

Open Data Initiatives Fundamental Pillar For Emergence and Development of Smart Cities.

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Abstract: Smart city is a booming phenomenon in the 21st century with Open data initiatives increasingly becoming part of elements considered in emergence of this cities. Data plays an important role in enhancing informed decision making in real time. Availability of different open data talesis an added advantage. This paper analyses data initiatives from countries that are in the process of developing smart cities namely Kenya and India. Although their geographical boundaries vary in priorities of respective governments in development plans. We consider China, India and Africa, where smart city initiatives are promoted as a way of enabling modernization and national development, responding to population growth/migration, and managing economic and urban transitions. The study sought to identify how the open data initiatives available in this respective countries and they are similar to the conceptual framework of smart cities also to identify how they will shape development of different smart cities. This findings show the necessity of open data initiatives on emergence of smart cities.

I. INTRODUCTION

Economy and social transformation have made people to move to cities, resulting a large wave of urbanization throughout the world. By 2030, the urban population is estimated to reach 5 billion (about 60 percent of the world population), thus produces massive opportunities for the economic and social development of cities [13].

Development of fundamental infrastructure and policies is correspondingly important to ensure fast urban growth and ensure efficient usage of resources thus improve of governance and service delivery, offer swift seamless mobility, and achieve easy access to urban public facilities, affordable housing, quality healthcare, education, and living in highly populated areas [14].

A special spotlight is needed, covering urbanization trends in innovative management of urban operations and a variety of “smart” services to As an emerging paradigm, the smart city leverages a variety of promising techniques, such as the Internet of Things (IoT), cyber-physical systems, big data analysis, and real-time control, to enable intelligent services and provide comfortable life for local residents [16].

Sensors are currently used to collect and transfer data control center where there are powerful computing systems, such as cloud servers, to process and analyze the collected data. Fueled by human intelligence, the control center makes optimal decisions and manipulates the urban operations via feedback components, such as actuators [15].

Having the advanced information, communication, and control technologies as backbones, a smart city can offer various applications, including intelligent transportation, smart energy, intelligent healthcare, and smart homes. Not

only can this up-and-coming connected city quickly identify the demands of people and a city, but it can also manipulate urban operations to improve urban living quality in an intelligent and sustainable way. It is expected that the global smart city market will exceed US\$1200 billion by 2020, which is almost triple that in 2014 [13]

The home area information collected and managed by smart home applications may pave the way to disclosing residences’ highly privacy-sensitive lifestyle and even cause economic loss. Although some off-the-shelf techniques (encryption, authentication, anonymity, etc.) and policies might be directly applied to avert these problems [17]

A smart city employ combination of data collection, processing, and disseminating technologies in conjunction with networking and computing technologies and data security and privacy measures in managing of data.[18]

Smart cities are born from convergence of its citizens, infrastructure and ICT in order to improve resource management. This convergence offers many benefits, but it also poses many security and privacy challenges. Though there are different mechanism in place to enhance security still remains a challenging issue. [20-23]

Kenya and India are developing countries that have declared and started various initiatives of developing smart cities by changing existing cities into smart level as well as building new smart cities. In this paper we will analyze a number of open data initiatives that started that can play a role in development of different sectors in smart cities.

II. LITERATURE REVIEW

More than half of the World's population now lives in urban areas [3] This shift from a primarily rural to a primarily urban population is projected to continue for the next couple of decades (see <http://www.unfpa.org>). Such enormous and complex congregations of people inevitably tend to become messy and disordered places

Difficulty in waste management, scarcity of resources, air pollution, human health concerns, traffic congestions, and inadequate, deteriorating and aging infrastructures are among the more basic technical, physical, and material problems [4]

Another set of problems are more social and organizational in nature rather than technical, physical or material. Problems of these types are associated with multiple and diverse stakeholders, high levels of interdependence, competing objectives and values, and social and political complexity. In this sense, city problems become wicked and tangled. [6]

Making a city "smart" is emerging as a strategy to mitigate the problems generated by the urban population growth and rapid urbanization. Smart cities is principally about digitally instrumenting cities to change how urban infrastructures and city services are configured and managed. That produce continuous streams of data that dynamically feed into management software and control rooms enabling the real-time regulation of city systems [1]

Initiative principally concerned with improving urban policy, development and governance by using advances in ICT to reconfigure human capital, creativity, innovation, education, participation, sustainability, and management [2] Smart city is one that uses digital technologies and ICT to promote a citizen-centric model of urban development and management that promotes social innovation and social justice, civic engagement and activism, and transparent and accountable governance.[1]

Despite variations in smart city visions and deployments, each is united through an expectation that data-driven, networked technologies can be used to reconfigure how aspects of daily life are performed for the better and to tackle pressing urban issues,

An emergent number of objects are being connected to the Internet at an extraordinary rate comprehending the knowledge of the Internet of Things (IoT). In 2008, CISCO reported that the number of things connected to the Internet surpassed the number of people living on earth, whereas, in 2020, it will touch the limit of 50 billion, resulting in enrichment of the digital world [7].

There is a different domain in which IoT plays a vital role and improve the quality of human life. The people are also now using the capillary devices in IoT for health applications [8]. There are a lot of domains where IoT is applicable healthcare, automation, and transportation. It

empowers object's capabilities of hearing, seeing, listening and communicating them together. The internet now will be viewed as having billion of smart devices that are connected with embedded systems. IoT will significantly increase the scope and size as well as opening a new scope with new challenges. [9]

World's population in cities is expected to be above seventy percent by 2050. [10] With massive volumes of devices that will be connected together this will produce a tale of open data that will be big in nature. With analyze of this data for making informed decision will make

It is observed that 70% of the world's population (more than six billion) will live in cities and neighboring regions by 2050. Having such massive volume of the population, billions of the devices will also communication with each other, this producing overwhelming of Big Data. Data based on the user needs and choices, the cities would become even smarter. [10]

Digitization enables data collection has resulted in the accumulation of huge amounts of data that can be used in various beneficial application domains. Effective analysis and utilization of big data is a key factor for success in many business and service domains, including the smart city domain. [12]

The key concept of the smart city is to get the right information at the right place and on the right device to make the city related decision with easiness and to facilitate the citizens more quick and fast ways.[11]

III. OPEN DATA INITIATIVES

In China, India and Africa, smart city initiatives are promoted as a way of enabling modernization and national development, responding to population growth/migration, and managing economic and urban transitions. Within these broad geographic areas, there is considerable variation depending on the priorities of city governments and administrations, and the influence of local culture, history, politics and economies.

For example, in Europe/US the development of smart cities is principally concerned with improving the efficiency of city services, creating resilience and sustainability, strengthening security and control, and fostering economic development.

For comparison purpose Kenya and India countries have been chosen since from previous research it has been identified that the views of both countries on smart cities are same.

There nine components in smart cities, they include: healthy, infrastructure, building, transport, energy, technology, governance, education and citizens.

3.1 KENYA

The structure of Kenya government include: central and forty seven county governments. There are three major cities namely, Mombasa, Nairobi and Kisumu. These cities are being developed to become smart city in a step to improve service delivery by using technology.

The Kenya Open Data initiative (KODI) was officially launched in the year 2011. The aim of this program was to make key government data available freely to the public

online in a single portal. The portal hosts different government datasets. For example the census data sets collected in the previous years are held there, national along with county expenditure and information on key services that are offered by the government are indicated such as education, health, tourism, sanitation and agriculture. Kenya was among the first country to launch this initiative with a sole aim of helping in propagating better governance [30]

OPEN DATA INNITITIVES (KENYA)

TABLE 3.1

NO.	SMART COMPONENT	DESCRIPTION	USE
1.	Health care.	OTI'S MEDISMART	Smart is providing a complete healthcare solution, including cards, readers and related software that are seamlessly integrated with hospital management systems.
		SMART HEALTH APP	Provide accurate baseline information resource on HIV/AIDS, TB and Malaria.
		MATIBABU	Diagnose malaria without a blood sample.
		MPEDIGREE	Phone-based anti-counterfeit ICT software application which allows pharmaceutical retailers and users verify the authenticity of a drug.
		STAR HEALTH	Relates data through visualizations and various widgets. It works for the journalists as well as the general public.
2.	Transport.	REAL TIME PASSENGER INFORMATION.	Train stations display the information
		SMART BUSES	Smart Buses will be using software that enables people to get more information about the routes and times of travel.
		SMART MATATU APP	Smart Matatu, uses sensors that are installed in the matatu to track the driver's behaviour and give real-time feedback to the owners.
		TRAFFIC MANAGEMENT SYSTEM	Controls traffic in real time including videosurveillance, traffic actuated controllers and e-police which monitors violations.
3.	Energy	AUTOMATED MANAGEMENT	Lighting and AC prepaid digital meters which only allow consumers to use units they have paid for.
		KPLC PREPAID METER	a recharge card with a 20 digit number, more like the cell phone airtime scratch card

4.	Technology	MOTION SENSING CCTV + ALARM SYSTEM	Deters 95% intrusion and break-ins
5.	Governance	E-PROMIS	Platform for managing the national development budget.
		KIEMS	Real time election management identification and electronic display.
6.	Citizen	SECURING HOMES	Control & Monitor your home from your phone or tablet
		KENYA'S WAYO	Collects feedback, tracks performance and measures service delivery across various service points in real-time, enabling its customers to be updated on changes.
7.	Education	FINDMYSCHOOL	Provides information on how individual schools in Kenya perform in national examinations. Simplicity in presenting underlying data along with visualization to for easy understanding and sharing
		COUNTY SAFETY	The County Safety Crime enables Visualization through intensity map of all crimes reported in selected local dailies.
		GOTTOVOTE	Used to show how data driven tools can help ordinary citizens act on the news they read or watch, by finding out how national event affects their personal lives or local communities for instance election.
		CODE4KENYA	Created to accelerate the awareness furthermore the ability of the public to make sense of data and to promote engagement around critical public issues.

3.2 INDIA

The national informatics Centre (NIC) in collaboration with the US government, created an Open Government Data Platform India as an open source portal for Indian government ministerial departments to publish the data to the public for easy and open access by citizens.

Various initiatives have been launched by the government with the intention of boosting and forming a country for a knowledge future by increasing efficiency and improving interactions between government departments and citizens. This aims at ensuring government services are made available electronically hence automatic reduction of paperwork.

Government departments and agencies at large have contributed a lot of data sets across different segments i.e.

Population census, water and sanitation, health and family welfare, transportation and agriculture. More importantly the dynamic response of the portal is an added advantage to the citizens in accessing the particular data sets that they need. Users can demand a specific dataset from the government or search for any available data from given options.

Challenges arising however include the large volume of existing government data which is not available in digital formats, hence many departments are slow to share their respective datasets, issue of capacity, attitude, lack of demand along with enough confidence and courage to release the data, the existing state of data explains this reluctance. [31]

OPEN DATA INITIATIVES (INDIA)

TABLE 3.2

NO.	SMART COMPONENT	DESCRIPTION	USE
1)	Health care.	PRACTO	Sequoia Capital-funded Practo provides healthcare solutions for healthcare providers and consumers. Practo Search lets patients to browse through doctor profiles online and book appointments,
		NETMEDS	Netmeds is a licensed online pharmacist offering prescription medicines and other health products across India,
		LYBRATE	Online and app-based doctor consultation platform to connect to healthcare specialists from diverse fields including ayurveda and homeopathy.
		SMART HEALTH	SMART Health India has made ASHAs, together with local doctors, the focus of this important initiative designed to deliver affordable healthcare to rural communities has made ASHAs, together with local doctors, the focus of this important initiative designed to deliver affordable healthcare to rural communities
2)	Transport.	REAL TIME PASSENGER TRANSPORT INFORMATION.	Digital displays at bus and train station of arr. And dep. Time.
		ELECTRONIC TICKETING MACHINE	Hardware device capable of issuing passenger tickets and sending the ticket data over serial and GPRS interfaces. It is capable of automatic fare collection (AFC) using smartcards and recharging the smart cards.
		MYSURU'S SMART PUBLIC BUS	Uses GPS enabled mini-computers to monitor the speed and coordinates of each of the 400 city buses and also allows passengers to track their arrival time online or on mobile phones.
		RFID	Basic automated toll fee collection
3)	Governance	PASSPORT SEVA	Delivery of Passport Services with wider accessibility and reliability. Disaster Recovery Centre, a nationwide common software application and 24 x 7 call center
		IMMIGRATION, VISA AND FOREIGNER'S REGISTRATION & TRACKING (IVFRT)	Advancements and up grading of the Immigration services, it has been undertaken by the Ministry of Home Affairs under the National e-Governance Plan (NeGP)
		MINISTRY OF CORPORATE AFFAIRS (MCA12)	E governance project that enhances e-forms, registration and incorporation of new companies, Payment of Penalty fees, online tracking in MCA etc.
		UNIQUE IDENTIFICATION (UID)	Planning Commission as an identification for all resident across the country hence will be the primary basis for efficient delivery of welfare services

4)	Citizens	CRIME AND CRIMINAL TRACKING NETWORK & SYSTEMS CCTNS	To automate all police centers across the country thus enabling transformation of police force into a knowledge based force thus improving the delivery of services to citizen.
		MISSION MODE PROJECT (MMP)	Introduction of Information and communication technologies hence more citizens will be equipped with knowledge thus lessen the time and cost of services.
		UNIQUE IDENTIFICATION (UID)	Planning Commission will use (UID) for identification of each resident across the country hence would be used primarily as basis for efficient delivery of welfare services
		NATIONAL LAND RECORDS MODERNIZATION PROGRAMME (NLRMP)	Computerization of Land Records (CLR) & Strengthening of Revenue Administration and Updating of Land Records (SRA&ULR). Consolidation of schemes into a National Land Records Modernization Program (NLRMP) thus improving delivery of services.
5)	Energy	SMART DISCOM	Smart meters and the back-end infrastructure of a smart-grid network, even the distribution company would start behaving smartly. The smart model, which could be tied to a dynamic tariff, would help domestic and institutional consumers.

IV. CONCEPTUAL FRAMEWORK FOR SMART CITY

A research was conducted on a number of journals with the intention of illustrating the attention that is paid by scientific community on that domain. It was identified that smart cities play a role in utilizing intelligent urban space to address a number of problems. [29] The conceptual framework work of the city appears to be structured and consisting of following application domain:

- Living: It covers education, health, safety, and quality of life in urban space
- Utilization and management of resources: Deals with different resources including, energy, water monitoring and management
- Urban infrastructure: refers to building hence communication and linking of different appliances using ICT.
- Coherency: social issues that address digital divide, social relations, and ICT connectivity
- Government: mentions public e-service delivery, e-democracy and participation, accountability and transparency, and administration's efficiency within the city
- Economy: covers areas that reflect domestic product in city, innovative spirit, employment, and e-business

- Transportation sector: it concerns use of ICT to management transportation, as well as intelligent transportation products and mobility in general

Analysis of Kenya and India according to number of applications that have been formed to enable improved delivery of services among the citizens of those countries, will help in collection of open data that can be shared through their portal and be used in development of smart cities.

4.1 SOURCES OF OPEN DATA INITIATIVE

General municipal & business services are a creation of partnership network between cities, stakeholders, government, business community enterprise, suppliers, service providers and citizens. Data analysis done on data collected can benefit local government to govern and distribute resources.

Smart management of intelligent buildings is also a source of data, it enables integration of communication network for building control system, and Information of citizens of a particular area, suppliers, environmental group's creditors and owners is contained.

Smart Education, health and social care open data initiatives initiated in this area will improve the processes undertaken along with enhanced service delivery and better access. Information of educational centers, social healthy providers, local people and programs initiated is contained.

Intelligent systems enhancing smart energy, smart lighting, connects the supply grid to demand elements through different services. Information contained include for suppliers, regulators, business communities, environmental groups and organizations

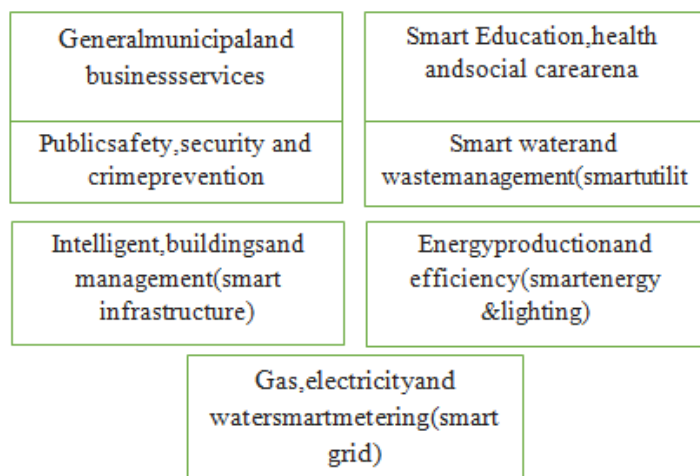
Smart metering for electricity gas and water. Utility meter records energy, water or gas usage in real time it also maintains the communication. Contains data on usage, citizens, business community and enterprises, suppliers and service providers, creditors and owners.

Smart utility i.e. water and waste management. Intelligent systems are used to manage water and sewer systems and flow management with real time awareness control. Data contained include of Water suppliers and waste management companies and suppliers, local governance, citizens, regulators, environmental groups and organizations.

Public safety, enables security and prevention of prevention by warning users of danger and ensure faster response time for emergency services. Local people and residents, local authority governance, local interest groups, suppliers and service providers.

SOURCES OF OPEN DATA INITIATIVE

FIGURE 4.1



Countries economy sectors are part of open data initiatives including: public safety, education, healthy, governance, energy sector, transport infrastructure and waste management. Though smart services delivery a lot of data is collected from: suppliers, service providers, environmental organizations, local authority governance, regulators, business communities, environmental groups and organizations, Information of educational centers, healthy and social providers. Data collected is analyzed in smart cities and used to make informed decisions in real time. Open data initiatives will enhance development of better services thus improving the living standards of citizens which is the same goal of smart cities. Open data initiatives

are fundamental enhancing smart cities development in given countries.

V. FUTURE SCOPE AND CONCLUDING REMARKS

Smart city is a phenomenon that is booming. Billions of intelligent smart devices are connected in different sectors of the economy and mostly in cities to enhance service delivery. All this devices generate data in large scale. Open data initiatives are increasingly becoming part of elements of consideration in emergence of Smart city. Data is the driving force in development of smart cities. Availability of different open data tales is an added advantage. A few researchers have assessed emergence of smart cities and identified the conceptual framework with various application domain. Analysis of various applications in Kenya and India have proved to be profitable in providence of data that will shape up the development of different smart cities. In future researchers should concentrate on metrics of the development and ratios of the impact in various smart cities that are being developed in respective countries.

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