# Reconceptualising Smart Cities:

## A Reference Framework for India

# Compendium of Resources

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CENTER FOR STUDY OF
SCIENCE, TECHNOLOGY & POLICY

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# Introduction

The purpose of this Compendium is to provide policy makers, academicians, industry and all other stakeholders interested in 'Smart Cities' a collection of different types of resources pertaining to smart cities. It is a supplementary resource document to CSTEP's report titled *Reconceptualising Smart Cities: A Reference Framework for India*, which contains resources collected between August 2014 and August 2015.

The main Report is available at: http://cstep.in/publications/reports/190

The Compendium consists of 3 parts, which have been colour-coded in the following manner:

Compendium 1: Smart City Definitions

Compendium 2: Sources of Indicators for Urban Areas

Compendium 3: Additional Resources

# Compendium 1: Smart City Definitions

This is a compilation of about a hundred different definitions of a 'Smart City' sourced from a range of literatures. This indicates the variety and differences that exist in the very concept of smart cities globally and the evolving nature of work/research in this domain. These definitions were further analysed to understand the varying focus laid on the notion of 'Smart City', which has been presented in the main [Report](#).

# Category: Academic

| Definition | Keywords |
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| A Smart Sustainable City is a city well performing in 6 characteristics, built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens. <br> 1. Economy <br> 2. Mobility <br> 3. Environment <br> 4. People <br> 5. Living <br> 6. Governance | Economic growth, Transport, Mobility, Environment, Standard of living, Governance |
| Giffinger, Rudolf, Et Al. "Smart Cities Ranking of European Medium-sized Cities." Centre of Regional Science, Vienna UT, Oct. 2007. Page 10. Web. <br> *Last Accessed 8 Feb. 2014.* <br> http://www.smart-cities.eu/download/smart_cities_final_report.pdf | |
| We believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance. | ICT, High quality of life, Natural resource management, Participatory governance, Transport infrastructure, Communication infrastructure, Economic growth, Sustainability |
| Meijer, Albert, and Manuel Pedro Rodríguez Bolívar. "Governing the Smart City: Scaling-Up the Search for Socio-Techno Synergy." T EGPA 2013 (Edinburgh, September) Permanent Study Group on E-Government, 2013, Web. *Last Accessed 8 Feb. 2014.* <br> https://www.scss.tcd.ie/disciplines/information_systems/egpa/docs/2013/BolivarMeijer.pdf | |
| The rudiments of what constitutes a Smart Sustainable City which we define as a city in which ICT is merged with traditional infrastructures, coordinated and integrated using new digital technologies. | Traditional infrastructure, ICT, Integrated infrastructure, Coordinated infrastructure, Digital technology |
| Batty, Michael, Kay Axhausen, , Giannotti Fosca, Alexei Pozdnoukhov, Armando Bazzani, Monica Wachowicz, Georgios Ouzounis, and Yuval Portugali . "CASA Working Paper 188 - Smart Cities of the Future." The Bartlett Centre for Advanced Spatial Analysis - UCL, 05 Oct. 2012. Web. <br> *Last Accessed 8 Feb. 2014.* <br> http://www.bartlett.ucl.ac.uk/casa/publications/working-paper-188 | |

**Academic**

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| Instead of striving for physical growth, today a city's success should be measured by how wisely it uses energy, water, and other resources, how well it maintains a high quality of life for its people, and how smart it is in building prosperity on a sustainable foundation. In short, cities have to become much smarter about how they use existing capacity and resources. | Wise use of resources, Quality of life, Sustainability |

Dixon, Michael J. "How Smart Cities Save Money (and the Planet)." Harvard Business Review. HBR Blog Network, 29 Oct. 2012. Web. *Last Accessed 8 Feb. 2014.*
http://blogs.hbr.org/cs/2012/10/tech-savvy_cities_are_saving_m.html

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| The Cellular City Compact, diverse, walkable and attractive cities are a luxury, but they should not be. The City Science Initiative at the MIT Media Lab is exploring technologies to help develop cities that facilitate the creation of desirable urban features, such as shared electric vehicles, adaptable living environments, and flexible work spaces.<br><br>Our goal is to design urban cells that are compact enough to be walk able and foster casual interactions, without sacrificing connectivity to their larger urban surroundings. These cells must be sufficiently autonomous and provide resiliency, consistent functionality, and elegant urban design. Most importantly, the cellular city must be highly adaptable so it can respond dynamically to changes in the structure of its economic and social activities. | Urban, Technology, Desirable features, Shared electric vehicles, Adaptable living environments, Flexible work places<br><br>Compact urban cells, Elegant design<br><br>Connected, Autonomous, Adaptable, Dynamic |

"About City Science." MIT Cities. Massachusetts Institute of Technology, 2012. Web.
*Last Accessed 8 Feb. 2014.*
http://cities.media.mit.edu/about/cellular-city

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| Tracing the genealogy of the word smart in the label Smart Sustainable City can contribute to an understanding of how the term smart is being loaded. In marketing language, smartness is cantered on a user perspective. Because of the need for appeal to a broader base of community members, smart serves better than the more elitist term intelligent. Smart is more user-friendly than intelligent, which is limited to having a quick mind and being responsive to feedback. Smart Sustainable City is required to adapt itself to the user needs and to provide customized interfaces. | User perspective, User-friendly, Responsive, Adaptability |

Nam, Taewoo, and Theresa A. Pardo. "Conceptualizing Smart City with Dimensions of Technology, People, and Institutions." The Proceedings of the 12th Annual International Conference on Digital Government Research, June 2011. *Last Accessed 8 Feb. 2014.*
http://www.ctg.albany.edu/publications/journals/dgo_2011_smartcity/dgo_2011_smartcity.pdf

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| A city that monitors and integrates conditions of all of its critical infrastructures including roads, bridges, tunnels, rails, subways, airports, sea-ports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens. | Integrated infrastructure, Resource optimisation, Preventive maintenance, Monitors security, Maximised services |
| R.E., Hall, Bowerman B, Braverman J, Taylor J, Todosow H, and Von Wimmersperg, U. "The Vision of a Smart City." SciTech Connect: U.S. Department of Energy. Office of Scientific and Technical Information (OSTI), 28 Sept. 2009. Web. *Last Accessed 8 Feb. 2014.* http://www.osti.gov/scitech/servlets/purl/773961 | |
| The term Smart City is not used in a holistic way but with reference to various aspects which range from ICT districts to smart inhabitants in terms of their educational level. In addition, the term often refers to the relation between city government and citizens (e.g., good governance or smart governance). There is often a strong reference to the use of modern technology in everyday urban life, which includes innovative transport systems, infrastructures and logistics as well as green and efficient energy systems. Additional 'soft factors' connected to urban life for a Smart City include: participation, security/safety, cultural heritage. In conclusion, the literature review reveals the following main dimensions (or clusters of aspects): Smart Governance (related to participation); Smart Human Capital (related to people); Smart Environment (related to natural resources); Smart Living (related to the quality of life) and Smart Economy (related to competitiveness). | Living, Governance, Economy, Infrastructure, ICT, Citizens, Transport, Energy, Urban life |
| Lombardi, Patrizia. "New Challenges in the Evaluation of Smart Cities." Network Industries Quarterly, Vol. 13, 2011. Web. *Last Accessed 8 Feb. 2014*. http://newsletter.epfl.ch/mir/index.php?module=epflfiles&func=getFile&fid=241&inline=1 | |
| "The 'eco-cities' theme does not stand alone but is situated in a complex array of relevant variations of sustainable development, sustainable urban development, sustainable communities, bioregionalism, community economic development, appropriate technology, social ecology, green movement." | Ecology, Technology, Communities |
| Roseland, Mark. "Dimensions of the Eco-city." Dimensions of the Eco-city. Pergamon, Aug. 1997. Web. *Last Accessed 8 Feb. 2014*. http://www.sze.hu/fk/kornyezet/Cikkek2/Dimensions-of-the-eco-city_1997_Cities.pdf | |

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| A sustainable city is one in which its people and businesses continuously endeavour to improve their natural, built and cultural environments at neighbourhood and regional levels, whilst working in ways which always support the goal of global sustainable development. | Business, Natural environment, Built environment, Cultural environment |
| G, Haughton, and Hunter C. Sustainable Cities. London: Jessica Kingsley and Regional Studies Association, 1994. Web. http://www.civ.utoronto.ca/sir/ | |
| We say that a sustainable city is one in which the community has agreed on a set of sustainability principles and has further agreed to pursue their attainment. These principles should provide the citizenry with a good quality of life, in a liveable city, with affordable education, healthcare, housing, and transportation. | Quality of Life, Lovable city, Education, Healthcare, Housing |
| Munier, Nolberto. "Handbook on Urban Sustainability." Springer, 2007. Web. *Las Accessed Feb. 15, 2014*. http://www.springer.com/environment/environmental%2Bmanagement/book/978-1-4020-5350-4 | |
| A sustainable city can broadly be defined as "one that has put in place action plans and policies that aim to ensure adequate resource availability and (re)utilization, social comfort and equity and economic development, and prosperity for future generations | Policies, Resource availability, Social comfort, Economic development, Future generations |
| Zhao, Jingzhu. "Towards Sustainable Cities in China." SpringerBriefs in Environmental Science. Springer, 2011. Page 2. Web. *Last Accessed 8 Feb. 2014*. http://link.springer.com/book/10.1007%2F978-1-4419-8243-8 | |
| A sustainable city is one that relates its use of resources and its generation and disposal of wastes to the limits imposed on such activities by the planet and its organisms. | Resources, Waste, Planet, Organisms |
| Zhao, Jingzhu. "Towards Sustainable Cities in China." SpringerBriefs in Environmental Science. Springer, 2011. Page 2. Web. *Last Accessed 8 Feb. 2014*. http://link.springer.com/book/10.1007%2F978-1-4419-8243-8 | |
| The basic feature of a sustainable city can be characterized as: facilitating economical uses of resources by technological and environmental improvements, targeting economic development, wealth building, social progress, and ecological security, maintaining a balance among resources, environment, information, interflow of material of the inner–outer urban system, meeting a city's future needs based on a correct assessment, and satisfying the needs of urban development in the present. | Technology, Economic development, Wealth, Social progress, Resources, Information, Urban development |

**Academic**

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| Zhao, Jingzhu. "Towards Sustainable Cities in China." SpringerBriefs in Environmental Science. Springer, 2011. Page 3.Web. *Last Accessed 8 Feb. 2014.* http://link.springer.com/book/10.1007%2F978-1-4419-8243-8 | |
| Improving the quality of life in a city, including ecological, cultural, political, institutional, social, and economic components without leaving a burden on future generations. | Ecological, Cultural, Political, Institutional, Social, Economic |
| Zhao, Jingzhu. "Towards Sustainable Cities in China." SpringerBriefs in Environmental Science. Springer, 2011. Page 2. Web. *Last Accessed 8 Feb. 2014.* http://link.springer.com/book/10.1007%2F978-1-4419-8243-8 | |
| World Watch Institute considered that a city moving toward sustainability should improve public health and well-being, lower its environmental impacts, increasingly recycle its materials, and use energy with growing efficiency. | Public health, Materials, Recycle, Energy efficiency |
| Zhao, Jingzhu. "Towards Sustainable Cities in China." SpringerBriefs in Environmental Science. Springer, 2011. Page 2. Web. *Last Accessed 8 Feb. 2014.* http://link.springer.com/book/10.1007%2F978-1-4419-8243-8 | |
| A sustainable city is one that can provide and ensure sustainable welfare for its residents with the capacity of maintaining and improving its ecosystem services. | Residents, Ecosystem services, Welfare |
| Zhao, Jingzhu. "Towards Sustainable Cities in China." SpringerBriefs in Environmental Science. Springer, 2011. Page 2. Web. *Last Accessed 8 Feb. 2014.* http://link.springer.com/book/10.1007%2F978-1-4419-8243-8 | |
| The urban ecosystem service can be generally defined as processes and conditions offered for people's survival and development by cities as social–economic–natural complex ecosystem. | People, Survival, Development, Social, Economic, Natural |
| Zhao, Jingzhu. "Towards Sustainable Cities in China." SpringerBriefs in Environmental Science. Springer, 2011. Page 2. Web. *Last Accessed 8 Feb. 2014.* http://link.springer.com/book/10.1007%2F978-1-4419-8243-8 | |
| Smart City is referred as the safe, secure environmentally green, and efficient urban centre of the future with advanced infrastructures such as sensors, electronics, and networks to stimulate sustainable economic growth and a high quality of life. | Safe, Secure, Environment, Green, Efficient, Urban, Future, Infrastructure, Sensor, Electronics, Networks, Sustainability, Economy, Quality of life |
| Schaffers, Hans, and Nicos Komninos, Et Al, Schaffer"Landscape and Roadmap of Future Internet and Smart Cities." 17 Apr. 2012. Web. *Last Accessed 9 Feb. 2014.* http://hal.inria.fr/docs/00/76/97/15/PDF/FIREBALL_D2.1_M24.pdf | |

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| This holistic definition nicely balances different economic and social demands as well as the needs implied in urban development, while also encompassing peripheral and less developed cities. | Economic, Social, Urban development |
| Schaffers, Hans, and Nicos Komninos, Et Al. "Smart Cities and the Future Internet: Towards Cooperation Frameworks for Open Innovation." Page 172. Web. *Last Accessed 15 Feb. 2014.* http://wwwsop.inria.fr/axis/pages/bestpaper/FIA2011t.pdf | |
| A Smart City is a city well performing in a forward-looking way in the six characteristics (smart economy, smart people, smart governance, smart mobility, smart environment, smart living) built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens. | Mobility, Environment, Living Citizens, Economy, People, Governance, |
| Chourabi, Hafedh, Taewoo Nam, Shawn Walker, Ramon J. Gil-Gracia, Sehl Mellouli, Karine Nahon, Theresa A. Prado, and Hans Jochen Scholl. "Understanding Smart Cities: An Integrative Framework." Hawaii International Conference on System Sciences, 2012. Page 2290. Web. *Last Accessed 9 Feb. 2014.* http://www.ctg.albany.edu/publications/journals/hicss_2012_smartcities/hicss_2012_smartcities.pdf | |
| Simply put, we can define a Smart City, a public administration or authorities that delivers (or aims to) a set of new generation services and infrastructure, based on information and communication technologies. Defining new generation service is nevertheless a bit more complex and broader as the systems and services provided by smart cities should be easy to use, efficient, responsive, open and sustainable for the environment. The Smart City concept brings together all the characteristics associated with organizational change, technological, economic and social development of a modern city. Smart City services and infrastructures as well entail the characteristics of engaging and interacting with for the citizen that made use of them. Another central element is the adaptive nature of services, ICT systems, infrastructures, buildings that comprehends the Smart City concept. They acknowledge their initial status via a set of indicators and adapt their response according to the external changes that affect them. In doing so, they intelligently adapt to the external variables and demands that are subject to, thus offering an always customized, more efficient and adaptive response. | Technology, Economic, Social development, ICT, Infrastructure, Buildings |
| González, Juan Andrés Alonso, and Andrea Rossi. "New Trends for Smart Cities." Competitiveness and Innovation Framework Programme, 2011. Web. *Last Accessed 9 Feb. 2014.* http://opencities.net/sites/opencities.net/files/contentfiles/repository/D2.2.21%20New%20trends%20for%20Smart%20Cities.pdf | |

## Category: Corporate

| Definition | Keywords |
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| A city "connecting the physical infrastructure, the IT infrastructure, the social infrastructure, and the business infrastructure to leverage the collective intelligence of the city". | Interconnected IT, Social, Business infrastructure |
| Chourabi, Hafedh, Taewoo Nam, Shawn Walker, Ramon J. Gil-Gracia, Sehl Mellouli, Karine Nahon, Theresa A. Prado, and Hans Jochen Scholl. "Understanding Smart Cities: An Integrative Framework." Http://www.ctg.albany.edu/ Hawaii International Conference on System Sciences, 2012. Page 2290. Web. *Last Accessed 9 Feb. 2014.* | |
| Hitachi's vision for the Smart Sustainable City seeks to achieve concern for the global environment and lifestyle safety and convenience through the coordination of infrastructure. Smart Sustainable Cities realized through the coordination of infrastructures consist of two infrastructure layers that support consumers' lifestyles together with the urban management infrastructure that links these together using IT. | Coordinated infrastructure, Lifestyle safety, Lifestyle convenience, Urban infrastructure, IT |
| Hitachi. "Smart City Overview." Smart Cities : Hitachi. Hitachi, Web. *Last Accessed 9 Feb. 2014.* http://www.hitachi.com/products/smartcity/vision/concept/overview.html | |
| A Smarter City uses technology to transform its core systems and optimize finite resources. At the highest levels of maturity, a Smarter City is a knowledge-based system that provides real-time insights to stakeholders, as well as enabling decision-makers to proactively manage the city's subsystems. Effective information management is at the heart of this capability, and integration and analytics are the key enablers. | Technology |
| IBM. "IBM's Smarter Cities Challenge." IBM Corporation, July 2013. Web. *Last Accessed 9 Feb. 2014.* http://smartercitieschallenge.org/scc/executive_reports/SCC-CopenhagenReport.pdf | |
| 5 steps to make a city smart<br>1. Vision: setting the goal and the roadmap to get there.<br>2. Solutions: bringing in the technology to improve the efficiency of the urban systems.<br>3. Integration: combining information and operations for overall city efficiency.<br>4. Innovation: building each city's specific business model.<br>5. Collaboration: driving collaboration between global players and local stakeholders. | Urban systems, Efficiency, Technology, Integration, Innovation, Efficiency |

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| Schneider Electric. "Smart Cities." Schneider Electric, Web. *Last Accessed 9 Feb. 2014.* http://www2.schneiderelectric.com/sites/corporate/en/solutions/sustainable_solutions/smart-cities.page | |
| A Smart Sustainable City is one in which the seams and structures of the various urban systems are made clear, simple, responsive and even malleable via contemporary technology and design. Citizens are not only engaged and informed in the relationship between their activities, their neighbourhoods, and the wider urban ecosystems, but are actively encouraged to see the city itself as something they can collectively tune, such that it is efficient, interactive, engaging, adaptive and flexible, as opposed to the inflexible, mono-functional and monolithic structures of many 20th century cities. | Citizen contribution, Efficiency, Interactive, Adaptive, Flexible |
| ARUP. "Transforming the 21st Century City via the Creative Use of Technology." Arup's IT & Communications Systems Team., 01 Sept. 2011. Web. *Last Accessed 9 Feb. 2014.* http://www.arup.com/Publications/Smart_Cities.aspx | |
| Infrastructure, operations and people What makes a city? The answer, of course, is all three. A city is an interconnected system of systems. A dynamic work in progress, with progress as its watchword. A tripod that relies on strong support for and among each of its pillars, to become a smarter city for all. | Interconnected systems, Progress, Infrastructure, Operations, People |
| IBM. "Smarter Cities." IBM SMARTER PLANET, Web. *Last Accessed 6 Feb. 2014.* http://www.ibm.com/smarterplanet/us/en/smarter_cities/overview/index.html | |
| A city's attractiveness is directly related to its ability to offer the basic services that support growth opportunities, build economic value and create competitive differentiation. Potential inhabitants, of both the commercial and residential variety, are a discriminating lot, and they are looking for cities that operate efficiently and purposefully. They are looking for smarter cities. In particular, we are seeing the most advanced cities focus on three areas of expertise:<br>• Leveraging information to make better decisions<br>• Anticipating and resolving problems proactively<br>• Coordinating resources to operate more efficiently<br>Forward-thinking cities are not waiting for better economic times to take action. They are focused on staying competitive, maximizing the resources at their disposal and laying the groundwork for transformation. They are redefining what it means to be a smarter city. | Growth, Economy, Competitive differentiation, Efficiency, Purpose |

IBM. "Smarter, More Competitive Cities." IBM SMARTER PLANET, Jan. 2012. Web.
*Last Accessed 6 Feb. 2014.*
http://public.dhe.ibm.com/common/ssi/ecm/en/pub03003usen/PUB03003USEN.PDF

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| Replacing the actual city infrastructures is often unrealistic in terms of cost and time. However, with recent advances in technology, we can infuse our existing infrastructures with new intelligence. By this, we mean digitizing and connecting our systems, so they can sense, analyze and integrate data, and respond intelligently to the needs of their jurisdictions. In short, we can revitalize them so they can become smarter and more efficient. In the process, cities can grow and sustain quality of life for their inhabitants. | Technology, Connecting systems, Analyse data, Integrate data, Responsive, Efficient, Growth, Quality of life, Sustainability |

IBM. "India Needs Sustainable Cities." IBM SMARTER PLANET, Web. *Last Accessed 6 Feb. 2014.*
http://www.ibm.com/smarterplanet/in/en/sustainable_cities/ideas/

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| The Smart Sustainable City concept is really a framework for a specific vision of modern urban development. It recognizes the growing importance of information and communication technologies (ICT) as drivers of economic competitiveness, environmental sustainability, and general liveability. By leveraging ICT as a core element of their development, the Smart Sustainable Cities of the future will foster economic growth, improve the lifestyle of citizens, create opportunities for urban development and renewal, support eco-sustainability initiatives, improve the political and representative process, and provide access to advanced financial services. The right ICT infrastructure will affect the way each city will be created and evolve. It will enable Smart Sustainable Cities to include vastly enhanced sustainable areas, such as smart buildings, smart infrastructures (water, energy, heat, and transportation) and smart services (e-substitutes and e-services for travel, health, education, and entertainment), which drastically change the urban experience for city dwellers and travellers. | ICT, Economy, Environment, Sustainability, Quality of life, Development, Renewal, Citizen representation, Financial services, Smart buildings, Smart infrastructure, Water, Energy, Heat, Transportation, E-services |

Alcatel Lucent. "Understanding the Market Opportunity in the Cities of Tomorrow." Alcatel Lucent, Feb. 2011. Web. *Last Accessed 6 Feb. 2014.* http://www2.alcatellucent.com/knowledge-center/admin/mci-files 1a2c3f/ma/Smart_Cities_Market_opportunity_MarketAnalysis.pdf

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| A city has common capabilities and delivers some set of common services, as well - Office and residential buildings, Natural resource management, Transportation, Health and safety, Waste management, Education and culture, Public administration and services. One important characteristic that distinguishes an Intelligent City is the manner in which it delivers services using advanced technologies: an integration of a number of innovations including machine-to-machine communication enabled by telematics, sensors and RFID technologies; smart grid technologies to enable better energy production and delivery; intelligent software and services; and high-speed communications technologies that serve as a core network for all related city, citizen and business services. | Services, Natural resource management, Transportation, Health, safety, Waste management, Education, Culture, Public administration, Services, ICT, RFID, Integrated, Smart grid, Energy, High speed communication |
| Berton, Bruno, Patrice Massat, and Shawn Collinson. "Building and Managing an Intelligent City." Accenture Management Consulting, Web. *Last Accessed 9 Feb. 2014.* http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture-Building-ManagingIntelligent-City.pdf | |
| The 'Smart Community' is a next - generation community in which the management and optimized control of various infrastructures such as electricity, water, transportation, logistics, medicine, and information are integrated. The Smart Community will provide comprehensive solutions encompassing energy, water, and medical systems in order to realize a synergetic balance between environmental Considerations and comfortable living. | Electricity, Water, transportation, Logistics, Medicine, Information, Integrated, Optimization, Energy, Comfortable living |
| Takenaka, Shoji. "Toshiba Smart Community." Toshiba, 2 Feb. 2012. Web. *Last Accessed 9 Feb. 2014.* http://www.saudiarabia-jccme.jp/forumpdf/14-2.pdf | |
| We define *Smart Sustainable City* as the city that uses information technology and communications to make both their critical infrastructure, its components and utilities offered more interactive, efficient and citizens to be more aware of them. It is a city committed to the environment, both environmentally and in terms of cultural and historical elements (translated using Google translator). | ICT, Infrastructure, Utilities, Interactive, Efficient, Aware, Environment, Culture, History |
| Telefonica. "What Is a Smart City?". Telefonica, Web. *Last Accessed 9 Feb. 2014.* http://smartcity-telefonica.com/?p=373 | |
| A city that uses data, information and communications technologies strategically to:<br>• Provide more efficient, new or enhanced services to citizens,<br>• Monitor and track government's progress toward | Quality of Life, Technologies, Authorities, Buildings, Transport, Water |

Corporate

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| policy outcomes, including meeting climate change mitigation and adaptation goals,<br>• Manage and optimise the existing infrastructure, and plan for new more effectively,<br>• Reduce organisational silos and employ new levels of cross-sector collaboration, enable innovative business models for public and private sector service provision. | |
| Arup, Accenture, Horizon, and University of Nottingham. "Information Marketplaces: The New Economics of Cities." The Climate Group, Web. *Last Accessed 9 Feb. 2014.* http://www.theclimategroup.org/_assets/files/information_marketplaces_05_12_11.pdf | |
| The Smart City concept includes Digital City and Wireless City. In a nutshell, a Smart City describes the integrated management of information that creates value by applying advanced technologies to search, access, transfer, and process information. A Smart City encompasses e-Home, e-Office, e-Government, e-Health, e-Education and e-Traffic. | Integrated management, Advanced technologies, Information |
| Huawei. "Brilliant Life Powered by Smart City." Huawei Ltd, Web. *Last Accessed 9 Feb. 2014.* http://www.huawei.com/en/about-huawei/publications/communicate/hw-079367.htm | |
| Sustainable city is made up of 3 main parameters to make sure an overall development of Energy, Healthcare, Buildings, Transport, and Water management in a city;<br>• Environmental Care – with right technologies, cities will become more environmentally friendly.<br>• Competitiveness – With the right technologies, cities will help their local authorities and business to cut costs<br>• Quality of Life – With the right technologies, cities will increase the quality of life for their residents. | Quality of Life, Technologies, Authorities, Buildings, Transport, Water |
| Siemens. "Transforming Cities for the Better through Sustainable Technology." Siemens, Web. *Last Accessed 9 Feb. 2014.* http://w3.usa.siemens.com/topics/us/en/sustainablecities/Pages/home.aspx | |
| As nations look to rebuild their aging infrastructures and at the same time take on the challenge of global climate change, Patel argues that resource usage needs to be at the heart of their thinking. And, we must take a fundamental perspective in examining "available energy" in building and operating the infrastructure. Only if we use fewer resources to both build and run our infrastructures, he says, will we create cities that can thrive for generations to come. And we can only build in that way, he suggests, if we seamlessly integrate IT into the physical infrastructure to provision the resources – power, water, waste, etc. - at city scale based on the need. | Infrastructure, Energy, IT, Power, Water, Waste |

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| Patel, Chandrakanth. "Rebuilding Cities Right." Hewlett Packard Development Company, L.P., Web. *Last Accessed 9 Feb. 2014.* http://www.hpl.hp.com/news/2009/janmar/patel_interview.htm | |
| One manifestation of the Oracle iGovernment vision is Oracle's Solutions for Smart Cities, which will address the ever increasing need to provide businesses and citizens with transparent, efficient and intelligent engagement with their local authority/administration - through any channel - for any purpose, from information requests and government programs enrolment, to incident reporting or scheduling inspections, to complete online start-up of a local business. Development, implementation and refinement of such a multi-channel, single point-of-contact platform to all government organizations lays the foundation for a range of additional capabilities from business recruitment and retention to self-selecting, interest- and knowledge-based communities amongst citizens to improved management of civil contingencies and emergency disaster planning. | Authority, Information, Business, Development, Citizens, Disaster |
| Oracle. "Solutions for Smart Cities." Oracle, Web. *Last Accessed 9 Feb. 2014.* http://www.oracle.com/us/industries/public-sector/smart-cities.htm | |
| A future where clean, efficient and decentralised energy will power a smart electricity grid to deliver power efficiently to millions of homes; a world not suffering from water scarcity where waste is seen as a resource; where citizens' mobility and healthcare needs are all taken care of by efficient and comprehensive systems; and where they can live in sustainable cities with green spaces, clean air and a high quality of life. | Efficient, Decentralised, Energy, Electricity, Water, Waste, Green Spaces, Clean Air and Quality Life |
| Dunlop, Harley. "The Role of ITC in Creating a Low-carbon City Region Economy." GE in Leeds City - UK, 11 Sept. 2012. Web. *Last Accessed 15 Feb. 2014.* http://www.basecities.com/content/leeds/docs/pm_smart_pt1_COMPRESSED.pptx | |

**Corporate**

| Urbanization, rapid population growth and shortages of resources are placing a new strain on city systems. So how can cities fuel economic growth whilst improving environment and social conditions? What must they do to raise service quality despite finite resources, and ever-growing demand? How can they work more effectively across the public sector, and with the private and 3rd sectors to transform outcomes? Smart technologies help city administrations tap into public information and create not just smarter, but more sustainable cities. | Fuel economy, Technology, Administrations, Sustainable |
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Capgemini. "Build Smarter Cities for the Future." Www.capgemini.com. Capgemini, Web. *Last Accessed 9 Feb. 2014.* http://www.capgemini.com/public-sector/cities

| "Smart Cities" are an effective response to today's needs which have become crucial. Thanks to the rapid, pressing trends seen throughout the world.<br>In our view, the "smart city" is an urban model that minimizes efforts around "low level" needs and effectively satisfies "higher level" needs to guarantee an elevated quality of life while optimizing resources and areas for sustainability. | Quality of Life, Optimising, Resources, Sustainability |
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ABB. "Smart Cities in Italy: An Opportunity in the Spirit of the Renaissance for a New Quality of Life." ABB, Web.
*Last Accessed 9 Feb. 2014.*
http://www02.abb.com/db/db0003/db002698.nsf/0/af0569d84fa29925c1257a71004dc253/$file/SmartCitiesReport10Points.pdf

| It takes more to build a smart city than simply using ICT to link and manage social infrastructure. Providing new value and services that residents truly need is also essential. Generating the knowledge to arrive at solutions by continuing to closely examine local issues, while putting this information into the equation when analysing the enormous amount of data from smartphones, various sensors, meters, and other devices, is a crucial task. Achieving it requires that Fujitsu put ICT to work to establish a sustainable social value cycle and create new innovations. | Knowledge, Solutions, Sensors, Data, ICT, Innovations, Infrastructure |
|---|---|

Fujisu. "Making Secure, Prosperous Society a Reality." Fujitsu, Web. *Last Accessed 9 Feb. 2014.* http://www.fujitsu.com/global/about/responsibility/feature/2012/smartcity/

| The IBM vision for a smarter city uses technology to bring cities forward so that they can accomplish these types of objectives:<br>• Quality of life for its citizens and visitors | Quality of Life, Water and Energy consumption, Networks, Information |
|---|---|

- A well-managed city works to create an optimal urban environment for citizens, visitors, and industries by focusing on urban design, energy and water management, and an efficient and easy-to-use transportation system. These cities provide better performing and reliable city services that enable simplified and integrated access to services.
- A healthy and safe city addresses the health and safety of residents and visitors through innovations in local healthcare networks, disease management and prevention, social services, food safety, public safety, and individual information privacy.
- A sustainable city implements concrete measures toward sustainability through, for example, reduced consumption of energy and water and reduced emissions of $CO_2$. Possible measures that can make a city sustainable include urban planning principles for mixed land use, architecture and construction principles for buildings, and methods to use rainwater instead of treated water.
- A city with good governance strives to improve the quality and efficiency of city services. It mandates transparency and accountability at all levels of the government. It provides the means to listen, understand, and respond to the needs of its citizens and businesses.
- A city that incorporates culture and events attracts visitors and keeping citizens interested in the city through investments in arts, culture, and tourism. These investments are a great way to draw attention to the city and a way to establish the city as a world-class location to live in.
- A city focused on its citizens looks to address their needs by providing information and access to city services in a convenient and easy-to-use manner. When done right, both the citizens and city government can benefit. This mechanism gives the citizens access to the information and services when needed and gives the city a means to share important information and obtain input from their citizens in a timely manner.

Kehoe, Michael, Et Al. "Smarter Cities Series: A Foundation for Understanding IBM Smarter Cities." IBM - Red Books, 6 Dec. 2011. Page 3. Web. *Last Accessed 9 Feb. 2014*.
http://www.redbooks.ibm.com/redpapers/pdfs/redp4733.pd

| Business growth and development, building the city economy. | Digital, Commerce, Building the city economy, Cost effective. |
|---|---|
| • A city of digital innovation focuses on using strategic investments in connectivity and communications (for example wireless broadband either broadcast or through hotspots). It attracts cutting edge businesses in the industrial and high-tech fields and builds human and intellectual capital. | |
| • A city of commerce establishes itself as local, regional, or national centre of commerce and economic development. It builds local expertise in a specific industry and the infrastructure and services to support continued growth and to remain competitive. | |
| • A city attracting and keeping skilled workers promotes itself as being a desirable place to locate to or to grow up and stay in. This ability to maintain skilled workers is accomplished by anticipating and accommodating shifts in business needs, skills, local population, and demographics to offer economic opportunities. | |
| • A city with free flowing traffic identifies and manages congestion actively. This demand is accomplished by making various forms of transport (such as road, air, rail, and bus) cost effective and efficient. | |
| Kehoe, Michael, Et Al. "Smarter Cities Series: A Foundation for Understanding IBM Smarter Cities." IBM - Red Books, 6 Dec. 2011. Page 4. Web. *Last Accessed 9 Feb. 2014*. http://www.redbooks.ibm.com/redpapers/pdfs/rep4733.pdf | |
| IBM defines a smarter city as one that makes optimal use of all the interconnected information available today to better understand and control its operations and optimize the use of limited resources. | Information, Operations, Resources, Optimize. |
| IBM. "IBM Offers Smarter City Assessment Tool.". , 24 June 2009. Web. *Last Accessed 9 Feb. 2014.* http://www03.ibm.com/press/us/en/pressrelease/27791.wss | |
| Smart cities: Innovative urban developments that leverage ICT for the management of natural energy consumption at the community level and other technologies to balance environmental stewardship with comfortable living. | Innovation, urban, ICT, Energy, Community, Technology, Environment, Living |
| Fujitsu. "Making Secure, Prosperous Society a Reality." Fujitsu, Web. *Last Accessed 9 Feb. 2014*. http://www.fujitsu.com/global/about/responsibility/feature/2012/smartcity/ | |

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|---|---|
| Cities are complex and dynamic system. According to SAP there are 8 fundamental factors that determine what defines a sustainable city.<br><br>• Smart Economy – Long term prosperity, innovation, entrepreneurs, and social business models<br>• Good Government – High performing<br>• Open Society<br>• Resilience and Sustainability – being clean and green<br>• Global attractiveness<br>• Human and social capital<br>• World-class financial expertise<br>• Excellent infrastructure – physical and soft infrastructure (technology, research and knowledge) | Smart Economy, Good Government, Open Society, Global Attractiveness, Human and Social Capital, Infrastructure, Knowledge, Technology. |
| AP Urban Matters: Better Cities, Better Lives. SAP, Web. *Last Accessed 12 Feb. 2014.* http://global.sap.com/demos/richmedia/videos/sap-urban-mattersbetter-cities-better-lives-12-ov-us.epx | |
| Smart is a combination of Collaborative Leadership, Policy and legal, customer insight, budget and performance management, service orientation and technology | Leadership, Policy, Customer, Service Orientation, Technology |
| Colclough, Graham. "Transformational Government - Leading Cities Through the Change." Capgemini - Global Cities, 11 July 2011. Web. *Last Accessed 12 Feb. 2014.* | |
| In a broader definition, a city can be considered as "smart" when its investment in human and social capital and in communications infrastructure actively promote sustainable economic development and a high quality of life, including the wise management of natural resources through participatory government | Human capital, Social capital, Communication, Economic growth, Economic development, sustainability, Quality of life, Natural resource management, Participatory government |
| Hirst, Paula, Et Al. "JOINT EUROPEAN SUPPORT FOR SUSTAINABLE INVESTMENT IN CITY AREAS." European Investment Bank, 11 Dec. 2012. Web. *Last Accessed 12 Feb. 2014.* http://ec.europa.eu/regional_policy/thefunds/instruments/doc/jessica/jessica_horizontal_study_smart_and_sustainable_cities_en.pdf | |
| A smart city is a city that meets its challenges through the strategic application of ICT goods network and services to provide services to citizens or to manage its infrastructure. A sustainable city is a city that meets the needs of the present without compromising the ability of future generations to meet their own needs. | |
| Lovehagen, Nina, and Anna Bondessan. "Evaluating Sustainability of Using ICT Solutions in Smart Cities – Methodology Requirements." Ericsson, 14 Feb. 2013. Web. *Last Accessed 12 Feb. 2014.* http://www.ericsson.com/res/docs/2013/loevehagen-bondesson-evaluatingsustainability-of-using-ict-solutions.pdf | |

## Category: Government

| Definition | Keywords |
|---|---|
| Traditionally, a Smart Sustainable City has been defined as a city that uses information and communications technology to make both its critical infrastructure, its components and utilities more interactive, efficient, making citizens more aware of them | ICT, Interactive critical infrastructure, Interconnectivity, Efficiency, Awareness |
| Azkuna, Inaki. "International Study on the Situation of ICT, Innovation and Knowledge in Cities." City of Bilbao, 2012. Page 21. Web. *Last Accessed 12 Feb. 2014.* http://issuu.com/uclgcglu/docs/smartcitiesstudy_en | |
| In preparing this report, we used the Smart Sustainable City model, which identifies the presence and convergence of six areas: economy, mobility, environment, citizenship, quality of life, and, finally, management.<br><br>A city can be defined as smart when it displays a positive performance in these six areas, and when it has been built based on a "smart" combination of elements (communication, infrastructure, economic development) and on purposeful and independent citizen activities (participation, education ) that make sound management of natural resources through participatory governance | Convergence, Integration, Economy, Mobility, Environment, Citizenship, Quality of life, Communication, Infrastructure, Economic development, Citizen participation, Education, Natural resource management, Participatory governance |
| Azkuna, Inaki. "International Study on the Situation of ICT, Innovation and Knowledge in Cities." City of Bilbao, 2012. Page 7. Web. *Last Accessed 12 Feb. 2014.* http://issuu.com/uclgcglu/docs/smartcitiesstudy_en | |
| Smart Sustainable Cities combine diverse technologies to reduce their environmental impact and offer citizens better lives.<br><br>This is not, however, simply a technical challenge. Organizational change in governments - and indeed society at large - is just as essential.<br><br>Making a city smart is therefore a very multidisciplinary challenge, bringing together city officials, innovative suppliers, national and EU policymakers, academics and civil society. | Diverse Technology, Environment, Quality of living, City officials, Suppliers, Policy makers, Academics, Civil society. |
| "Smart Cities and Communities." European Commission, Web. *Last Accessed 12 Feb. 2014.* http://eu-smartcities.eu/faqs | |

**Government**

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| A type of city that uses new technologies to make them more liveable, functional, competitive and modern through the use of new technologies, the promotion of innovation and knowledge management, bringing together 6 key fields of performance: the economy, mobility , the environment, citizenship, quality of life and, finally, management. | Liveable, Technology, Citizen, Quality of Life, Management, Economy |
| Azkuna, Inaki. "International Study on the Situation of ICT, Innovation and Knowledge in Cities." City of Bilbao, 2012. Page 7. Web. *Last Accessed 12 Feb. 2014.* http://issuu.com/uclgcglu/docs/smartcitiesstudy_en | |
| A really smart city develops the city to reach the aim of improving the quality of life. Needs sound and innovative economic development as a means to reach this aim. Uses ICT as a tool with a great potential for ameliorating daily life, public services and the economy | Quality of Life, Innovative, Economic, ICT, Public Services, Life |
| Schweiker, Marit. "Aims and Goals of Smart City Management - Putting Quality of Citizens' Lifes First." Council of European Municipalities and Regions, 5 Oct. 2010. Web. *Last Accessed 12 Feb. 2014.* http://ec.europa.eu/regional_policy/conferences/od2010/fileupload/2010/docs/3905A34Presentation_OD_Smart_Cities_CEMR.pdf | |
| Smart City as a high-tech intensive and advanced city that connects people, information and city elements using new technologies in order to create sustainable greener city, competitive and innovative commerce and an increase life quality with a straightforward administration and maintenance system of city. | Advanced  high-tech information, Sustainability, Green, Competitive, Innovation, Commerce, Quality of life, Administration, Maintenance |
| Schaffers, Hans, and Nicos Komninos, Et Al. "Smart Cities and the Future Internet: Towards Cooperation Frameworks for Open Innovation." Page 172. Web. *Last Accessed 15 Feb. 2014.* http://wwwsop.inria.fr/axis/pages/bestpaper/FIA2011t.pdf | |
| Amsterdam Smart City uses innovative technology and the willingness to change behaviour related to energy consumption in order to tackle climate goals. Amsterdam Smart City is an universal approach for design and development of a sustainable, economically viable program that will reduce the city's carbon footprint | Smart City, Innovative, Technology, Energy, Economically, Carbon footprint |
| Lee, Jung Hoon, and Marguerite Gong Hancock. "Toward a Framework for Smart Cities: A Comparison of Seoul, San Francisco & Amsterdam." Stanford Program on Regions of Innovation and Entrepreneurship, 2012. Web. *Last Accessed 12 Feb. 2014.* http://iisdb.stanford.edu/evnts/7239/Jung_Hoon_Lee_final.pdf | |

**Government**

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|---|---|
| There are three major functions that "ICT Smart Town" is expected to contain:<br>• ICT to be used use both in ordinary times and in times of disaster<br>• ICT is used in order to contribute to self-sustaining town development in ordinary times, while it functions for disaster prevention and mitigation in times of disaster.<br>• Users, mainly local citizens, can participate in the Smart Town community using the ICT system through user-friendly and accessible interfaces such as mobile phones and TVs.<br>• - New Services resulting from the Use of "Big Data", including the government-held (public) data, private sector data and real-time data, collected through sensors. | Disaster, Citizens, Smart Town, Community, Interfaces, Government, Real-time data |
| "Current Activities For Smart Sustainable Cities", Japan Ministry of Internal Affairs and Communications (MIC) Smart Town, Contribution No. FG-SSC-0033, ITU Focus Group on Smart Sustainable Cities, Madrid, September 2013. Web. *Last Accessed 14 Feb 2014.* http://ifa.itu.int/t/fg/ssc/docs/1309-Madrid/in/fg-ssc-0033-japan.doc | |
| Smart cities should be regarded as systems of people interacting with and using flows of energy, materials, services and financing to catalyse sustainable economic development, resilience, and high quality of life; these flows and interactions become smart through making strategic use of information and communication infrastructure and services in a process of transparent urban planning and management that is responsive to the social and economic needs of society. | People, Quality of Life, Energy, Materials, Sustainable, Economic, Urban Planning, Society |
| European Innovation Partnership on Smart Cities and Communities." European Commission, 14 Oct. 2013. Web. Last Accessed 12 Feb. 2014. http://ec.europa.eu/eip/smartcities/files/sip_final_en.pdf. | |
| Based on the exploration of a wide and extensive array of literature from various disciplinary areas we identify eight critical factors of smart city initiatives: management and organization, technology, governance, policy context, people and communities, economy, built infrastructure, and natural environment. | Technology, Governance, Policy context, People and communities, Economy, Built infrastructure, and Natural environment |
| Chourabi, Hafedh, Taewoo Nam, Shawn Walker, Ramon J. Gil-Gracia, Sehl Mellouli, Karine Nahon, Theresa A. Prado, and Hans Jochen Scholl. "Understanding Smart Cities: An Integrative Framework." Hawaii International Conference on System Sciences, 2012. Page 2289. Web.<br>*Last Accessed 9 Feb. 2014.*<br>http://www.ctg.albany.edu/publications/journals/hicss_2012_smartcities/hicss_2012_smartcities.pdf | |

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|---|---|
| A City can be defined smart when systematic information and communication technologies and resource-saving technologies are used to work towards a post fossil society, to reduce resource consumption, enhance permanently citizens' quality of life and the competitiveness of local economy – thus improving the city´s sustainability. At least the following areas are taken into account: energy, mobility, urban planning and governance. An elementary characteristic of a smart city is the integration and cross-linking of these areas in order to implement the targeted ecological and social aspects of urban society and a participatory approach. | Energy, Mobility, Urban planning, Governance, Integration, Ecological, ICT |
| Homeier, Ina. "Smart City Wien Initiative." City of Vienna, May 2013. Web. *Last Accessed 12 Feb. 2014.* http://www.impacts.org/euroconference/vienna2013/presentations/Vienna%20impacts%20smart%20city.pdf | |
| Smart cities should be regarded as systems of people interacting with and using flows of energy, materials, services and financing to catalyse sustainable economic development, resilience, and high quality of life; these flows and interactions become smart through making strategic use of information and communication infrastructure and services in a process of transparent urban planning and management that is responsive to the social and economic needs of society | Systems, People, Energy, Materials, Services, Finance, Sustainable, Economic, Resilience, Quality of Life, ICT Infrastructure, Urban Planning, Responsive, Urban Planning, Social |
| European Innovation Partnership on Smart Cities and Communities – Strategic Implementation Plan, 2013. Web. *Last accessed 02 Mar. 2014.* http://ec.europa.eu/eip/smartcities/files/sip_final_en.pdf | |
| Create a real shift in the balance of power between the use of information technology by business, government, communities and ordinary people who live in cities | Power, Information technology, Business communications, Government, People |
| Deakin, Mark. "Towards Smart(er) Cities." European Commission, Web. *Last Accessed 12 Feb. 2014.* http://www.smartcities.info/files/Towards_Smart(er)CitiesTC_(2).pdf | |

## Category: Individual

| Definition | Keywords |
|---|---|
| A smart city offers its inhabitants a maximum of life quality by a minimum use of resources thanks to intelligent combination of different infrastructure systems (Transport, Energy Communication, etc.) on different levels like buildings, areas, quarters and cities.<br><br>«Intelligent» in this context does not automatically means «IT». By similar performance, passive or self-regulating mechanism are preferable to active regulated systems. | Quality of Life, Infrastructure Systems, Intelligence |
| "Definitions and Overviews." Smart Cities Council, Web. *Last Accessed 12 Feb. 2014.* http://smartcitiescouncil.com/smart-cities-information-center/definitions-and-overviews | |
| "...are territories with a high capacity for learning and innovation, which is built - in to the creativity of their population, their institutions of knowledge creation and their digital infrastructure for communication". .... [and are concerned] with people and the human capital side of the equation, rather than blindly believing that IT itself can automatically transform and improve cities." | Learning, Innovation, Creative people, Knowledge institutions, Communication infrastructure |
| Hollands, Robert. "Will the Real Smart City Please Stand Up?" Taylor & Francis Online, 26 Nov. 2008. Web. *Last Accessed 12 Feb. 2014.* http://www.tandfonline.com/doi/abs/10.1080/13604810802479126#.Uv-TivmSxUd | |

## Category: Industry Associations

| Definition | Keywords |
|---|---|
| The Council defines a Smart Sustainable City as one that has digital technology embedded across all city functions | ICT, Integrated, City functions |
| "Definitions and Overviews." Smart Cities Council, Web. *Last Accessed 12 Feb. 2014.* http://smartcitiescouncil.com/smart-cities-information-center/definitions-and-overviews | |
| "At its core a smart city is a welcoming, inclusive city, an open city. By being forthright with citizens, with clear accountability, integrity, and fair and honest measures of progress, cities get smarter". | Integrity, Citizens |
| Comstock, Maggie. "What Is a Smart City and How Can a City Boost Its IQ?" World Bank Blogs - Sustainable Cities, 02 Apr. 2012. Web. *Last Accessed 12 Feb. 2014.* http://blogs.worldbank.org/sustainablecities/what-is-a-smart-city-and-how-can-a-cityboost-its-iq | |

## Category: Internet

| Definition | Keywords |
|---|---|
| A developed urban area that creates sustainable economic development and high quality of life by excelling in multiple key areas; economy, mobility, environment, people, living, and government. Excelling in these key areas can be done so through strong human capital, social capital, and/or ICT infrastructure. | Economic growth, Standard of Living, Quality of life, Transport, Mobility, Environment, Governance, Human capital, Social capital, ICT, Urban area |
| "Smart City." Business Dictionary, Web. *Last Accessed 13 Feb. 2014.* http://www.businessdictionary.com/definition/smart-city.html. | |
| • Framing the "triple bottom line" of economy, environment, and social equity in one big picture.<br>• -- We're working to get our arms around a more sustainable future — a better way to connect people, homes, jobs and places — as a metro area and region, with more transportation choices. Frankly, it's very tough challenge. | Metro, Economy, e Environment and social equity, Transportation, Interconnect people, home, jobs and places |
| Ott, Marc. "Tools for Sustainble Cities." HBR Blog Network, 20 Apr. 2011. Web.<br> *Last Accessed 12 Feb. 2014*.<br>http://blogs.hbr.org/2011/04/the-sustainable-places-analyti/ | |
| Smart Sustainable Cities can be identified (and ranked) along six main axes or dimensions. These axes are: a smart economy; smart mobility; a smart environment; smart people; smart living; and, finally, smart governance. These six axes connect with traditional regional and neoclassical theories of urban growth and development. In particular, the axes are based - respectively - on theories of regional competitiveness, transport and ICT economics, natural resources, human and social capital, quality of life, and participation of citizens in the governance of cities | Economy, Mobility, Environment, People, Living, Governance, Growth, Development, Regional competitiveness, Transport, ICT, Natural resources, Human capital, Social capital, Quality of life, Participation of citizens in the governance |
| "Smart City." Wikipedia.com, Web. *Last Accessed 12 Feb. 2014.*<br>http://en.wikipedia.org/wiki/Smart_city | |
| A developed urban area that creates sustainable economic development and high quality of life by excelling in multiple key areas; economy, mobility, environment, people, living, and government. Excelling in these key areas can be done so through strong human capital, social capital, and/or ICT infrastructure. | Urban, Quality of Life, Economy, Mobility, Environment, People, Government, ICT Infrastructure |
| "Smart City."   Business Dictionary, Web. Last Accessed 13 Feb. 2014.<br>http://www.businessdictionary.com/definition/smart-city.html | |

## Category: International Telecommunication Union (ITU)

| Definition | Keywords |
|---|---|
| A Smart Sustainable City is mainly based on the information and communication technologies. Through the transparent and full access to information, the extensive and secure transmission of information, the efficient and scientific utilization of information, it increases the urban operational and administrative efficiency, improves the urban public service level, form the low-carbon urban ecological circle, and construct a new formation of urban development. | ICT, Information access, Information utilization, Operational efficiency, Administrative efficiency, services, Low carbon, Urban development |
| "White Paper on Smart Sustainable Cities", Fiberhome Technologies Group, Contribution No. FG-SSC-0005, ITU Focus Group on Smart Sustainable Cities, Turin, May 2013. Web. *Last Accessed 14 Feb 2014.* http://ifa.itu.int/t/fg/ssc/docs/1305-Turin/in/fg-ssc-0005-iberhome%20technologies%20group.zip | |
| Smart Sustainable Cities are well managed, integrated physical and digital infrastructures that provide optimal services in a reliable, cost effective, and sustainable manner while maintaining and improving the quality of life for its citizens. Key attributes of a Smart Sustainable City are Mobility, Sustainability, Security, Reliability, Flexibility, Technology, Interoperability and Scalability. Foundational aspects include Economy, Governance, Society and Environment with Vertical Infrastructures such as Mobility, Real Estate & Buildings, Industrial & Manufacturing, Utilities-Electricity & Gas, Waste, Water & Air Management, Safety & Security, Healthcare and Education. All of these are woven into a single fabric with ICT infrastructure as a core. | Well managed, Integrated, Digital infrastructure, Optimize services, Sustainability, Quality of life, Mobility, Security, Reliability, Flexibility, Technology, Interoperability, Scalability, Economy, Governance, Society, Environment, Real Estate & Buildings, Industrial & Manufacturing, Utilities-Electricity & Gas, Waste, Water & Air Management, Safety & Security, Healthcare and Education, integrated, ICT |
| "Smart Sustainable Cities – Food For Thought", Sekhar Kondepudi, National University of Singapore, Contribution No. FG-SSC-0013, ITU Focus Group on Smart Sustainable Cities, Turin, May 2013. Web. *Last Accessed 14 Feb 2014.* http://ifa.itu.int/t/fg/ssc/docs/1305-Turin/in/fg-ssc-0013-singapore%20university.zip | |

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|---|---|
| It's a city with a large, efficient and widespread technological network that fosters dialogue between citizens and everyday objects. It integrates the huge amount of information available to generate intelligence and *improve daily life in a lifestyle that is increasingly "smart".* It combines innovation with the environment, mobility and quality of life. It is a new phenomenon, complex and rapidly changing. Technological innovation moves in several directions (*green buildings, smart mobility, e-health, e-government...*) | ICT, Integrated, Quality of life, Innovation, Environment, Mobility, Green buildings, Health, Environment governance |
| "Smart Sustainable Cities & Smart Statistics", Government of Italy, Contribution No. FG-SSC-0014, ITU Focus Group on Smart Sustainable Cities, Turin, May 2013. Web. *Last Accessed 14 Feb 2014.* http://ifa.itu.int/t/fg/ssc/docs/1305-Turin/in/fg-ssc-0014-Italy.zip | |
| ICT spans across a number of application sectors that characterize the framework of Smart Sustainable Cities. Among others, Energy, Buildings, Transport & Mobility, Water & Waste Management. | ICT, Sustainability, Energy, Buildings, Transport, Mobility, Water management, Waste management |
| "Requirements and opportunities in developing a common, cost-effective, reliable and secure ICT infrastructure by exploiting and fostering synergies among different areas encompassed in the concept of Smart Sustainable Cities", University of Genoa, Contribution No. FG-SSC-0020, ITU Focus Group on Smart Sustainable Cities, Turin, May 2013. Web. *Last Accessed 14 Feb 2014.* http://ifa.itu.int/t/fg/ssc/docs/1305-Turin/in/fg-ssc-0020-genoa%20university.zip | |
| "A Smart Sustainable City has been defined as a 'knowledge', 'digital', and 'cyber' or 'eco' city; representing a concept open to a variety of interpretations, depending on the goals set out by a Smart Sustainable City's planners. We might refer to a Smart Sustainable City as an improvement on today's city both functionally and structurally, using information and communication technology (ICT) as an infrastructure.<br><br>Looking at its functions as well as its purposes, a Smart Sustainable City can perhaps be defined as "a city that strategically utilizes many smart factors such as Information and Communication Technology to increase the city's sustainable growth and strengthen city functions, while guaranteeing citizens' happiness and wellness." | ICT, Strategic resource utilization, Sustainability, Growth, Services, Citizen happiness, Citizen wellness |
| Hwang, Jong Sung, and Young Han Choe. "Smart Cities Seoul: A Case Study." International Telecommunications Union, Feb. 2013. Web. *Last Accessed 12 Feb. 2014.* http://www.itu.int/dms_pub/itu-t/oth/23/01/T23010000190001PDFE.pdf | |

## Category: Magazine

| Definition | Keywords |
|---|---|
| Smart Sustainable Cities use information and communication technologies (ICT) to be more intelligent and efficient in the use of resources, resulting in cost and energy savings, improved service delivery and quality of life, and reduced environmental footprint--all supporting innovation and the low-carbon economy. | ICT, Cost efficiency, Energy efficiency, Energy savings, Quality of life, Environment, Improved service delivery, Innovation, Low carbon economy |
| Cohen, Boyd. "The Top 10 Smart Cities On The Planet." Fast Company, 11 Jan. 2011. Web. *Last Accessed 12 Feb. 2014.* http://www.fastcoexist.com/1679127/the-top-10-smart-citieson-the-planet | |
| An Eco-city is defined as a city in which citizens; business and government sustainably work, live and interact through delivery of integrated, low carbon products and services. The objective of this project is to build a new industrial community to maximize welfare of the people and minimize carbon emission and the above vision can be achieved by integrating technology across water, waste, energy, transportation and safety infrastructure while taking measures like maximum utilization of renewable resources for electricity supply, minimum loss of natural resources and others. | Sustainably, Integrated, Low carbon products & services, Maximize welfare, Industrial community, Integrated technology |
| "Manesar to Home Eco-city Project." Business Standard, 22 Apr. 2011. Web. *Last Accessed 12 Feb. 2014.* http://www.business-standard.com/article/economy-policy/manesar-tohome-eco-city-project-111042200074_1.html | |

## Category: Market Research

| Definition | Keywords |
|---|---|
| An Eco-city is defined as a city in which citizens; business and government sustainably work, live and interact through delivery of integrated, low carbon products and services. The objective of this project is to build a new industrial community to maximize welfare of the people and minimize carbon emission and the above vision can be achieved by integrating technology across water, waste, energy, transportation and safety infrastructure while taking measures like maximum utilization of renewable resources for electricity supply, minimum loss of natural resources and others. | Sustainably, Integrated, Low carbon products & services, Maximize welfare, Industrial community, Integrated technology |
| "Manesar to Home Eco-city Project." Business Standard, 22 Apr. 2011. Web. *Last Accessed 12 Feb. 2014.* http://www.business-standard.com/article/economy-policy/manesar-tohome-eco-city-project-111042200074_1.html | |
| "The use of Smart Computing technologies to make the critical infrastructure components and services of a city–– which include city administration, education, healthcare, public safety, real estate, transportation, and utilities–– more intelligent, interconnected, and efficient" | Computing technologies, Interconnected components, City administration, Education, healthcare, Public safety |
| Washburn, Doug, and Usman Sindhu. "Helping CIOs Understand "Smart City" Initiatives." FORRESTER, Last Accessed Last Accessed 11 Feb. 2010. Web. *Last Accessed 12 Feb. 2014.* http://public.dhe.ibm.com/partnerworld/pub/smb/smarterplanet/forr_help_cios_und_smart_city_initiatives.pdf | |
| A Smart Sustainable City is characterized by the integration of technology into a strategic approach to sustainability, citizen well-being, and economic development. | ICT, Sustainability, Citizen well-being, Economic development. |
| Woods, Eric, and Clint Wheelock. "Smart Cities." Navigant Research, 2013. Web. *Last Accessed 12 Feb. 2014.* http://www.navigantresearch.com/wpassets/uploads/2013/01/SCIT-13-Executive-Summary.pdf | |
| The terms "smart" and "intelligent" have become part of the language of urbanization policy, referring to the clever use of IT to improve the productivity of a city's essential infrastructure and services and to reduce energy inputs and CO2 outputs in response to global climate change. | ICT, Infrastructure productivity, Services, Low carbon, Environment |
| Hodkinson, Steve. "Is Your City Smart Enough." OVUM Consulting, Mar. 2011. Web. *Last Accessed 12 Feb. 2014.* http://www.cisco.com/web/strategy/docs/Is_your_city_smart_enoughOvum_Analyst_Insights.pdf | |

| | |
|---|---|
| A Smart Sustainable City is one that "uses information and communications technologies to make the critical infrastructure components and services of a city — administration, education, healthcare, public safety, real estate, transportation and utilities — more aware, interactive and efficient." | ICT, Administration, Education, Healthcare, Public safety, Real estate, Transportation, Utilities, Integrated, Efficient, Interactive |

Belissent, Jennifer. "Getting Clever About Smart Cities: New Opportunities Require New Business Models." FORRESTER, 2 Nov. 2010. Web.
*Last Accessed 13 Feb. 2014.*
http://www.forrester.com/Getting%2BClever%2BAbout%2BSmart%2BCities%2BNew%2BOpportunities%2BRequire%2BNew%2BBusiness%2BModels/fulltext/-/ERES56701?objectid=RES56701

| | |
|---|---|
| An urbanized area where multiple public and private sectors cooperate to achieve sustainable outcomes through the analysis of contextual information exchanged between them. The sectors could include hospitals or emergency services or finance and so on. The interaction between sector-specific and intra-sector information flows results in more resource-efficient cities that enable more sustainable citizen services and more knowledge transfer between sectors. | Information exchange, Integrated, Resource efficiency, Services, Sustainability |

Maio, Andrea Di. "Technology Is Almost Irrelevant for Smart Cities To Succeed." Gartner, 10 Aug. 2012. Web. *Last Accessed 13 Feb. 2014.*
http://blogs.gartner.com/andrea_dimaio/2012/08/10/technology-is-almost-irrelevant-forsmart-cities-to-succee

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| Cities need to differentiate themselves to attract investment and productive residents, and this coupled with constrained financial resources, fast-growing populations, and aging infrastructures, is driving investment in Smart Sustainable City solutions. Smart Sustainable City solutions leverage ICT not only to deliver higher-quality citizen services more efficiently but also to effect behaviour change in government workers, city businesses, and citizens so cities can develop more sustainably. | ICT, Services, Efficient, Development and behavioural change in government workers, City businesses, and Citizens |

Woods, Eric, and Clint Wheelock. "Smart Cities." Navigant Research, 2013. Web.
*Last Accessed 12 Feb. 2014.* http://www.navigantresearch.com/wpassets/uploads/2013/01/SCIT-13-Executive-Summary.pdf

Hodkinson, Steve. "Is Your City Smart Enough." OVUM Consulting, Mar. 2011. Web. *Last Accessed 12 Feb. 2014.*
http://www.cisco.com/web/strategy/docs/Is_your_city_smart_enoughOvum_Analyst_Insights.pdf

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| Many cities are exploring the "Smart City" or Intelligent Community concept to improve efficiencies, optimize how they use largely finite resources and become better places to live and make business. They are deploying new information and communications technology to strengthen social and business services across different sectors and to build an intelligent digital nervous system supporting urban operations. By incorporating information and communications technology and strategically exploiting the vast amounts of data they generate, smart cities can make buildings more efficient, reduce energy consumption and waste, and make better use of renewable energy. They can manage traffic intelligently, monitor how infrastructure performs, provide better communications infrastructures, deliver services much more efficiently, and enhance citizens' access to government. | Social, Business, Efficient, Renewable, Monitor, Infrastructure, Citizens, Government, ICT, Energy Consumption |
| "Innovative Future of Russia's Cities." Center for Smart City Innovation – Ernst & Young, Web. *Last Accessed 13 Feb. 2014.* http://www.ey.com/RU/en/Services/SpecialtyServices/Smart-City-Innovation-Center | |
| What makes a city tick?<br>"Justice remains the appropriate name for certain social utilities which are vastly more important, and therefore more absolute and imperative, than any others," John Stuart Mill wrote in Utilitarianism in 1861. He added, "education and opinion, which have so vast a power over human character, should so use that power to establish in the mind of every individual an indissoluble association between his own happiness and the good of the whole." Many of those we spoke with this year in developing Cities of Opportunity agree. The foundations of healthy cities remain rule of law and safety and security today, as well as strong education to foster those qualities for future generations. | Justice, Education, Happiness, Healthy, Security, Safety |
| Craren, Tom, Brendan Dougher, and Kathryn Wylde. "Cities of Opportunity." PwC, 2012. Page 4. Web. *Last Accessed 15 Feb. 2014.*<br>http://www.pfnyc.org/reports/2012-Cities-of-Opportunity.pdf | |
| It is precisely because of the importance of cities and the need to deepen knowledge of urban issues that we undertake the study. The effort to question and understand where cities are and where they are headed benefits all of us in a world urbanizing like never before. This includes the officials and policymakers setting the course, businesses invested in city well-being, and the citizens who build their lives in thousands of city neighbourhoods worldwide, rich or poor, picturesque or prosaic. | Policymakers, Business, Well-being, Urbanisation |

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| Craren, Tom, Brendan Dougher, and Kathryn Wylde. "Cities of Opportunity." PwC, 2012. Page 3. Web. *Last Accessed 15 Feb. 2014.* http://www.pfnyc.org/reports/2012-Cities-of-Opportunity.pdf | |
| Smart city is characterized by the integration of technology into a strategic approach to sustainability, citizen well-being, and economic development. Smart city projects span several industry and operational siloes: energy, water, transportation, buildings management, and government services. Most importantly, the smart city concept promotes new integrated approaches to city operations, leading to innovation in cross-functional technologies and solutions. | Technology, Well-being, Economic Development, Energy, Water, Transportation, Buildings, Government, Innovation, Technology |
| Woods, Eric, and John Gartner. "Smart City Suppliers." Navigant Research, 2013. Web. *Last Accessed 13 Feb. 2014.* http://www.navigantresearch.com/wp-assets/uploads/2013/07/LBSCITS-13-Executive-Summary.pdf | |
| According to Deloitte the three market drivers of smart cities are smart water, smart energy and smart agriculture; Smart water is increasingly seen as a component of ambitious smart city programs that address the myriad of problems created by mass urbanization Smart Energy - The race for more and more energy sources is driving an increase in unconventional oil and gas exploration – in turn driving significant water and wastewater issues. Smart Agriculture - The challenge to feed a growing global population is stressing food systems in both the developed and developing world and require novel agricultural solutions | Solutions, Water, Agriculture, Energy, Population |
| Haji, Sheeraz. "State of Cleantech Innovation." Deloitte Services LP, 20 Sept. 2013. Web. *Last Accessed 13 Feb. 2014.* http://www.deloitte.com/assets/DcomUnitedStates/Local%20Assets/Documents/Energy_us_er/us_er_2013AESeminar_NewTechnologies_Sep2013.pdf | |
| The definition of sustainable development comprises five categories: Basic needs. Access to safe water, sufficient living space, adequate health care, and education are fundamental priorities for urban populations. Resource efficiency. A city's efficiency in such areas as the | Water, Living Space, Health Care, Urban populations, Energy, Recycling, Quality of Life, Pollutants, Cleanliness, Efficient, Policies and Standards |

| use of water and energy and the effective recycling of waste directly correlates to the quality of life of its citizens.<br><br>Environmental cleanliness. Limiting exposure to harmful pollutants is fundamental to a city's liveability.<br><br>Built environment. Equitable access to green space, public transportation, and dense, efficient buildings makes communities more liveable and efficient.<br>Commitment to future sustainability. An increase in the number of employees and the level of financial resources devoted to sustainability suggests how committed city governments are to implementing national and local policies and standards. | |
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| Bouton, Shannon, Molly Linday, and Jonathan Woetzel. "New Models for Sustainable Growth in Emerging-market Cities." McKinsey&Company, June 2012. Web. *Last Accessed 13 Feb. 2014.* http://mckinseyonsociety.com/downloads/reports/Sustainability/SRP_07_Cities.pdf/ | |

## Category: Non-profit

| Definition | Keywords |
| --- | --- |
| A city "combining ICT and Web 2.0 technology with other organizational, design and planning efforts to de-materialize and speed up bureaucratic processes and help to identify new, innovative solutions to city management complexity, in order to improve sustainability and liveability." | ICT, Web 2.0, Bureaucratic efficiency, City management, Innovative solutions, sustainability, Liveability, Standard of living |
| Toppeta, Donato. "The Smart City Vision: How Innovation and ICT Can Build Smart, "liveable", Sustainable Cities." Think Innovation, Oct. 2010. Web. *Last Accessed 13 Feb. 2014.* http://www.thinkinnovation.org/en/portfol/the-smart-city-vision-how-innovationand-ict-can-build-smart-liveable-sustainable-cities-2-2/ | |
| A city striving to make itself "smarter" (more efficient, sustainable, equitable, and liveable) | Efficient, Sustainable, Equitable, Liveable, Standard of living |
| Chourabi, Hafedh, Taewoo Nam, Shawn Walker, Ramon J. Gil-Gracia, Sehl Mellouli, Karine Nahon, Theresa A. Prado, and Hans Jochen Scholl. "Understanding Smart Cities: An Integrative Framework." Hawaii International Conference on System Sciences, 2012. Page 2290. Web. *Last Accessed 9 Feb. 2014.* http://www.ctg.albany.edu/publications/journals/hicss_2012_smartcities/hicss_2012_smartcities.pdf | |

## Category: Others

| Definition | Keywords |
| --- | --- |
| What makes a city Smart? A non-vendor driven definition of a 'Smart Sustainable City'<br><br>The closer a city behaves to the ethos of the Internet, the smarter it is. That means the city is a platform – an enabler for the people. So, empowering people is at the center of the perfect storm. So, what does a Smart Sustainable City look like?<br><br>A city can be defined as smart when investments in human and social capital and traditional (ex-transport) and modern(ex-ICT) communications infrastructure fuel sustainable economic development and a high quality of life with a wise management of natural resources through participatory governance | People enabler, Human capital, Social capital, Traditional communication, Modern communication, ICT, Economic development, Quality of life, Natural resource management, Participatory governance |
| Ajit Jaokar, "Big Data for Smart Cities", Smart Cities Industry Summit, London, Sept 2012, Web. *Last accessed Feb 14 2014.* http://www.opengardensblog.futuretext.com/wpcontent/uploads/2012/09/informa-smart-cities-ajit-jaokar.pdf | |

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| 7 important elements in most cases of Smart Sustainable City (Source: Xi She):<br>Sensible - sensor sensing the environment<br><br>1. Connectable - a networking devices bring the sensing information to the web<br>2. Accessible - the broader information of our environment is published on the web, and accessible to the user in web, (web)<br>3. Ubiquitous - the user can get access to the information thought web, but more importantly in mobile any time, any place (mobile)<br>4. Sociable - the user acquired with the information, and publish it though his social network (social network)<br>5. Sharable - shared are not limited to data, but also to the physical object, when some object are in free status, the people can get the notification and use them. (web, mobile)<br>6. Visible/augmented - to retrofit the physical environment, make the hidden information seen not only through mobile device by individual but seen in naked eyes in more border range of the physical places like street signs. | Sensor monitoring, Internet connectivity, Information availability, Mobile, Visible |
| "The Apps for Smart Cities Manifesto" World Smart Capital, 2012. Web.<br>*Last Accessed 13 Feb. 2014.*<br>http://www.appsforsmartcities.com/?q=manifesto | |
| Smart city is a city that employs the ICT infrastructures by sensing, transmitting and utilizing the information in order to fulfil the information sharing and service collaboration, further improve the citizens' living-hood standards and their quality of life, increase the urban operation efficiency and public service level, enhance the economy development quality and industry competitive ability, and realize the scientific and sustainable development of the city. | Sensing, Transmitting, ICT Infrastructure, Information, Collaboration, Quality of Life, Urban Efficiency Economy, Competitive, Scientific, Sustainable |
| Definition of Smart Cities - China Communications Standards Association (CCSA), smart city: terminologies and definitions, 2013,<br>http://www.ccsa.org.cn/workstation/project_disp.php?auto_id=4336 (in Chinese) | |

# Compendium 2: Sources of Indicators for Urban Areas

This compendium is a compilation of a large number of sources of indicators for various urban infrastructure and services to facilitate quick access and overview. The sources comprise of urban infrastructure and services indicators that exist in international as well as Indian contexts and are used for assessment of baseline conditions in urban areas.

# City-level Indicators

**Smart Cities Readiness Guide, Smart Cities Council , 2013**
http://www.rinnovabili.it/wp-content/uploads/2013/12/SmartCitiesCouncil-ReadinessGuide.pdf
Focusses on a framework for smart cities and how various city responsibilities/targets should use the technology enablers to become a smart city. It covers all overall city-level targets or indicators.
No benchmarks available.

**ADB Green Cities, Asian Development Bank, 2012**
http://www.adb.org/sites/default/files/publication/30059/green-cities.pdf
Focusses on environmental and social aspects of cities and how investments and technology can be used to make green cities.
No benchmarks available.

**Global City Indicators, Global City Institute, The World Bank, ERM, 2008**
http://cityindicators.org/Deliverables/Final%20Indicators%20Report%203_21_08_4-23-2008-924597.pdf
- Outlines a conceptual framework for the selection of standardised city indicators that measure and monitor city performance and quality of life, globally.
- Provides a framework that ensures that the indicators programme is relevant worldwide and sustainable.
- Includes indicators for both social and physical sectors.
No benchmarks available.

**Cities of Opportunity, Price Waterhouse Coopers, 2014**
http://www.pwc.com/us/en/cities-of-opportunity/2014/assets/cities-of-opportunity-2014.pdf ,
http://www.pwc.com/us/en/cities-of-opportunity/2014/pdf-download.jhtml
It analyses the trajectory of 30 cities through their current performances by using 59 variables constituting 10 indicator groups.
No benchmarks available.

**The Organisation for Economic Co-operation and Development, OECD, 2014**
http://www.oecd.org/
This organisation helps the member countries to:
- Restores confidence in markets and the institutions that make them function.
- Re-establishes healthy public finances for future sustainable economic growth.
- Fosters and supports new sources of growth through innovation, environmentally friendly 'green growth' strategies and the development of emerging economies.
- Ensures that people of all ages can develop their skills to work productively.
No benchmarks available.

**The World Bank, WORLD BANK, 2014**
http://www.worldbank.org/
Focuses on the existing situation of various sectors in cities from different countries and also sets common development goals/targets globally.
Benchmarks for few cities available.

**ISO 37120, ISO, 2014**
http://www.iso.org/iso/home.htm
Establishes a set of standardised indicators that provide a uniform approach to what is measured, and how that measurement is to be undertaken. It also helps to guide policy, planning and management across multiple sectors and stakeholders.
No benchmarks available.

**Global City Indicators, World Bank, ISO, Participating Cities, 2014**
- Enables elected officials, city managers, and public to monitor the performance of cities over time
- Facilitates comparisons across cities
- Provides enhanced government accountability demanded by policy makers and the public.
No benchmarks available.

**Urban Regional Development Plans Formulation and Implementation) Guidelines, MoUd, 2014** http://moud.gov.in/URDPFI
Information for city-level status of various infrastructure and services available for Planners.
Benchmarks available.

**United Cities and Local Governments, UCLG, 2014**
http://eetd.lbl.gov/sites/all/files/china_eco-cities_indicator_systems.pdf
Projects as the united voice and world advocate of democratic local self-government, promoting its values, objectives and interests, through cooperation between local governments, and within the wider international community.
No benchmarks available.

**Report of the Sub Committee on Development of Sustainable Habitat Parameters in the Field of Urban Planning, Town and Country Planning Organisation, Ministry of Urban Development, 2011**
http://www.mpurban.gov.in/pdf/UrbanPlanning.pdf
Outlines a vision combined with a set of recommended actionable/measurable indicators for the sustainable development in the country.
No benchmarks available.

# Transport Indicators

**Ministry of Transport, New Zealand, Ministry of Transport , New Zealand, 2014**
http://www.transport.govt.nz/ourwork/tmif/
Provides insight into how to improve the overall performance of the transport system, improve the performance of transport crown entities and achieve better value for money for the government from its investment in the transport system. It also provides indicators that contain key information on the transport sector.
No benchmarks available.

**Developing Indicators for Comprehensive and Sustainable Transport Planning, Victoria Transport Policy Institute, Canada, 2008**
http://courses.washington.edu/cee587/Readings/sustainability.pdf
- Provides guidance on the selection of indicators for comprehensive and sustainable transportation planning.
- Discusses the concept of sustainability and the role of indicators in planning, describes factors to consider when selecting indicators.
- Identifies potential problems with conventional indicators, describes examples of indicators and indicator sets.
- Provides recommendations for selecting indicators for use in a particular situation.
No benchmarks available.

**Indicators to Assess Sustainability of Transport Activities, Joint Research Centre - European Commission, Institute of Environment and Sustainability, 2007**
http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/10416/1/indicators%20report_green%20template.pdf
Focuses on the development of indicators to measure sustainability of transport systems and it covers only transport-related indicators.
No benchmarks available.

**Sustainable Measures, International Society of Sustainability Professionals (ISSP), 1993-2014**
http://www.sustainablemeasures.com/Database/Transportation.html
Explains what indicators are and how they relate to sustainability, how to identify good indicators of sustainability, and how indicators can be used to measure progress toward building a sustainable community
No benchmarks available.

**Sustainable Urban Transport in Asia Making the Vision a Reality-Project report, A CAI-Asia Program, Clean Air Initiative for Asian Cities Center, 2004-2005**
http://pdf.wri.org/sustainable_urban_transport_asia.pdf
This report's objective is to work with stakeholders in Asian cities to identify indicators of sustainable transport for use in the policy making process. It is a response to the

extraordinary - and largely uncontrolled - growth of motorised transport in most of Asia.
No benchmarks available.

**Worldwide Trends in Energy Use and Efficiency Key Insights from IEA Indicator Analysis, International Energy Agency, 2008**
http://www.iea.org/publications/freepublications/publication/Indicators_2008-1.pdf
It compiles information on all end-use sectors, plus power generation, for key developed and developing countries. Energy indicators for the transport sector have been extracted.
No benchmarks available.

**Tool Kit on Gender Equality Results and Indicator, Asian Development Bank (ADB), Australian Aid, 2013**
http://www.oecd.org/derec/adb/tool-kit-gender-equality-results-indicators.pdf
Assists development practitioners to ensure that gender perspectives are incorporated into development initiatives, and to monitor and evaluate gender equality results. It presents a menu of gender equality outcomes, results, and indicators that may be selected or adapted by users.
No benchmarks available.

**Bangalore Mobility Indicators, Directorate of Urban Land Transport (DULT, GoK), 2008, 2010-2011**
http://www.urbantransport.kar.gov.in/bangalore%20mobility%20indicators-2008.pdf,
http://urbantransport.kar.gov.in/Bangalore%20Mobility%20Indicators_%2822-12-2011%29.pdf
Identifies transportation indicators for assessing mobility in Bangalore to help policy makers. It attempts to make a comparative statement of present and past indicators.
Benchmark available.

**Sustainable Urban Transport Indicators, The Energy Resource Institute, 2014**
http://www.teriin.org/projects/nfa/pdf/working-paper-12-Sustainable-urban-transport-indicators.pdf
Attempts to present a comprehensive set of indicators in order to help cities for setting a trajectory of sustainable transportation.
No benchmarks available.

**Indicators of environmental sustainability in transport, Robert Joumard Henrik Gudmundsson Editors, 2010**
http://www.eurosfaire.prd.fr/7pc/bibliotheque/consulter.php?id=1943
Contributes to the development of methods to efficiently integrate complex environmental issues into the assessment and decision processes regarding transport.
No benchmarks available.

# Water, Sanitation and Solid Waste (WSSW) Indicators

**Performance Indicators for water supply, International Water Association, 2008**
http://books.google.co.in/books?id=nfSZiheXeRsC&printsec=frontcover&source=gbs_ge_s
ummary_r&cad=0#v=onepage&q&f=true
Contains performance indicator derived by IWA and collected from discussion of various
water industry professionals in a performance assessment scheme that should be used to
assist decision making in a utility at all levels.
No benchmarks available.

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**PAS (Performance Assessment Systems), Performance Measurement for Urban
Water Supply and Sanitation, CEPT University, 2011**
http://www.pas.org.in/Portal/document/PerformanceAssessmentDoc/pdf/List%20and
%20Definition%20of%20KPI%20indicators_Jan%2018%202011.pdf
http://www.pas.org.in/web/ceptpas/performance?p_p_id=SLBPerformanceAssessment_
WAR_Portal&p_p_lifecycle=1&p_p_state=normal&p_p_mode=view&p_p_col_id=column-
1&p_p_col_count=2&actionVal=Retrieve&SkipAccessChecking=false
It contains a set of Key Performance Indicators (KPI) that helps identify goals for ULBS
and corresponding reform action. It also contains a set of Local Action Indicators (LAI) to
assist ULBs in narrowing down ULB-level actions to be undertaken to achieve reforms.
No benchmarks available.

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**Result and indicators for the water and sanitation sector, European Commission,
2009**
http://ec.europa.eu/europeaid/how/evaluation/methodology/impact_indicators/wp_wa
ter_en.pdf
The presentation consists of result/outcome indicators, and specific/intermediate impact
indicators to help fill the "missing middle" gap between implementation indicators and
global impact indicators.
No benchmarks available.

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**The California Water Sustainability Indicators Framework,  California Department
of Water Resource; US Environment Protection Agency Region 9, 2011**
http://www.waterplan.water.ca.gov/docs/meeting_materials/workshop/08.24.11/CWP_
SIF_Draft_Framework_Jul20_11.pdf
It brings together water sustainability indicators provides information on water system
conditions and their relations to ecosystems, social systems, and economic systems.
No benchmarks available.

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**Water & Wastewater Utilities Indicators, The World Bank - Water and Sanitation
Division, 1996**
http://www.wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/1996/0
5/01/000009265_3961214144805/Rendered/PDF/multi_page.pdf

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It provides insight into indicators of water and sanitation utilities, mainly in urban areas by categorising them into operational indicators, financial indicators and overview of tariff rates and structure.
No benchmarks available.

**Performance Indicators for Wastewater Services, The International Water Association, 2003**
http://books.google.ca/books?id=9dZGWJy5gwEC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
It provides guidelines for the establishment of a management tool for wastewater utilities based on the use of performance indicators.
No benchmarks available.

**Assessment of factors influencing the performance of solid waste recycling program, Resources, Conservation and Recycling Journal, 2008**
http://www.thaiscience.info/Article%20for%20ThaiScience/Article/4/Ts-4%20assessment%20of%20factors%20influencing%20the%20performance%20of%20solid%20waste%20recycling%20programs.pdf
It investigate the factors influencing the performance of SWM relating to solid waste recycling covering a total of 120 solid waste recycling programmes located in different urban areas of Thailand.
Benchmark available.

**Solid Waste Management,  United Nations Environment Programme (UNEP), 2005**
www.unep.org/ietc/InformationResources/Publications/SolidWasteManagementPublication/tabid/79356/Default.aspx
http://www.unep.or.jp/Ietc/Publications/spc/Solid_Waste_Management/Vol_I/30-AppendixC.pdf
It examines the use of technologies that are environmentally sound for managing municipal solid wastes in developing countries. It also covers key non-technical aspects, and offers regional overviews on solid waste management.
No benchmarks available.

**Waste Management: An indicator of urban governance, Professor David C. Wilson, Waste & Resources Management Consultant, 2001**
http://www.davidcwilson.com/Waste_Management_An_Indicator_of_Urban_Governance.pdf
It covers the indictors that can be used to measure different aspects of urban governance.
No benchmarks available.

# Energy Indicators

**Energy Indicators for Sustainable Development: Guidelines and Methodologies, International Atomic Energy Agency, UN Department of Economic and Social Affairs, International energy Agency, Eurostat, European Environment Agency, 2005**
http://www-pub.iaea.org/MTCD/publications/PDF/Pub1222_web.pdf
It is a product of an international initiative to define a set of Energy Indicators for Sustainable Development (EISD) and corresponding methodologies and guidelines.
No benchmarks available.

**Worldwide Trends in Energy Use and Efficiency-Key Insights from IEA Indicator Analysis, International Energy Agency, 2008**
http://www.iea.org/publications/freepublications/publication/Indicators_2008-1.pdf
It brings together information on all end-use sectors, plus power generation, for key developed and developing countries. Energy indicators for the transport sector have been extracted.
No benchmarks available.

**Indicators for the Framework for Action On Energy Security in the Pacific, Pacific Islands Countries and Territories (PICT), 2011**
This document consists of indicators and a sample baseline for the implementation plan of the Framework for Action on Energy Security in the Pacific (FAESP).
No benchmarks available.

**Monitoring Performance of Electric Utilities, The World Bank, 2009**
http://www.esmap.org/sites/esmap.org/files/P099234_AFR_Monitoring%20Performance%20of%20Electric%20Utilities_Tallapragada_0.pdf
It consists of select electricity sector indicators from all sources available and presents them on the web in a form useful for all types of potential audiences within and outside the World Bank: utility managers and specialists, policy makers, energy sector practitioners, researchers and wider public.
Benchmark available.

**The World Development Indicators, The World Bank, 2015**
http://data.worldbank.org/data-catalog/world-development-indicators
It presents the most current and accurate global development data, and includes national, regional and global estimates.
No benchmark available.

**Energy Efficiency Indicator - Global Results, Institute for Building Efficiency , Urban Land Institute, 2011**
http://www.institutebe.com/InstituteBE/media/Library/Resources/Energy%20Efficiency%20Indicator/2011-EEI-Global-Results-Executive-Summary.pdf
The 2011 Energy Efficiency Indicator (EEI) is the fifth annual survey of global executives and building owners responsible for energy management and investment decisions in commercial and public-sector buildings.
No benchmark available.

**Electrical and Mechanical Service Department - Hong Kong, Electrical and Mechanical Service Department - Hong Kong, 2011**
http://ecib.emsd.gov.hk/en/index.htm
The department has commissioned the development of energy consumption indicators and benchmarking tools for three sectors, namely Residential, Commercial and Transport in Hong Kong.
Benchmark available.

# Housing Indicators

**Performance Indicators and Social Housing in Australia, Institute for Social Research, Swinburne University of Technology Melbourne**
http://www.sisr.net/publications/01burke.pdf
This paper provides insight into the types of indicators that have been chosen, how they have been modified over time, and their usefulness as measures of social housing policy interventions.
No benchmark available.

**Report on Trend and Progress of housing In India, National Housing Bank, 2013**
The document gives an overview of the housing sector in India and the current policy environment for housing. The document also sheds light on global and domestic economic and housing trends.
No benchmark available.

**Sustainable Measures, International Society of Sustainability Professionals (ISSP), 1993-2014**
http://www.sustainablemeasures.com/Database/Housing.html
This website provides indicators of a sustainable community; ways to measure how well a community is meeting the needs and expectations of its present and future members.
No benchmark available.

**Affordable Housing Performance Indicators for Landed Houses in the Central Region of Malaysia, Canadian Center of Science and Education, 2014**
http://www.ccsenet.org/journal/index.php/mas/article/viewFile/38428/22230
The main aim of this research is to develop Affordable Housing Performance Indicators (AHPI) for landed houses.
Benchmark available.

# Miscellaneous Indicators

**UNESCO, 2014**
http://data.uis.unesco.org/
It covers all education-related aspects including access, quality, equity, finance, etc.
Indicators are applicable regardless of urban or rural settlement.
No benchmark available.

**SSA (RTE), MHRD, Department of Education and Child Literacy, 2009**
http://ssa.nic.in/
To improve the education system in India.
Benchmark available.

**Smart City Study: International Study on the situation of ICT, innovation and Knowledge in cities, UCLG (United Cities and Local Governments), 2012**
http://www.uclg-digitalcities.org/app/uploads/2015/06/es_smartcitiesstudy.pdf
Study on the situation of ICT, innovation and knowledge in cities.
No benchmark available.

**WHO (World Health Organisation), 2014**
http://www.who.int/en/
Provides overall details on the present situation of health-related issues. It primarily seeks to create an efficient and healthy society by making sure that every individual has access to quality health facilities at any cost.
No benchmark available.

**Melbourne stainable Society Institute, MSSI, 2012**
http://www.sustainable.unimelb.edu.au/files/mssi/MSSI_Perceptions-Indicators_Report_final.pdf
To understand the perception of different communities on sustainability.
No benchmark available.

# Compendium 3: Additional Resources

This is a compilation of a large number of secondary resources that were referred to for this study in addition to the bibliography included in the main [Report](#). These references provide a deeper and comprehensive understanding of various concepts used and mentioned in the study report.

Agarwala, R., Developing model village clusters, The Hindu
http://www.thehindu.com/opinion/op-ed/developing-model-village-clusters/article6420016.ece
*The article talks about how creating central towns with urban facilities for 100 or so villages in each tehsil will prevent wastage of national resources on 'model villages' and 'smart cities'.*

A Short History of Urban Planning, Slide Share
http://www.slideshare.net/zfrmhd/urban-planning-history
*The presentation explains Marxist inspiration, the roots of urban planning, urban public health as a focus of concern, etc.*

Anand, V., Functions of the Urban Local Bodies (ULBs), Financing Small Cities
http://financingcities.ifmr.co.in/blog/2012/12/17/functions-of-the-urban-local-bodies-ulbs/
*The post discusses the functions devolved to ULBs as per the 74th Constitutional Amendment as well as the capabilities of ULBs to carry out these functions successfully.*

Anand, V., IFMR Capital, JNNURM: Brief Overview of the Mission – Part II, Financing Small Cities
http://financingcities.ifmr.co.in/blog/2013/02/21/jnnurm-brief-overview-of-the-mission-part-ii/
*This post discusses the progress made during JNNURM-I, key lessons learnt from the mission and the proposed features of the next phase of the Mission, JNNURM-II.*

Ananthakrishnan, G., Small & Smart, The Hindu
http://www.thehindu.com/sunday-anchor/small-smart/article6229337.ece
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*The paper describes about Building Information Modeling (BIM) tools in modelling the built environment. Current BIM strategies limit the size of facilities that can be modelled while increasing the time needed for modelling and the quality of BIM models produced. As a case study of this new approach look at Bechtel Civil's Planning and Development (PPD) design for a new community in Angondje, Libreville, Gabon where 6,000 dwelling units using 21 different building types for a population of 30,000 people were produced.*

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Economic Disparities in India, Regional Economic Inequality, India Online
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*The articles discuss the regional differences among India's different states and territories in terms of per capita income, socio-economic development, poverty and availability of infrastructure.*

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http://mhrd.gov.in/rte
*Information on Right to Education*

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http://www.planningcommission.nic.in/plans/planrel/fiveyr/welcome.html
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*The article talks about the Gujarat International Financial Tec (GIFT) City in Ahmedabad.*

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http://www.inclusivecity.com/Content/10012/Inclusive_Design_Moving_Beyond_New_Urbanism.html
*The authors describe about the New Urbanism period and what lies beyond this period with concepts like form based codes, walkability and transit oriented development emphasised.*

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*The IEA is an autonomous organisation which works to ensure reliable, affordable and clean energy for its 29 member countries and beyond.*

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*The IEA conducts a broad range of transport research and analysis, focusing on ways in which countries can reduce the energy and greenhouse gas intensity of their transport sectors.*

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*Provides data for indicators of various sectors from agriculture to urban development.*

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*The Melbourne Sustainable Society Institute (MSSI) aims to facilitate and enable research linkages, projects and conversations leading to increased understanding of sustainability and resilience trends, challenges and solutions. The MSSI approach includes a particular emphasis on the contribution of the social sciences and humanities to understanding and addressing sustainability and resilience challenges.*

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*The document describes the JNNURM second phase and learning's from the first phase.*

National Mission on Sustainable Habitat, Ministry of Urban Development
http://www.moud.gov.in/sites/upload_files/moud/files/NMSH_0.pdf
*It is one of the eight Missions under NAPCC and aims to make cities sustainable through improvements in energy efficiency in buildings, management of solid waste and shift to public transport.*

National Urban Information System, Ministry of Urban Development
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*Ministry of Urban Development has launched National Urban Information System (NUIS) Scheme in March, 2006 to develop GIS databases for 137 towns/cities in the country in two scales i.e., 1:10,000 and 1:2000.*

Outcome and Impact Level Indicators Water and Sanitation Sector, European Commission
http://ec.europa.eu/europeaid/how/evaluation/methodology/impact_indicators/wp_water_en.pdf
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*The report provides insight into strategic plan preparation, financing of plan preparation and implementation, technical and capacity building support, etc.*

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*Self-determination theory has focused on the social–contextual conditions that facilitate versus forestall the natural processes of self-motivation and healthy psychological development. Specifically, factors have been examined that enhance versus undermine intrinsic motivation, self-regulation, and well-being. The findings have led to the postulate of three innate psychological needs—competence, autonomy, and relatedness—which when satisfied yield enhanced self-motivation and mental health and when thwarted lead to diminished motivation and well-being. Also considered is the significance of these*

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https://sustainabledevelopment.un.org/natlinfo/indicators
*The Division for Sustainable Development (DSD) provides leadership in promoting and coordinating implementation of the sustainable development agenda of the United Nations. The work of the Division translates into five core functions: (1) Support to UN intergovernmental processes on sustainable development; (2) Analysis and policy development; (3) Capacity development at the country level; (4) Inter-agency coordination; and (5) Knowledge management, communication and outreach.*

Smart Location Mapping Smart Growth, United Nations Environment Protection Agency
http://www.epa.gov/smartgrowth/smartlocationdatabase.htm
*The page focuses on interactive maps and data for measuring location efficiency and the built environment.*

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http://smartcities.gov.in/
*The site provides information about the Smart Cities Mission such as what are smart cities, smart features, and details of the selection process, implementation, financing and guidelines.*

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*The article provides a history of India's urban planning with detailed description of India's Five Year Plans.*

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https://www.gov.uk/government/collections/sustainable-development-indicators
*This series contains the Sustainable Development Indicator set. The indicators are intended to provide an overview of national progress on key issues that are important economically, socially and environmentally in the long term.*

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http://www.uclg.org/en/media/news/smart-cities-study-situation-ict-innovation-and-knowledge-cities
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*This Tool Kit aims to assist development practitioners to ensure that gender perspectives are incorporated into development initiatives, and to monitor and evaluate gender equality results.*

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*The page focuses on explaining Central Place Theory and its evaluation.*

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http://www.imeche.org/news/blog/top-ten-smart-cities-in-the-world
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*The document describes the components of a city development plan and the preparation process of the plan.*
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*Provides information about the on-going schemes and completed schemes*

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http://www.econport.org/content/handbook/Urbanecon/exist.html
*The post explains why cities exist, using economies of scale.*

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*The primary World Bank collection of development indicators, compiled from officially-recognised international sources. It presents the most current and accurate global development data available, and includes national, regional and global estimates.*

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