3.1 Smart City Planning and Development

Here we explore how plans and strategies are further developed and concretised during different stages of implementation.

Once the motivations and benefits are understood, the next critical question is execution. Globally, the approach towards building Smarter Cities follows two broad streams:

The first is “Greenfield” smarter cities, being planned as part of a country’s push towards infrastructure modernization and capacity building. With little to no constraints of legacy infrastructure, processes and a sprawling population, such cities can be designed and built optimally from the grounds-up. Most of these cities are built with a specific industry focus – as hubs for financial services or logistics or technology.

The second, larger initiative is to make “brownfield” cities smarter. This involves urban renewal and development of existing cities, satellite tows and tier-2/tier-3 cities. In contrast with the “clean slate” approach to create a green field smart city, the journey of a brownfield city to become smarter involves many complexities and constraints, such as legacy infrastructure, systems and processes. In addition since a large population already lives in these cities, the transformation needs to occur without significant disruption to city operations.

Cities are built on the three pillars of *Planning and Operations, Infrastructure* and *People*. What differentiates a “Smart City” is that it takes a *holistic* view of these domains – where they work in an interconnected, integrated fashion to enable optimized decision making, and utilize resources efficiently.

- City planning, management and operation: Key elements included here are physical and digital master plans, ongoing urban planning, operational processes for inter-agency collaboration and command & control. This also includes key policy and legal frameworks, to achieve specific outcomes.
- Smarter Infrastructure: Typical smart city infrastructure includes:
  - Smart Grids
  - Smart Water Management
  - Public Safety, Security and Disaster Management
  - Smart multi-modal Transportation
  - Solid Waste and Wastewater management
  - Airports and other transportation hubs

  Technology and automation are typically foundational elements of these smarter infrastructure projects. The selection of these initiatives is driven by local context and priorities.

- **People:** Given that citizens’ quality of life and productivity is the eventual goal of a smarter city, this includes designing systems for citizen engagement, education, healthcare and social services.

Within this overall framework, we look at key variations for green field vs. brownfield cities:

	Greenfield	Brownfield
City planning, management & operation		
Physical planning	Grounds-up master plan taking into account strategic location (e.g. industry corridor), industry focus (e.g. finance, IT, logistics) and population projections	Revisiting potentially outdated physical and urban plans. Reconfiguration to achieve specific outcomes.
Digital planning	Instrumenting and interconnecting the city's infrastructure and citizens. Establishing centralized command and control, and planning core digital infrastructure such as telecom towers, optical fiber and last-mile access networks	Top-down flow – starting with command and control and inter-agency coordination, moving down to retrofitting automation and integrating individual subsystems, such as smart grid, smart water.
Process design	Definition, implementation and monitoring of inter-agency collaboration and governance processes.	Process re-engineering to break silos between agencies and enable coordination.
Policy and Regulatory framework	Policy design to enable specific outcomes e.g. empowering the SPV, establishing an incentive structure for stakeholders.	Creating or empowering a "smart city cell" within the existing municipal framework and chain of command – with well-defined delegation and accountability
Smarter Infrastructure		
Factored into design – little to no limitations of legacy or aging infrastructure, or disrupting existing citizen services. Benefit of a not having hit peak workloads yet.		Project-based approach, based on local priorities. For example, metro project in a congested metropolis, or a CCTV and Dial 100 initiative to address high crime rate.
People		
Factored into design – citizen portals for smart e-governance and citizen services, education and healthcare systems designed to optimally to serve the projected needs of the citizens over a long-term horizon. Green environments and entertainment spaces for sustainable, healthy living.		Project-based approach based on local priorities. For example, specific mobile or social media initiatives to help citizens avoid traffic, self-regulate water & energy consumption, report crime or public infrastructure maintenance issues, etc.

3.1.1 Planning Techniques

Planning techniques are those methods or processes followed by planners in preparing or evaluating their plans, programs, and policies. Planners have a considerable array of analytic techniques at their disposal. **Cost–benefit analysis, risk assessment, environmental assessment, program evaluation, participatory methods,** and many others may be included in this regard. These techniques may aid a planner in deciding a course of action to follow or in assessing the effects of particular actions on different publics. Most of these techniques, and perhaps especially cost–benefit analysis, have been connected conceptually and methodologically to utilitarianism, as follows. First, utilitarianism relies upon the quantification of 'goods' and 'harms' so that both

can be summed and compared. This is a starting point, too, for cost–benefit analysis in which costs and benefits are identified, measured, added, and contrasted in order to determine whether a course of action would result in more benefits than costs. Second, this sort of conclusion is clearly based on utilitarian thinking in which a maximum amount of good is sought.

The fact that planning techniques are linked to ethical theories is not particularly troubling. This kind of observation attests to the post-positivist world in which we find ourselves where the planner is not regarded as a value-free technician but as an individual who necessarily brings certain biases, values, and conceptual lenses to their work. Similar, then, to contemporary views of science, defining one's perspective and unearthing one's assumptions is an essential first step in doing research and in doing planning. While this approach to science and to planning continues to be debated, an issue arising from the mere association of certain ethical approaches to certain planning techniques remains. This is the fact that techniques based on consequential or utilitarian thinking can be seen as over-represented in planning ethics in that methods based more on nonconsequential thinking do not have the prominence of their philosophical cousins. One branch of moral philosophy thus gets short shrift in helping planners to develop and evaluate plans—a branch that is generally regarded as just as viable and important as consequential approaches. Lake (1993) discusses one aspect of this phenomenon in the context of feminist ethics and techniques based on geographical information systems (GIS). He argues that the data-aggregation focus on GIS is incompatible with the focus on the 'concrete other' (Benhabib 1992) in feminism. The same could be said of other ethical theories that attempt to highlight individual experiences and inherent value (the 'right') as opposed to formulaic assessments of consequences (the 'good'). Uncovering assumptions and seeking a broader distribution of ethical underpinnings for planning techniques is of central importance to this area of planning ethics.

3.1.2 City as a system

The city can be intended as a dynamically and complex system that evolves in space and time following trajectories that are hard to predict. These characteristics of complexity and dynamic evolution have represented the main critical factors for town planning, generally involved in drawing up forecasts – closed and static – of the future urban layout. It is thus necessary to draw up new theories of town planning that consider the systemic vision.

As stressed by some major contributions, the systemic approach allows the city to be viewed as a dynamically complex system, and complexity is the strategic factor able to ensuring system evolution. One of the system's characteristics is that it allows one to think about a subdivision into component subsystems. Among the subsystems we may distinguish some that can be considered most important (or reference), and others, still referring to the firsts, which characterize the system referring to specific peculiarities: the economic system, the transport system and so on.

In particular, we can identify five main urban subsystems. Some of these are made of material elements, the others are made of intangible elements (abstract).

1) The physical subsystem (material) is composed of spaces and channels interconnecting the spaces;

2) The functional subsystem (immaterial) is composed of urban activities carried out into spaces or through the channels;

3) The psycho-perceptive system (abstract) is made by the image of the city that each citizen elaborate by himself;

4) The geomorphological system (material) is composed of environmental elements and territorial areas (continents, nations, hydrographical basins, macro regions, municipal areas, and so on);

5) The anthropic/human system is represented by the "biocenotic" component of the city, the community that gives a sense to the space. The components of this system are represented by the human aggregations

acting inside urban space: the actors and the relationships; interactions between groups and/or individuals that work for the development of the city.

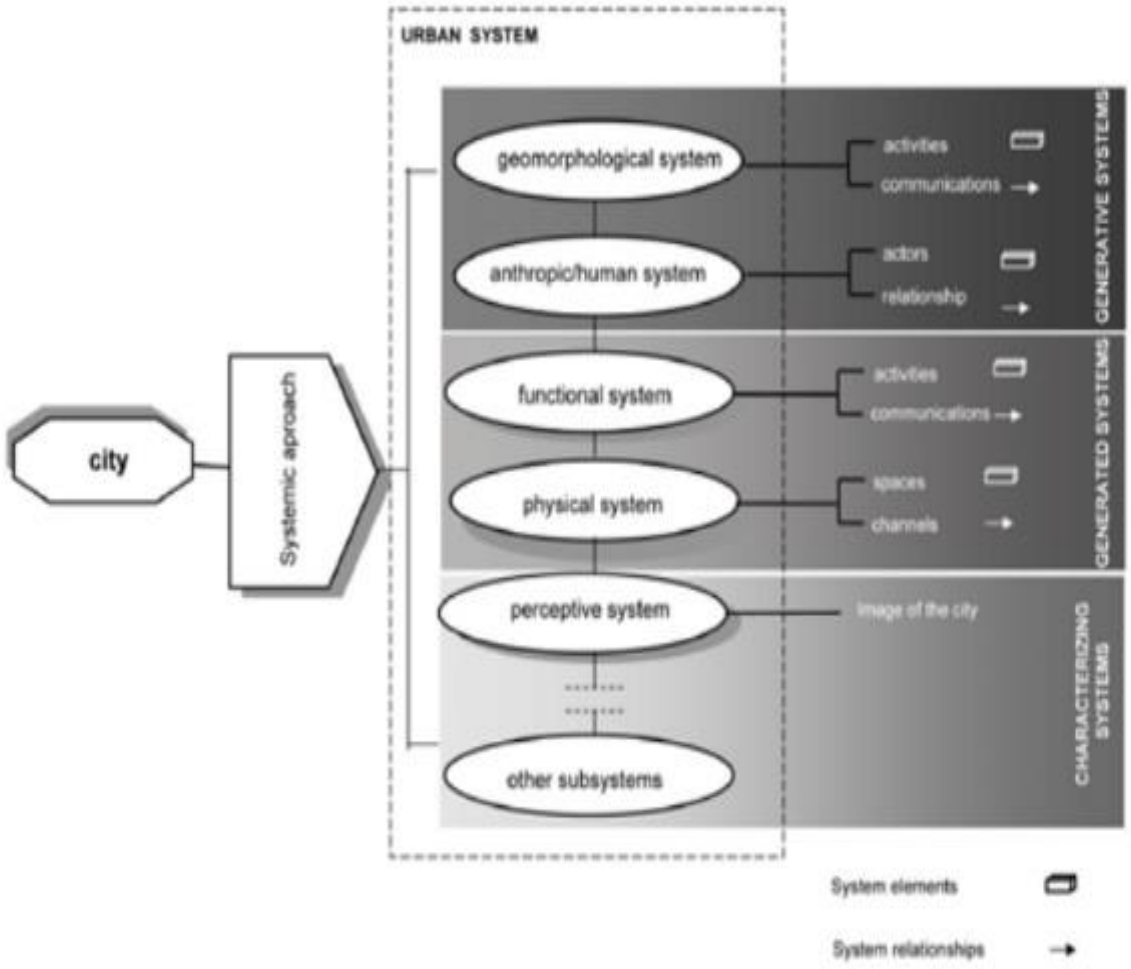


Figure 1 The urban system and the five sub-systems detected in the systemic approach

The geomorphological system and the anthropic/human one are to be considered as “generative” sub-systems because allows the generation of the urban system, without which the city would never exist.

The physical system and the functional system can be considered as “generated” systems which originate from the presence or interaction of generative systems.

As stated above, in each system the elements forming the systemic architecture should be found: the parts and the relationships (the set of the system relationships is called “structure”).

As regards the physical system the parts can be found in the built-up spaces of the city (buildings, squares, equipment, urban sites, and so on) and the relationships in the communication channels between the spaces that represent the “media” of the functional flows (roads, urban connectors, hydraulic infrastructure, energy and computer networks, and so on).

The functional system consists of the human activities, placed in the physical spaces, and of the relationships represented by the interconnection flows between the actions that form the transaction process characterizing the city.

The physical system and the functional one originate from the generative subsystems because produced by changes of the natural environment activities.

The psycho-perceptive system is another generated basic system; it is composed of the image of the city formed by individuals also on the basis of their own cognitive and emotional heritage. The perception of the urban system takes place thanks to the presence of a material space that contains the human and transactional activities of the city, but also with reference to events and activities taking place in specific sites. Such elements contribute to build the “memory of places”, which is one of the most important elements in the evolution of urban systems

3.1.3 The entropy concept

When the parts and relationships of the urban subsystems are properly balanced, cities are in a sustainable dynamic state. Problems arise when one or more subsystems changes its normal evolution trajectories and starts a considerable production of entropy.

Entropy is the phenomenon to be detected and prevented in order to achieve urban sustainability. Referring to the systemic paradigm, in the light of the previous assumptions, the city can be approached as a dynamic and complex system (or dynamically complex). This system changes and develops in space and time, namely it moves diachronically and evolves “within itself”. In other words the urban system changes, moment by moment, because of the changes in its parts and because of the relationships linking its parts.

In addition, still referring to systemic theory, it may be stated that the city is capable of starting self-regulation processes, theorized as “capability of adaptation”. This means that the components (parts and relationships) organize and change, reacting also to external cues, according to endogenous processes.

To give an example linked to the urban mobility function, we can consider the case when some roads or part of them are closed to traffic. This needs a general reorganization of mobility and this changes the direction and intensity of traffic flows. This reorganization makes an impact on the whole system due to the different composition of the flows.

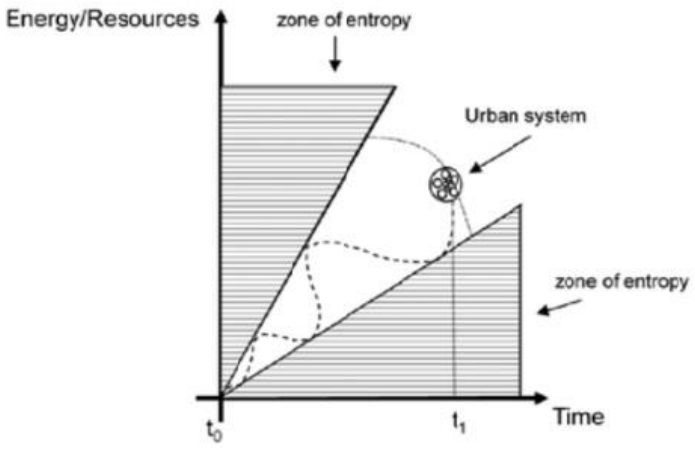


Figure 2 The dynamic trend of the urban system (axis of resources, range of expected trajectories, axis of time, arc of the possible system states at time t1) and the zones of entropy where the city have to avoid to go in order to evolve towards sustainable states.

Similarly, a systemic change occurs when an urban activity stops working, temporarily or not.

It is not hardly to believe how difficult is to define procedures capable of regulating systemic evolution, taking into account the several activities in a city, the continuous changes it undergoes and the relationships that define the interaction.

In order to implement a process for regulating this (spontaneous) evolution it is necessary to investigate first the parts and structure (set of relationships) of the system, trying to grasp the rules that cause the evolution and shift

The subsequent step consists in identifying the policies (strategies) that, by establishing a set of achievable targets in specific time segments, can allow the system to be controlled and steered towards future states included in a given range of optimal configurations, identified as “desired state” (Figure 2). Implementation of the strategies to meet the targets occurs in the third phase of the process. In any case, it should be underlined that the system cannot remain inside the expected evolution range. It could change its trend and move itself toward spaces that cause an entropic condition; this can also be due to a misguided strategic definition or an inadequate implementation of action.

The entropy has to be considered as a widespread negative condition of the system, which hinders the positive processes to achieve sustainability and tends to move the system towards the zone of entropy, driving the system towards trajectories totally different from those expected.

3.1.4 Smart City Master Plan

A Smart City Master Plan identifies locally-significant community stresses, evaluates potential information and communications technology (ICT) solutions, and outlines a roadmap to achieve effective integration of selected solutions. Developing a plan can be a proactive method for cities to understand which, of the seemingly endless smart city solutions available, might successfully provide high social and economic returns. Dr. Anthony Townsend and Dr. Stephen Lorimer (2015) describe this type of plan as “attempts to mobilize local stakeholders around visions, goals, and road maps to adapt to [the] external technological and economic pressures, within local social, economic and political constraints.” As the impacts of a smart city will affect and benefit the whole community, a plan requires new cross-city governance models and shared strategies. Essentially, a Smart City Master Plan will connect agencies in order to lay out a comprehensive approach for developing and deploying smart city solutions to improve overall quality of life.

THE VALUE PROPOSITION

Developing and implementing a Smart City Master Plan is likely not driven by potential short-economic returns, as it will require significant additional funding, resources, and, often, in-house capacity building. What makes it worthwhile are the social and environmental returns that will improve the economy and community in the long-term.

Building a smart city engages a diverse and extensive stakeholder group, including municipal agencies, industry insiders, academia, community leaders, and others. A Smart City Master Plan unifies these separate groups, breaking down information silos—which, in turn, allows thorough exploration of the potential social and environmental benefits.

DEVELOPING A PLAN

Based on a review of international initiatives and discussions with community and industry leaders, we have identified several key best practices for midsized cities developing a Smart City Master Plan.

Smart city solutions can impact all people within a community, and therefore also require involvement from various municipal agencies and community leaders. Information and agency silos need to be overcome to

build internal and external partnerships and foster collaboration. Partners should include academia, industry, civil society, and other levels of government.

To build a smart city that improves quality of life for all people, smart city plans should be developed to solve the true community needs. These needs can only be identified through inclusive and extensive citizen engagement. As part of this preliminary engagement, the core Smart City Master Plan project team and champion should be determined.

The strategic roadmap developed through a Smart City Master Plan is community-specific because each community faces different challenges, is in a different state of readiness, and has access to different solutions. By establishing the local context, the Plan and the technology applications it includes can be better fitted to the city. Knowing the current context will also define a baseline for results to be measured against.

To establish the context, municipalities should:

- Identify their priorities and areas which are in need of improvement;
- Determine the community short- to long-term goals; and
- Assess data currently available relevant to these goals and identify what additional data needs to be collected to complete baseline knowledge.

The success of a Smart City Master Plan is largely dependent on designing a robust strategy grounded on a clear vision for the future of the city. The vision and mission should build on existing priorities and assets to align with local needs and goals, while also defining aspirational targets to energize and mobilize stakeholders. A comprehensive plan will:

- Describe the preliminary engagement;
- Provide an approach for ongoing engagement;
- Verify the context;
- Outline smart city strategies to overcome challenges;
- Design a roadmap to implementation with targets and timelines; and
- Identify mechanisms to measure success.

Fostering a new innovation ecosystem by partnering with academia as well as major tech companies and start-ups is key for incubating smart city ideas and delineating appropriate roadmaps. These partnerships may also leverage important sources of funding.

To encourage effectiveness and longevity of smart city solutions, Smart City Master Plans can require solutions that are designed:

- To enhance digital inclusion and improve access for all citizens;
- For interoperability; and
- To evolve as new technologies become available.

Over time, smart city solutions will become the new normal and will be embedded within all city strategies as they are developed. A Smart City Master Plan ignites a cultural change:

- Municipalities will find new ways of working and collaborating;
- Citizens will be empowered through data and connected technology; and
- Skills and knowledge training will shift to support this technology revolution.

3.1.5 SMART CITIES – DEVELOPMENT OF SOLUTIONS

Many existing national and international smart city solutions have been summarized under seven categories below.

STREETLIGHTS: The existing and pervasive infrastructure of streetlights makes them an obvious choice for hosting a citywide communication network that can be leveraged as the backbone for applying smart city solutions. As street lighting networks are usually evenly deployed throughout a municipality, they provide one of the most equitable means of deploying technology. This network can also be used to monitor and control street lighting to reduce maintenance and electricity costs.

TRAFFIC & PARKING: Traffic and parking optimization leads to reduced time-on-road for cars and correspondingly reduces greenhouse gas (GHG) emissions. Sensors of real-time traffic can be used to control smart traffic signals to increase travel speeds and reduce intersection delays. Data from parking sensors can direct drivers to empty spaces via mobile apps while informing law enforcement of parking infractions.

ENVIRONMENTAL MONITORING: For environmental monitoring, current technology offers a wide range of options. Sensors are able to monitor and report weather conditions, air quality (i.e. various pollutants), ground conditions, and noise. This data can benefit citizens, policy makers and researchers by providing information on the health and environmental risks of ambient conditions.

SAFETY & SECURITY: There are also extensive smart city applications available for safety and security. One such application commonly mentioned by suppliers is gunshot detection. This type of sensor can be used to trigger image capture in the area when a shot is heard and alert emergency responders who can be directed by flashing streetlights. A similar system can be deployed for traffic accident detection.

CONNECTED CORE CITY SERVICES: Waste management, road salt applications, flood management, and utility efficiencies have been shown to improve through networked sensor technology. Some potential benefits, for example, are: optimizing water and electricity use with smart meters; minimizing salt use by applying based on ground temperatures; and emptying waste bins when full, with optimized collection routes.

REVENUE GENERATION: As one way to offset the costs of deploying new technology, cities can look for additional revenue generation opportunities. Some already being used include fees for Wi-Fi hotspots and electric vehicle charging stations.

COMMUNITY EMPOWERMENT: Through open data and inclusion efforts, smart city applications can more deeply connect citizens to city leadership and to each other, and build the capacity of citizens to make informed decisions. Efforts can include using technology to make services and information more accessible to vulnerable populations. ICT solutions also provide the opportunity for real-time feedback and iterative interaction between government and community, giving residents more influence in policy and decision-making.

3.1.6 Development Models

There are several urbanization models that incorporate digital technologies to address some of the urbanization and sustainability challenges: Digital Cities feature the integration of digital technology into the city's core infrastructure systems; Intelligent Cities rely on the digital city infrastructure to build intelligent buildings, transportation systems, schools, enterprises, public spaces, public services, etc. and to integrate

them into intelligent urban systems; and Smart Cities – deploy intelligent urban systems at the service of socio-economic development and improving urban quality of life.

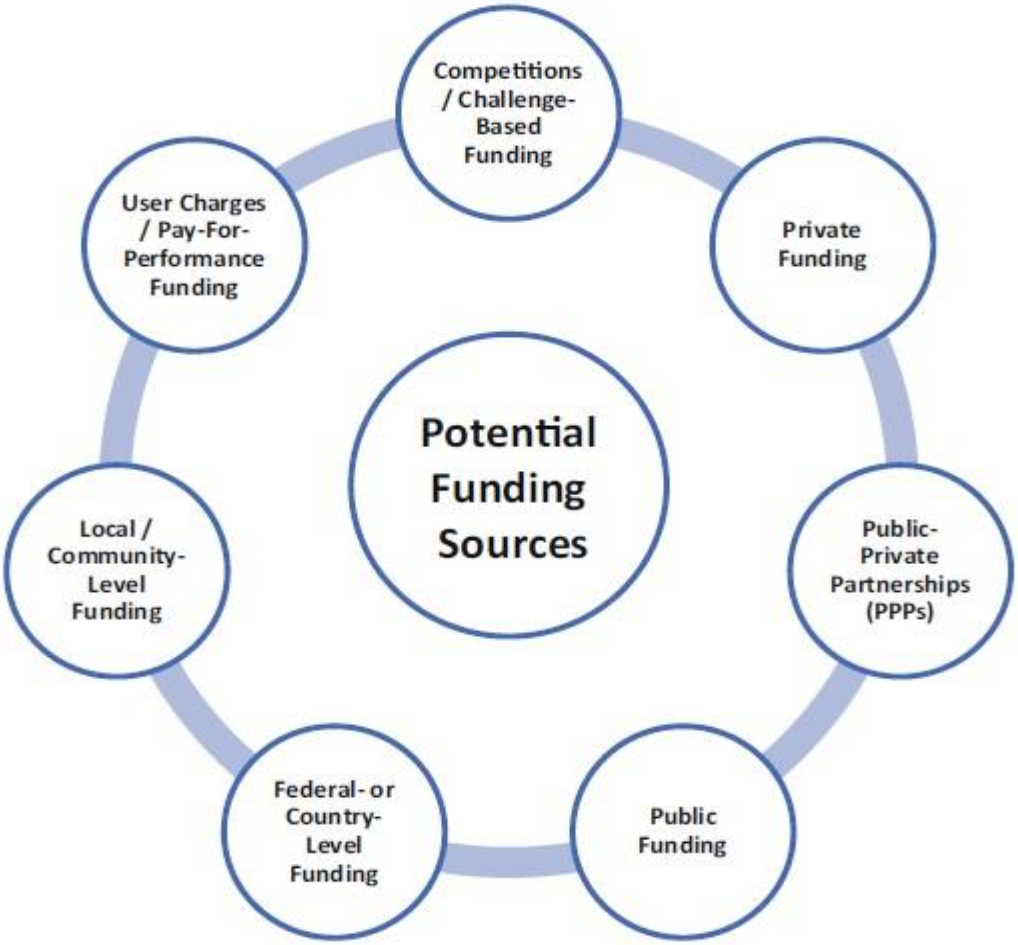
Smart City initiatives can help overcome the limitations of traditional urban development that tends to manage urban infrastructure systems in silos. By leveraging the pervasive character of data and services offered by digital technologies, such as Cloud Computing, the Internet of Things, or Open Data, they help connect different city stakeholders, improve citizen involvement, offer new and enhance existing services, and provide context-aware views on city operations. Smart City development is, however, highly complex, challenging and context-specific. The challenges include different discourses used by technologists and policymakers, lack of capacity to connect urban sustainability challenges to actionable approaches, and pressures on social and territorial cohesion requiring unique governance solutions.

3.2 Financing Smart Cities Development

Any Smart City endeavour, whether it is for a small “lighthouse” project or a large Smart City program, is an expensive process. From conceptualization and planning to development and implementation, costs rapidly rise and can easily cause a much needed project to perish. A key step in any Smart City effort is to evaluate all potential funding options early and determine what financing source, or what combination thereof, offers the best fiscal solution to bring the project from idea to realization.

Figure below portrays the most common funding sources for “lighthouse” and Smart City endeavours. The mix of financiers extends from governmental and public entities to private and creative financing pathways. As garnered from the array of funding sources, Smart City projects have piqued the interests and support from various levels of government, stakeholders, and residents.

The fiscal sources described in following sections have varying levels of availability and particulars, along with distinct benefits to the development and long-term sustainability of the smart technologies employed.



3.2.1 Types of Funding for Smart Cities

Government-Level Funding

For many Smart City programs, government-level funding is a critical component to whether the intended project can be completed as originally envisioned and proposed. Government funding comes from country-sponsored (or federal) agencies, and is generally one of the first funding options considered by Smart City developers. Governments are generally well invested in the urbanization of areas. They use the availability of their capital funds to remain connected to the holistic urbanization, and ensure a measured increase in the country's quality of life.

Government-level funding is beneficial to both Smart City developers and to the Government. This form of funding allows transparency to and from the citizens, and enables governmental access to different types of user data. For example, in a Smart City, governments can obtain critical data and metrics related to the use and efficiency of their transportation systems. Access to this data allows Governments a way to improve their service platforms and heighten their electronic governance (or e-governance) of citizens. In fact, e-governance is a significant component to intelligent populations (smart cities) by allowing public agencies a viable method to uphold transparent, proficient, and expeditious administrative services.

Furthermore, government-level funding is a straight forward and practical approach to secure capital for a smart project. Funding may or may not have to be repaid over time; however, the mutual economic and user information benefits to the Smart City and Government may serve as a quick return on the investment.

Local-Level Funding

Smart projects are targeted to large urbanized areas and smaller improvement zone communities alike. A powerful funding source for targeted smart projects comes from local-level funding sources. Incidentally, most investments made in a Smart City program occur through public funding sources. Such local-level sources include public development agencies, local economic development corporations, city/state/providence sources, and other locally invested quasi-agency organizations, such as utilities. Local financiers are generally highly invested in the urbanized area and may reap the rewards associated with Smart City technologies and projects.

Often local financiers designate monies for local region development with the hopes of driving population, the local economy, tourism, and the area's attraction to new businesses, Local-level funders are stakeholders looking at a return on investment and may require repayment over time through tax dollars or land allotments.

Community-Focused Funding

Another source of smart project funding comes from community-based sources, such as grass roots environmental community groups, large businesses invested in a community, local businesses looking for area rejuvenation, and targeted project economic stimulus. Unlike the local-level funding sources that are invested in large to small urban areas, community-based funding sources target individual communities within the urbanized or improvement areas. These community-focused funders usually have a vested interest in aspects of a larger smart project or interest in singular smart projects that can benefit a specific community. Often, community-focused funding pays for part of a larger Smart City project and not whole programs. This form of funding is a good way to supplement the costs of a total project and should be used in tandem with other funding sources. Community funds can be considered, for the most part, an approach to match other types of source funding.

Public–Private Partnerships (PPPs)

Many smart projects have significant benefits for both the private and public sectors, and can generate increased consumer mobility and economic gains. For these reasons, Smart City projects may be funded through Public–Private Partnerships.

A Public–Private Partnership, commonly known as a PPP or P3, is an "arrangement(s) between government and private sector entities for the purpose of providing public infrastructure, community facilities and related services". PPPs are desirable funding mechanisms for smart projects not only for the mutual economic benefits but also for the sharing of capital investments, program risks, oversight, and responsibilities among the partners. Additionally, with multiple partners invested in a smart project or program, the likelihood of successful completion of all phases increases due to the additional project oversight and union of financers wholly invested for a successful outcome and quick return on investment (ROI).

Loans and Municipal Bonds

Oftentimes funding sources are not available, hard to acquire in a reasonable timeframe that aligns with the project timetable, or inadequate to fund an entire smart project. Developers can turn to more traditional sources of funding, including loans and municipal bonds, to help supplement other project funding or keep smart projects aligned to the project schedule.

The upside to using loans and "muni" bonds is, after obtaining the appropriate approvals, the lump sum capital made available to pay for the project work. Monies from loans and bonds can be used as fast or as slow as necessary to pay for the project. Smart projects can face delays due to a poorly timed distribution of funds or restrictions on how monies can be spent. Each funding source has its own peculiarities for releasing funds, which can negatively impact the project deliverables schedule. However, municipal bonds and loans make the funds available for spending when necessary and appropriate during a project. The lenders, that include investment banks, insurance firms, and the government, typically take on an oversight role, auditing project deliverables and ensuring the monies are being spent appropriately and as initially intended.

However, the downside to using loans and "muni" bonds is that all loans and municipal bonds must be paid back in full over a fixed timeframe. The duration is dependent on the financier's agreement and the specific loans and bonds used to finance the project, and often have set deadlines for payback, interest applied to the outstanding balances, and is constrained by amortization schedules. For the capacity of upfront project capital, project developers ultimately will spend more for the financed smart project than initially estimated by the end of the entire payback period. The loans and bonds funding route is a balance between funding availability and project cost returns, and is a decision left for developers.

Private Funding

Lighthouse or smart projects can be funded by private sources. Private funding is a viable option for both smaller projects with targeted stakeholders or aspects of larger projects. Rarely will private funding sources be used for entire Smart City programs or large, multifaceted, urbanized area projects. Private funders often have interests in specific aspects of a project including, among other reasons, economic development interests, tourism, better people mobility in congested areas, and sustainability. Private funding sources have constraints on project expenditures arranged by the financiers and agreed upon prior to releasing funds. Private funds often have expenditure limits per a certain fixed period (i.e., per year or per month).

Smart projects using private funds are disposed to audits, oversight by a board of directors, milestone approvals for the release of funding, reduced or withdrawn funding, and funding inconsistencies. Private funders may also be susceptible to funding shortfalls, reduced or lackluster interest in a project over time, and impatience to any project delays. Overall, private funding can be a powerful approach to getting a lighthouse project completed; however, project developers must anticipate increased oversight, amplified "outsider" influence, and the need to reaffirm stakeholder interests.

User Charges and Pay for Performance

Smart city design and implementation is expensive regardless of location around the globe. New technology and advanced city transformations require upfront capital and a long-term economic plan to provide sufficient payback. Many Smart City programs are designed with a built-in repayment solution in the form of user charges and pay for performance. The idea is that users want an expanded and heightened city experience associated with a Smart City, and would be willing to pay a small surcharge for the experience. The concept is similar to the pay-for-use wireless networking ("WiFi") on an airplane, where users pay a small fee for the ability to stay connected at 30,000 ft.

Smart cities may choose to incorporate user charges into area taxes, city and utility bills, and other billable services. Some smart cities, such as in India, have begun applying parking fees, water and sewage surcharges, telecom fees, and utility(gas/electric power) surcharges to help pay for the available Smart City technologies. Proposing these small pay for performance user charges helps the Smart City developer communicate a sustainable, fiscally sound vision for the Smart City concept. User charges are "built-in" funding sources that avail a stronger return on investment and a viable approach to paying back secured funds.

3.3 Governance of Smart Cities

Managing a smart city means designing an organizational structure that fosters the widest stakeholder participation into urban governance. There are several solutions that can be adopted to coordinate and to manage smart projects, ranging from traditional municipal government to alternative modes of governance.

This section presents some models based on national and international case studies recognized as good practices of smart governance and stakeholders' involvement in local policy-making.

Gender approach

One of the main challenges faced by a smart city is to implement a gender mainstreaming approach in order to include in the smart city paradigm a real promotion of equal opportunities, a precondition for citizens' participation.

Gender mainstreaming calls for promoting equal opportunity in all political activities, across all public policy areas, throughout the process of policy-making – from agenda-setting, to decision-making, to implementation and evaluation.

Public and Private Partnership

Cooperation between governmental institutions and private actors in designing and financing programs and services is a fundamental part of the smart city strategy. Public-private partnerships (PPPs) are, in fact, fully recognized as a useful tool to improve the quality of delivered services and, above all, to ensure their economic sustainability. Through the involvement of businesses and private capital, it is possible to co-define, co-produce and, above all, to co-finance innovative projects.

Financial cooperation between public and private actors can be structured in different ways.

Urban Innovation

Cities are confronted every day with new and complex social, environmental, economic, cultural, and technological challenges. Innovation means finding new ways to meet these challenges and to satisfy citizens' needs. Innovation is therefore essential for cities to define smart policies.

A characteristic feature of current processes of urban innovation is the adoption of collaborative approaches to the definition, production and implementation of products and services. Examples of processes of co-design and co-production, based on cooperation between public authorities, citizens and businesses can be found in the experiences of Urban Living Labs, of collaborative e-government, and social innovation.

Place-based Approach

Cities are the places that face the greatest challenge of globalization: improving the quality of life of citizens through innovative and sustainable policies. To achieve this goal, cities must rethink current policy paradigms and recognize the importance of the local context that is the combination of social, cultural and institutional features within a given urban space. To adopt a place-based approach in defining urban policies means to involve local communities, to use their knowledge, to collaborate with all relevant stakeholders and to promote the inter-institutional cooperation.

3.3.1 Key Elements:

- Smart government can be considered as a basis for developing smart governance.
- Smart governance is the intelligent use of ICT to improve decision-making.
- Smart city governance fundamentally deals with government decisions for improving quality of life.
- Smart city governance emphasizes the citizens' role in collaborative decision-making.

3.3.2 Smart City Governance

The digital transformation is altering governance models in a disruptive way. Governance is the enabling environment that requires adequate legal frameworks and efficient processes to enable the responsiveness of government to the needs of citizens (by - UN Habitat, 2008). Governance can also be defined as interaction and collaboration of different stakeholders in decision-making processes.

The concept is commonly used to describe the action or manner of governing a state, an organisation, or other constellation of actors. This shows that government and governance are related, but different concepts. *Smart* Governance is defined as "the capacity of employing intelligent and adaptive acts and activities of looking after and making decisions about something". According to scholars, smart governance can be seen as basis to smart, open and participatory government.

These concepts play a key role in the growing discourse on smart cities, so we may expect that Information and Communication Technologies (ICTs) play a key role in smart government as part of wider models of smart governance. From this, it follows that the adjective 'smart' refers to context- and site-embedded combinations of ICT, technology, and innovation, as well some sort of democratic aspect. Also, concepts of *electronic* government and *electronic* governance (commonly abbreviated as e-government and e-governance) also emphasize the importance of ICTs in urban governance.

Smart cities are related to ICT-based urban innovation, i.e. intelligent use of ICTs to deliver better urban services, dealing with growing urban problems due to increasing urbanization, without the proper establishment of policies focused on well-being. One of the main objectives of smart cities is increasing the quality of life in the city. Many suggest, that to manage the dynamics of smart cities, a new model of governance is needed along with strong coordination by the local government to support in managing complex co-operation processes with a variety of stakeholders, in particular citizens. This scenario requires reshaping the role of governments, citizens, and other social actors, as well as exploring the new and emergent information technologies to frame a new governance model, including new relationships, new processes, and new government structures.

Smart governance is a concept that can be applied to the different levels of government as the application of emerging technologies for improving decision-making processes. When applied to the local government, smart city governance strongly focuses on the decisions made by government for improving the quality of life in cities, being the intersection of the main smart city dimensions (Smart Living, Smart Mobility, Smart People, Smart Economy and Smart Environment). Thus, the main objective of smart city governance is to increase the quality of the urban environment through the use of new technologies.

Key Elements:

- collaboration,
- citizen participation, and
- data-based evidence

Smart Governance and Electronic Governance

Smart Governance is generally defined as the capacity of applying digital technologies and intelligent activities in processing of information and decision-making (Scholl &Alawadhi, 2016).

Electronic governance is commonly defined as the application of technology by governments in order to transform themselves, their interactions with customers and the relationships with and citizens, businesses, other non-state actors and other arms of government, creating impact on the society (Estevez &Janowski, 2013; Janowski et al., 2012).

Fundamentally, below aspects refer mainly to two sub-themes:

1. Data and evidence-based policymaking- In order to achieve better governance and evidence-based policymaking, novel ICT solutions could be applied for processing, integrating and exploiting the huge and ever growing amount of data available and produced nowadays (by sensors, social media users, government, business and other stakeholders) and improving knowledge management capacities. The use of data to improve performance and decision-making is already a reality in public sector organizations. Open government data (OGD) as a specific set of data produced and made available for free by government organizations is constantly increasing (Peled, 2014) and lays the foundations for data-driven decision making and crowd sourced solutions through digital and mobile applications.

2. Collaborative, open and citizen-centric forms of governance - the advent of social media, mobile connectivity, and big and open data is pushing governments towards developing a vision of ICT-facilitated governance which is more open, collaborative, and responsive to the needs and aspirations of citizens. The understanding that government data and information belongs to the general public lays the foundations for

open forms of governance (Klaus, 2016). ICT innovations change the way government works, delivers services, and solves public problems in collaboration with citizens, but also addresses social impact and citizen empowerment (Linders et al., 2015). ICT-enabled urban management is a consequence of increasing demands from citizens to participate in decision-making, requiring changes in regulatory, policymaking and governance processes. Citizen centric e-governance, therefore, is considered as a new way to make use of ICT in order to enhance citizen's engagement with political discourse and decision making, influencing meaningful change in public policy and governance.

3.3.3 India Context: Special Purpose Vehicle (SPV)

The implementation of the Mission at the City level will be done by a Special Purpose Vehicle (SPV) created for the purpose. The SPV will plan, appraise, approve, release funds, implement, manage, operate, monitor and evaluate the Smart City development projects. Each smart city will have a SPV which will be headed by a full time CEO and have nominees of Central Government, State Government and ULB on its Board. The States/ULBs shall ensure that, (a) a dedicated and substantial revenue stream is made available to the SPV so as to make it self-sustainable and could evolve its own credit worthiness for raising additional resources from the market and (b) Government contribution for Smart City is used only to create infrastructure that has public benefit outcomes. The execution of projects may be done through joint ventures, subsidiaries, public-private partnership (PPP), turnkey contracts, etc suitably dovetailed with revenue streams.

The SPV will be a limited company incorporated under the Companies Act, 2013 at the city-level, in which the State/UT and the ULB will be the promoters having 50:50 equity shareholding. The private sector or financial institutions could be considered for taking equity stake in the SPV, provided the shareholding pattern of 50:50 of the State/UT and the ULB is maintained and the State/UT and the ULB together have majority shareholding and control of the SPV.

Funds provided by the Government of India in the Smart Cities Mission to the SPV will be in the form of tied grant and kept in a separate Grant Fund. These funds will be utilized only for the purposes for which the grants have been given and subject to the conditions laid down by the MoUD.