Infrastructure
- Sensor networks
- Digital water and waste management

#### Smart Governance and Smart Education: Government-on-the-Go
- eGovernment
- eEducation
- Disaster management solutions

#### Smart Healthcare: Intelligent Healthcare Technology
- Use of eHealth and mHealth systems
- Intelligent and connected medical devices

#### Smart Citizen*: Civic Digital Natives
- Use of green mobility options
- Smart lifestyle choices

#### Smart Security: Next Generation 911
- Surveillance
- Biometrics
- Simulation modeling and crime protection
- C2 and response

*Smart citizen and smart technology are integrated and not covered separately in this analysis.

Source: Frost & Sullivan
Executive Summary—Global Smart Cities in 2025

More than 26 global cities will be smart cities in 2025, more than 50% of which will be from Europe and North America.

Select smart city projects* in 2025**
- Smart cities in 2025

*Smart City projects are city projects that are being trialled/implemented within a small-scale for a specific industry/public entity/industry cluster. e.g., The Buffalo (United States) Smart Education Initiative

**This list is not exhaustive. The cities highlighted here have implemented at least one of six smart city aspects in their smart city projects.

Source: Forbes Smart City List 2009; Innovation Cities Global Index 2012-2013; specific Smart Project Websites for each city; Frost & Sullivan
Executive Summary—Summary of Smart City Market

Smart cities are anticipated to create huge business opportunities with a market value of $1.565 trillion by 2020.

Smart City Market by Segments*, Global, 2012-2020

1. Smart Governance and Smart Education**
2. Smart Security
3. Smart Energy
4. Smart Infrastructure***
5. Smart Mobility
6. Smart Healthcare
7. Smart Building

Note: The graph represents the market share of each segment in the smart city market. For more information on smart city market sectors please refer to appendix.

*These numbers represent the entire smart solutions eco-system in each segment for both urban and non-urban panoramas.
**Smart Education includes eLearning services for schools, universities, enterprises, and government entities.
***Smart Infrastructure includes sensor networks and digital management of water utilities not included in other segments.

Source: Frost & Sullivan
Smart Convergence
Companies in the smart city space will not only partner and converge among themselves to offer ‘smart’ capabilities but would also start converging with different participants in the ecosystem.

Smart City Market: Convergence of Competition, Global, 2012–2025

Point of Convergence

Telecom Participants
- Broadband and Internet service providers
- Phone lines
- Mobile communications
- Networked IT services

Security
- Firewalls, Internet protocol security
- Physical implementation of systems and monitoring
- Managed and monitoring services
- Cloud-based services
- Identity management, smart cards

Energy and Infrastructure Participants
- T&D technology
- Power electronics
- Renewable energy
- Integrated distribution management
- Substation automation
- AMI-enabled metering

Automation and Building Control Participants
- Building automation
- Demand-side management
- Device connectivity
- Monitoring and sensing
- Smart grid integration

Source: Frost & Sullivan
**Case Study—Amsterdam Smart City**

IBM, Cisco, Accenture, Philips, Vodafone are coming together to power Amsterdam Smart City.

**Smart City Market: Highlights of Smart Projects and Developers, Amsterdam City, 2012**

**Projects**
- Ship to grid
- Energy management
- Fuel cell technology

**Project Developers**
- Vattenfall-Nuon
- Liander
- Cisco

**Projects**
- Almere Smart Society
- Online Portal
- Open network

**Project Developers**
- Vodafone
- Philips
- Cisco
- IBM

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Source: Amsterdamsmartcity.com; Frost & Sullivan
Smart governance and smart security includes rolling out of policies and digital services from the government that help and support adoption of green and intelligent solutions through incentives, subsidies, or other forms of promotional schemes.

**eGovernment**
- 100% rate of access to a full range of government services through digital technology
- eAdministration
- Online Transactions (eFiling of tax returns)

**eEducation**
- Virtual Classrooms
- Distance Learning
- Computer-based Training

**Security**
- 50% reduction in crime rate
- Urban Security
- Critical Infrastructure Protection
- ID Management
- Cyber Security

Image Source: Dreamstime
Source: Frost & Sullivan
Smart Citizen—The Digizens of the Future

Smart citizens possess interest to embrace smart and green solutions in their day-to-day work schedule. More proactiveness of citizens in adopting smart concepts and smart products, which includes making ‘smart’ lifestyle choices, is expected.

**Green Mobility**
At least 70% of citizens travelling to work by public transport, bicycle, or foot

**Initiative to Reduce Air Pollution**
At least 40% of citizens follow the city’s green action plan; at least 30% of citizens have taken initiative to reduce air pollution

**Smart Lifestyle Choices**
Recycling of Waste
Reduction of Energy Consumption
Preference for Eco-friendly Products and Services

Image Source: Dreamstime
Source: Frost & Sullivan
Executive Summary—Smart City Funding Mechanisms
Most services are financed by either the central government or the city itself.

Smart City Market: Most Adopted Funding Mechanisms for Smart City Projects*·2012

<table>
<thead>
<tr>
<th>Funding Mechanism</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special Development Funds</td>
<td>Specific funds set up for implementing and scaling up urban development or smart city initiatives (e.g., European Commission ‘JESSICA’)</td>
</tr>
<tr>
<td>Public-private Partnerships</td>
<td>Funded and operated through a partnership of government and one or more private sector companies (e.g., Cisco-Songdo Partnership)</td>
</tr>
<tr>
<td>Self-financing (majority)</td>
<td>Self-financing of smart city projects from public budgets in collaboration with central governments or state governments (e.g., Seoul Smart City)</td>
</tr>
<tr>
<td>Private Investment</td>
<td>Financed through commercial stakeholders, service providers, private investors, and venture capitalists (e.g., Amsterdam Smart City Platform)</td>
</tr>
</tbody>
</table>

*Based on a sample size of 15 smart city projects.
Source: Frost & Sullivan
Smart City Services—eService
More than 60% of citizens in smart cities will have full access to eServices by the next decade.

Smart City Market: Types of eServices Delivered to Citizens and Business, Global, 2012–2015

- Information sharing through Internet—information sharing can be between individuals, organizations or firmware (e.g., files sharing, eBooks sharing, etc.)

- Electronic health record system, telemedicine, consumer health informatics, healthcare information system, etc.

- Online currency exchange, online fund transfer, micro-payment and micro-commerce, etc.

- Online tax payment, online electronic passport system, eApplication, etc.

- Digitalized product stores, online customer management, online marketing, online order management, etc.

- Online banking payments, online bill payments, online credit card payment, online debit card payment, etc.

Source: Frost & Sullivan
## How to Measure Smart City Plans?
Factors describing the impact of smart city initiatives and potential scalability of ICT infrastructure serve as key efficiency monitors of current smart city plans.

### Smart City Scoring Criteria* Global, 2013

<table>
<thead>
<tr>
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<th>1</th>
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<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Efficiency</strong></td>
<td>CO₂ emissions (&lt;10%)</td>
<td>CO₂ emissions (10%–50%)</td>
<td>CO₂ emissions (&gt;50%)</td>
<td>Zero CO₂ emissions</td>
<td>Innovating to Zero</td>
</tr>
<tr>
<td><strong>Project Timeline</strong></td>
<td>More than 20 Years</td>
<td>Up to 20 Years</td>
<td>Up to 15 years</td>
<td>Up to 10 years</td>
<td>Up to 5 years</td>
</tr>
<tr>
<td><strong>Infrastructure Development</strong></td>
<td>Lesser possibility to link existing infrastructure</td>
<td>Medium possibility to link existing infrastructure</td>
<td>High possibility of linking existing infrastructure</td>
<td>Upgrading existing infrastructure</td>
<td>Building new infrastructure</td>
</tr>
<tr>
<td><strong>Technology Approach</strong></td>
<td>Secure, fast, and wireless technology</td>
<td>Cloud-based services/enterprise-grade platform</td>
<td>Open data central/holistic platforms</td>
<td>Better assimilation of data through predictive technologies</td>
<td>Fully networked, open and expandable ICT architecture</td>
</tr>
<tr>
<td><strong>Business Model</strong></td>
<td>Only public/only private investment</td>
<td>Contractor/vendor model</td>
<td>Private consortiums</td>
<td>Public-private partnerships</td>
<td>Open collaboration</td>
</tr>
<tr>
<td><strong>Governance Maturity</strong></td>
<td>Smart city vision</td>
<td>Smart city strategy</td>
<td>Dedicated organization</td>
<td>Smart city leadership</td>
<td>Smart city consortium</td>
</tr>
</tbody>
</table>

*Scorecard based on Guidance Document published by European Commission Initiative, Smart Cities and Communities. Source: Frost & Sullivan
Singapore—The Next-generation Smart City
Singapore aims to have 80% of all its buildings meet its minimum ‘Green Mark Certified’ energy efficiency standards by 2030.

Key Aspects of Singapore Smart City, Asia-Pacific, 2013

**Smart Energy**
- 90% to 95% of electricity generated from natural gas
- Smart grid systems installed in more than 30% of the households

**Smart Citizen**
- One in two residents to commute to work by public transport
- 100% population with access to sanitation
- Target to recycle 65% of waste by 2020

**Smart Healthcare**
- Integrated health information system across Singapore
- Cloud computing models used in most healthcare organizations

**Smart Governance**
Establishment of Inter-Ministerial Committee on Sustainable Development to create Singapore’s national strategy on sustainable development

**Smart Technology**
- 100% broadband penetration rate
- Initialization of 4G LTE service
- 50% of households to have smart home solutions

**Smart Buildings**
- 80% of all its buildings to meet its minimum ‘Green Mark Certified’ energy efficiency standards by 2030
- Zero energy buildings in the next five years

**Smart Mobility**
- 70% of traffic to be public transport by 2020
- Availability of real-time travel information on Internet and mobile phones
- 40% rebate on purchases of green vehicles, such as hybrid, electric cars, etc.

Source: Siemens’ Green Index; Frost & Sullivan
Smart Cities—Key Conclusions and Future Outlook
# Future of Technology

In next 10 years, technology advancement will lead to automation of nearly 150,000 electric utility substations and a $280 million investment in vehicle to building technology.

<table>
<thead>
<tr>
<th>Energy</th>
<th>Smart Homes</th>
<th>Building and Automation</th>
<th>Internet</th>
<th>Healthcare</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>Use of inductive charges, bio-enhanced fuels.</td>
<td>Smart appliances, such as Internet refrigerator, Internet air conditioner, next-generation microwave ovens will be used widely.</td>
<td>Depth imaging sensors, near-field communication, biometric sensors, and smart power meters will be used.</td>
<td>Increased use of cloud computing, cyber warfare, mesh networking, and 50% deployment of 4G is likely.</td>
</tr>
<tr>
<td></td>
<td>The advent of multi-segmented smart grids, photovoltaic glass, and piezoelectricity is anticipated by 2020.</td>
<td>Robots will play more active roles as replacements for living, breathing humans.</td>
<td>Convergence of ICT with BMSes and other systems within buildings will replace traditional networked devices, with ICT-enabled building devices.</td>
<td>Zero-size intelligence for computer chips, rise in computer chips powered by just 5 atoms, or just one atom, and launch of 5G are likely to propel the Internet era even further.</td>
</tr>
<tr>
<td>2020</td>
<td>Kinetic energy from walking or cycling will be used to power homes, offices, and cities.</td>
<td>Compact high performance urban housing with movable walls, and the use of wireless applications to control lighting and home security devices will be widely prevalent.</td>
<td>New low-carbon materials, smart and biomimetic materials are to be used in constructing buildings. This will reduce waste and counter resource scarcity.</td>
<td>End of digital divide—the gap between information haves and have-nots will narrow considerably.</td>
</tr>
</tbody>
</table>

Source: Futuretechnology500.com; IBM.com; bbc.com; Frost & Sullivan
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