SMART CITIES: GLOBAL OUTLOOK

A REPORT BY ATOMCAMP

atomcamp

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About Us

atomcamp is a continuous learning platform that is helping the youth and organizations unlock opportunities with Data Science.

atomcamp hosts various courses and programs centered on tech education to upskill the Pakistani workforce and to create the awareness that continuous education is critical to keep up with the fast-paced world.

Technology Bootcamps

At atomcamp, we offer a variety of multidisciplinary courses, but our main focus is Data Science, Artificial Intelligence and Cloud Computing and Infrastructure, which are relatively new and emerging fields, especially in Pakistan. Our goal is to make careers in these fields accessible to everyone in Pakistan - regardless of the educational or professional background.

atomcamp's 6-month Data Science Bootcamp enables participants to learn relevant data skills and launch their careers. The program is meant for those who are aiming to switch into a data science career as well as those who want to incorporate data science training into their current jobs/careers to remain competitive.

Our 3-month AI bootcamp is designed to train you to launch your career in AI, regardless of the educational background. This program is designed for everyone as the first two months of AI bootcamp focus on building a foundation in Python, Math, and Machine Learning.

About the Author

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Our Mission

promote a culture of continuous learning

provide skill development for youth

encourage interdisciplinary learning

build learning communities

provide contextual & accessible knowledge

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Smart Cities: the Future

Revolutionizing urban communities, smart cities offer technology-powered efficient solutions to some of the most pressing problems faced by urban centers across the globe. While deploying technologies in cities is already an emerging trend, in the decades to come it will drive the rise of mega cities that service millions of citizens in the many processes of their day-to-day lives.

Defining Smart Cities

As technology evolves into new dimensions, the ways in which we live and interact with technology across various platforms are changing faster than we can imagine. Cities have been the basis of human life for decades. Urbanization is in fact a defining trend of the 21st century. According to UNDP, by 2050, around 70% of the world's population which is an additional 2.5 billion people will be living in cities, with a majority of this urbanization happening in Africa and Asia [1]. Moreover, the United Nations also projects that by 2050, there will be a 35% increase in the number of people living in the megacities of the world[2].

With an ever-increasing proportion of the world's population living in cities, the quality of life they offer citizens and potential improvements in this quality of life are critical points of discussion. Cities, of both the developing and the developed world, face problems across various dimensions from infrastructure to governance to traffic.

With such pressing problems plaguing urban populations, there is a need to upgrade the way that cities operate and the lifestyle they offer. Smart cities, typically defined as "cities that use information and communication technology (ICT) to improve operational efficiency, share information with the public, and provide a better quality of government service and citizen welfare"[3], are an obvious solution to these problems.

Key statistics about the state of cities

35% of the world's urban population already faces inadequate and unaffordable housing

Expected rise in sea levels by 2100
2+ meters

**90%** of the urban population worldwide lives in conditions that do not meet WHO health standards

Traffic congestion costs in the US alone in 2017
USD 300 billion

The main purpose of a smart city is to optimize city operations and encourage economic growth. At the same time, the quality of life for citizens must also be enhanced using smart technologies and data analysis. The value of such infrastructure is in how technology is used as opposed to the mere availability of technology [4].

What makes a city "smart"?

Smart cities have gained popularity as a buzzword that can be used in a variety of contexts however, there are several frameworks that address how a city can be defined as "smart" and what must be done to achieve this. To make a city "smart", how and where technology is applied are critical questions to answer. Let us look at each of these in turn. Technology can be employed across a variety of elements in the city, such as mobility, services, governance and economy[4].

Smart

1

How are technologies used?

2

Where are technologies used?
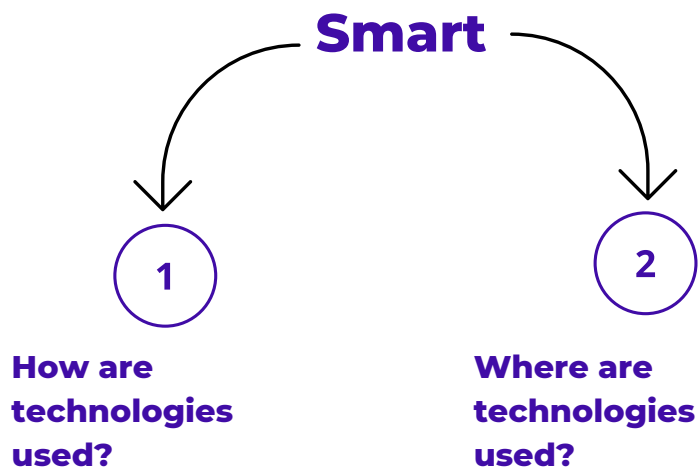
How should technology be used in smart cities?

The answer to this question has been presented by McKinsey and Co in a layered approach which defines the steps in which technology must be deployed in smart cities, regardless of its applications. According to them, three layers make a city "smart [5]":

Layer 1   Technology base:
This refers to a critical mass of cell phones and mobile devices connected through high speed networks

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Layer 2   Specific applications:
This layer concerns the use of specific applications that translate raw data into alerts, insights and action reports.
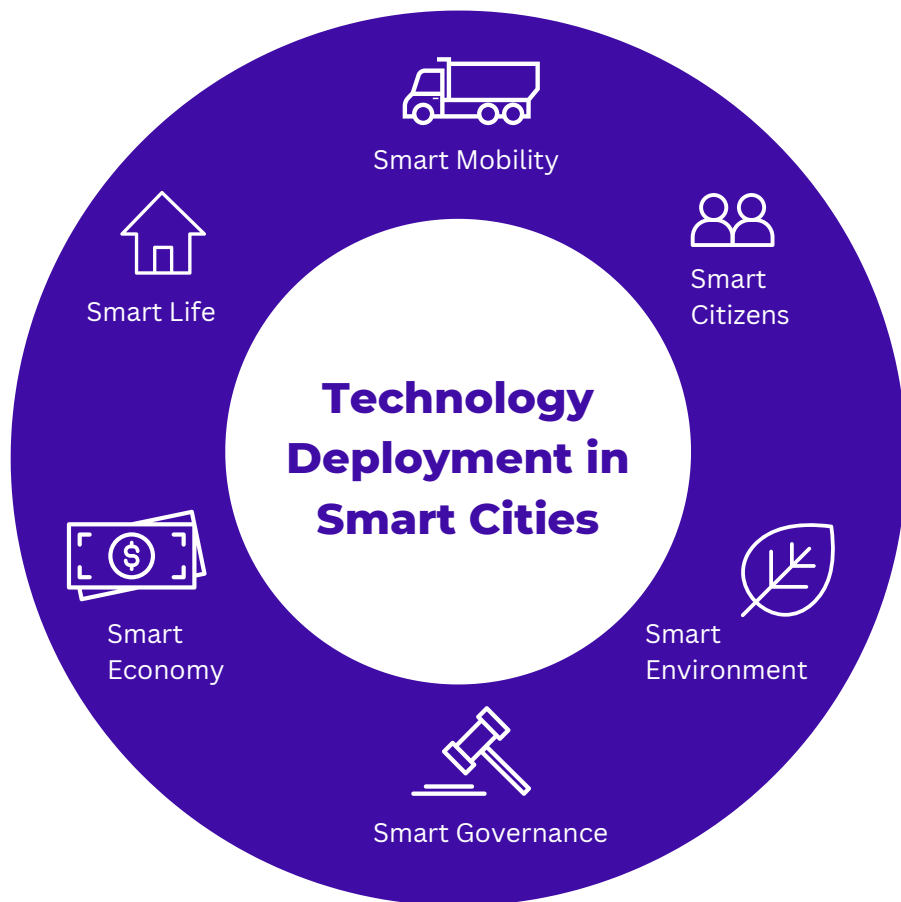
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Layer 3   Adoption & usage:
This means that the insights and action reports generated by applications using raw data are adopted by the relevant stakeholder whether that is the government, companies or the public at large.

Where should technology be used in smart cities?

Cities provide an expansive playground for technology across their various aspects. In smart cities, technology may be deployed across a host of frontiers such as mobility, economy and governance. When this technology is deployed, the goal is to improve the efficiency of operations and provide a higher standard of living in urban communities

Technology Deployment in Smart Cities

- Smart Mobility
- Smart Citizens
- Smart Environment
- Smart Governance
- Smart Economy
- Smart Life

Smart Mobility

Smart Mobility refers to the optimization of transport and communications to improve the standards for sustainability, efficiency, and safety in city transport and mobility. This can include the use of technologies in preventing congestion to save time for commuters, using energy-efficient vehicles to improve air quality, and creating new safety protocols. Electric vehicles, autonomous driving, and predictive traffic analytics are just some of the smart city technologies that can be employed for these purposes [6].

Smart Citizens

Smart citizens refer to digitally literate inhabitants of an urban smart city that are able to engage with technology in a productive and responsible way. These citizens would be able to leverage advances in technology to improve their social connections and linkages and to manage their interactions with the government and other public forums. Applications that improve interconnectedness, increase transparency regarding government operations, and provide information in real-time are critical technologies in this regard.

Smart Environment

Smart environment means employing technology in cities to improve sustainability and utilize environmental resources more efficiently. This can mean improvement in indicators such as noise pollution, air quality and carbon emissions. It can also mean using resources such as electricity, water and fuel with greater efficiency. Technologies that enable us to do this such as electric cars, noise barriers and large scale air purifiers, will be at the forefront of nourishing smart environments in smart cities.

Smart Governance

The adoption of technology by the government and its responsible use is another critical component of smart city management. Smart governance means the application of technology in government interfaces and processes to facilitate planning, operations, and reporting to all relevant stakeholders. This can mean the enhancement of government services and facilities through technology such as voting, tax collection, and citizen applications. It can also mean the rise of e-governments, that use ICT technologies to enhance their day-to-day workings.

Smart Life

Smart life means increasing the standard of living for all residents in a smart city. This means looking at aspects such as health, education, and digital inclusion and how these can be augmented using technology. Improving care for the elderly, sick, or disabled using Artificial Intelligence or other kinds of autonomous technologies, creating customized curriculums for learning, and improving access to the internet are some initiatives that can be taken to drive progress for a better quality of life in smart cities.

Technology for smart cities, therefore, can be deployed on at least six major fronts, mobility, citizens, environment, living, economy, and governance. The process of measuring the impact of such technology applications is a work in progress but even conservative estimates indicate that there will be substantial gains for urban communities in adopting technology for their day-to-day living and wider city infrastructure.

Smart Economy

Smart Economy means the use of technology to strengthen the economy of a smart city. This means driving improvements in the business climate and opportunities through technology to ensure prosperity for all stakeholders in the economy. Technologies that improve profitability and efficiency for businesses, as well as guard against unforeseen risks, will be critical in this regard. Moreover, technology in smart economies can also be employed to reduce uncertainty such as digital open data portals and tools for predicting supply shortage.

Projected Impact of Technology Deployment in Smart Cities

20-80 liters of water saved per day

8-15% lower disease burden

1-3% boost in employment

15-20% shorter commutes for workers

30-300 lives saved every year

Negative effects from air pollution reduced by 8-15%

Source: McKinsey [5]

Technologies Used in Smart Cities

Smart cities,their conception, construction, and management, are still in their nascent stages. However, it is clear that technology and advancements in technology will be key catalysts in allowing smart cities to flourish to their full potential. Some of these technologies have been defined below.

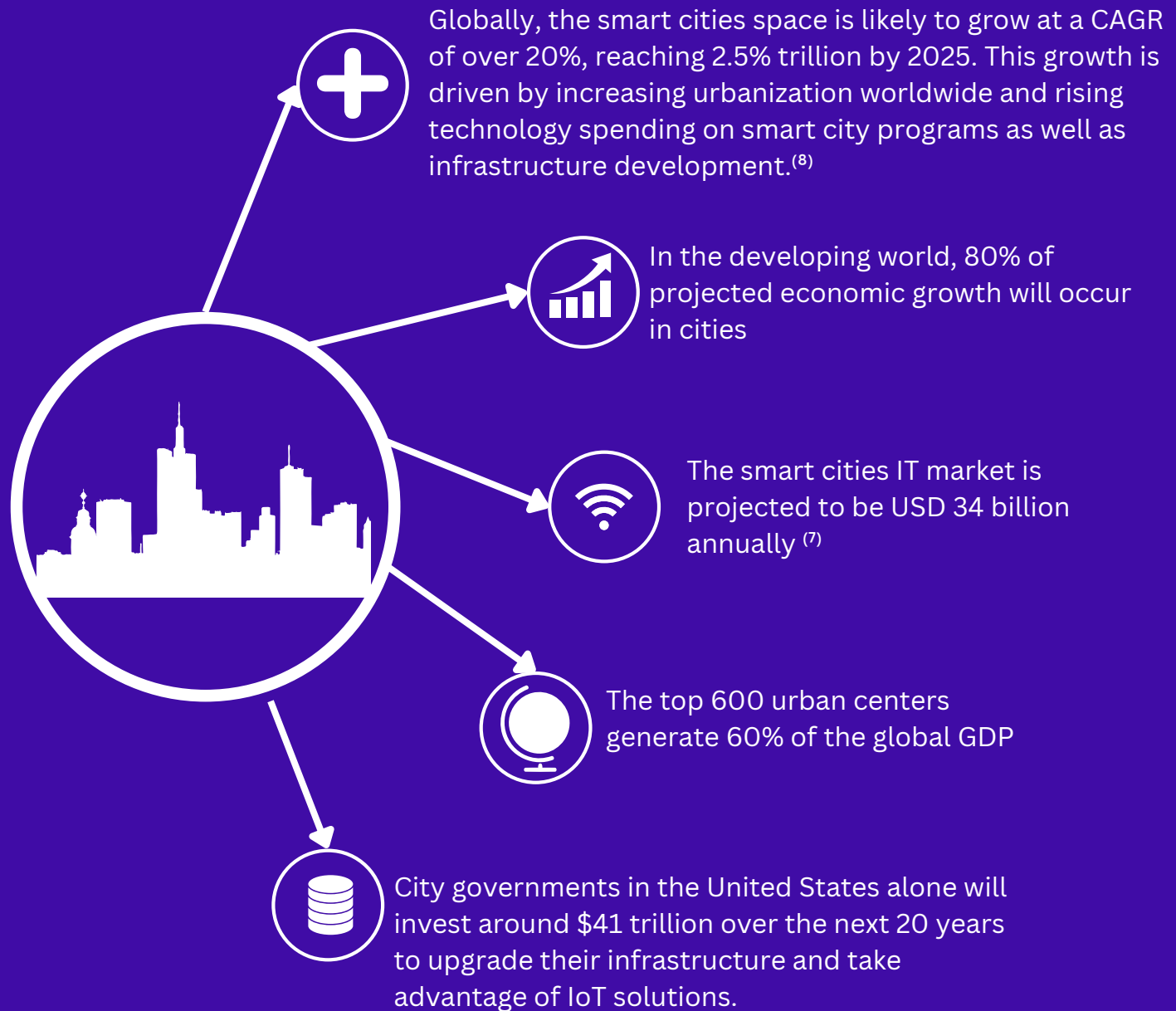| Technology Name	Technology Description	Application for Smart Cities
Internet of Things (IoT)	The Internet of Things refers to interconnected physical devices such as appliances and vehicles that may be embedded with software and hardware that allows them to exchange data. [10]	More efficient energy use & traffic safety
Application Programming Interfaces (APIs)	An API, or application programming interface, is a set of predefined rules that enables different applications to communicate with each other, letting companies open their data and functionality to external third-party users.[11]	Availability of big data for data analytics in heath, resource management and education
Artificial Intelligence (AI)	Artificial intelligence (AI) typically refers to the ability of a digital computer or computer-controlled robot to perform tasks that are usually attributed to intelligent beings [12].	Autonomous driving and deliveries, assistance with elderly and child care
Mesh Networks	Mesh networks refer to a singular network that links various devices together so that information can pass through various devices	Home monitoring and medical assistance
Geographical Information Systems (GIS)	A geographic information system (GIS) refers to a computer system that captures, stores, checks, and displays geographical data of all types, for example, a GIS can show elements such as streets, buildings, and vegetation.[13]	Real estate development and information, traffic management

Smart Cities: History and Growth

What is defined now as a "smart city" has had various different names across recent history, however advancements in technology and their widespread application to urban centers have been around for longer than one might think. Moreover, it is interesting to note that the private sector which involves large tech stakeholders have been critical drivers in creating awareness and usage for smart cities.

- 1974 – Los Angeles created the first urban big data project: "A Cluster Analysis of Los Angeles" report.

- 1994 – Amsterdam created a virtual 'digital city' – De Digital Stad (DDS) – to promote Internet usage.

- 2005 – Cisco put up $25m over five years for research into smart cities.

- 2009 – IBM unveiled a $50m Smarter Cities campaign to help cities run more efficiently

- 2011 – 6000 visitors from over 50 countries attended the first Smart City Expo World Congress in Barcelona.

- 2013 – China announced first batch of pilot smart cities, comprising 90 cities, districts and towns

- 2014 – Vienna City Council launched Smart City Wien Framework Strategy

- 2018 – IESE Business School Cities in Motion Index ranked New York, London and Paris as its top 3 cities.

- 2018 – Singapore won Smart City of 2018 award at the Smart City Expo World Congress.

- 2020 – Vietnam to start work on a new $4.2bn smart city close to Hanoi, with completion target of 2028

Source: the Verdict[9]

It is not just that smart city adoption has accelerated but as economic and demographic trends show, urbanization and the spending on cities and their technologies globally have also increased at startling rates. As a result of this, cities are becoming powerful epicenters of the economy.

Smart Cities Growing Faster than Ever

Globally, the smart cities space is likely to grow at a CAGR of over 20%, reaching 2.5% trillion by 2025. This growth is driven by increasing urbanization worldwide and rising technology spending on smart city programs as well as infrastructure development.[8]

In the developing world, 80% of projected economic growth will occur in cities

The smart cities IT market is projected to be USD 34 billion annually [7]

The top 600 urban centers generate 60% of the global GDP

City governments in the United States alone will invest around $41 trillion over the next 20 years to upgrade their infrastructure and take advantage of IoT solutions.

Building the Future: Companies in Smart City Development

As cities become a critical point of technological intervention, companies and organizations that create and provide technology products are becoming major stakeholders and drivers in the dialogue around smart cities. These organizations are and will continue to work closely with public sector stakeholders to change the landscape of cities through their products.

The activities of such organizations are divided across a vast scope which includes project management, policy advocacy and technological innovation.

Some of the companies working in smart city technology and management space are given below.

IBM

IBM is one of the companies at the very forefront of smart city development. The tech giant is responsible for major developments in smart city management as a result of its advocacy for smarter cities. It regularly produces knowledge and insights related to smart city management such as its report highlighting a version of smarter cities[14] or its work on assessing how smart a city is [15]. It has also hosted a "Smarter Cities" challenge which invites governments of various cities to compete for a lucrative grant by IBM for smart city development [16].

Ushahidi

Ushahidi, founded in 2008, is a global not-for-profit technology company that builds open-source software to mobilize communities. The Ushahidi platform gathers knowledge through data analysis and by crowd-sourcing information. The software can be used for a variety of tasks such as tracking violence, infections, or natural disasters and deploying alerts to people in a variety of mediums. Since its creation, the platform has deployed over 10 million alerts exactly for these purposes [17].

Aecom

Aecom is a fully integrated global infrastructure firm that has been working to develop connected cities in Saudi Arabia. Since 1996, they have worked on a variety of infrastructure projects throughout the region building infrastructure in transport, water management and drainage. Their latest project is the provision of project management consultancy for the construction of NEOM, a futuristic city in Saudi Arabia that promises to revolutionize the smart city concept forever [18].

Nord Sense

Nord Sense is Silicon Valley funded start-up, established in 2015 that specializes in technology products for waste management. Using smart sensors and data, Nordsense products offer an end-to-end optimization of waste collection and management through IoT. Their products can generate data on key waste production trends and offer route optimization for optimal waste collection [19].

Smart Cities: Case Studies from the Globe

Governments all over the globe have also sought to harness technology for improvements in the planning, development, and management of cities. City governments are increasingly adopting technology to better understand key pain points for citizens, to boost efficiency in day-to-day operations, and to increase transparency in government procedures. The following are some case studies that signify just how transformative the smart city revolution is and will be.

Smart Dubai Happiness Meter (Dubai, UAE)

The Smart Dubai Happiness Meter is a simple but powerful tool that works in real time. It has been instituted to measure the happiness of Dubai residents across various pain points in the urban experience. It measures feedback for a variety of public services such as mobility, energy, environment and social services. It is soon to be expanded for private sector services as well. In the two and a half years since its operations, more than 22 million Happiness votes from 4,400 touchpoints over 172 entities have been collected.

ConnectedLife (Singapore)

In Singapore, one of the most technologically advanced cities in the world, data is leveraged to provide assistance to the growing elderly population of the city. ConnectedLife's home monitoring solution works with three stakeholders: health officials, insurance providers and the government to provide insights for early intervention and holistic care. Their technology combines IoT with customized insurance to provide exactly the right kind of support to the elderly population.

Ahmedabad Heat Action Plan (Ahmedabad, India)

In 2015, Ahmedabad became the first Indian city to roll out a complete and efficient early warning system for extreme heat events and episodes. These episodes are a major threat to the well-being of poorer residents who are more vulnerable to such shifts in temperature.
Extreme heat events are also becoming more and more regular due to climate change. This plan relied on building public awareness, initiating an early warning system and promoting inter-agency coordination to alert residents of predicted extreme temperatures as forecasted through a variety of mediums.

Platform Economy (Amsterdam, Netherlands)

To ensure that users can trust platform economies in the Netherlands, the government has been working tirelessly to monitor the digital space. It has developed a standard for auditing and evaluating algorithms that is also employed within the government to ensure that the method is suitable for permits, concessions or contracts. This is a critical step in ensuring that the rights of citizens are protected in an increasingly digital economy.

Source: World Economic Forum[20]

U Crime Prevention, (Anyang, South Korea) 🇰🇷

Anyang in South Korea has established its smart city center which hosts an intelligent crime prevention system connected to reporting with the police. The way this works is that if a citizen reports a crime, surrounding CCTVs will be leveraged by the responding patrol car. For example, the suspect's escape path can be tracked by the surrounding CCTVs and communicated to the patrol car in real-time. Similarly, models built using data can also be used in CCTVs to detect illegal parking and vehicle identification [21].

HK Smart City Blueprint (Hong Kong, China) 🇨🇳

Hong Kong has maintained a consistent and systematic focus on smart city development with a focus on ensuring smart mobility. It has a fully functioning application called HKeMoblilty, a one stop service to look up information on public transport, routes traffic fares and real time traffic updates. Moreover, city authorities are currently using IoT technology to develop a traffic analytics model that forecasts traffic conditions for users on the app [22].

Wagri (Japan) 🇯🇵

Wagri Japan is an innovative platform set up by the government of Japan to provide real-time data to farmers and to bolster the agricultural economy of the country. Wagri allows farmers to share data to improve productivity. It also provides data about various aspects such as land, weather, soil, and market conditions. Users which include farmers and private corporations can use data on Wagri to make informed decisions about the allocation of resources [23].

Smart Cities: Gaps in Policymaking

Smart cities are undoubtedly a growing global phenomenon. This is signified by the fact that governments all over the world are employing technologies in their day to day operations at an accelerating speed. However, it is also critical to understand that the development and growth of smart cities is a relatively new concept and therefore, there are still many dimensions to consider and study regarding smart city development.

⚠️ Digital Divide:

While smart city development and initiatives have gone far in creating convenience and a superior lifestyle for citizens, they have also intensified the digital divide between various income classes. More than one-third of the world's population, for example, has never used the internet[24]. In a world where access to technology and digital literacy are fast becoming key determinants of the quality of life, this is a big issue. Policymakers, therefore, need to account for all income groups while designing initiatives for smart city development.

👤 People Driven:

Implementing initiatives in urban communities without consulting community members creates issues of inequality and inequity. It also reduces the efficacy of the policies implemented because they fail to account for local needs. Therefore, as governments amp up their smart city development, they must ensure that proper institutional planning is in place to provide context-sensitive outcomes in local areas and that a community-based approach is followed in the development and deployment of technology[25].

🛡️ Cyber Security & Data Privacy

While many pioneering cities have made great leaps in technology deployment, they have failed to set up a proper infrastructure for data privacy and protecting the rights of citizens [26]. Governments need to focus on ensuring that a comprehensive, centralized structure is in place for the privacy and security of their own data as well as that of major technology providers in urban areas. Furthermore, governments also need to create the necessary protocols and regulations to keep track of the implementation of cyber security and conduct routine checks to ensure that citizen data is well protected.

✊ Public Interest & Democracy:

Powerful technologies can be misused easily for private gains such as in the case of the Facebook and Cambridge Analytica scandal [27]. And such concerns are just limited to operators of technology but the technology itself. Facial recognition technologies for example have been found to harbor a racial bias against people of color [28]. Governments must therefore ensure that public interest and the principles of democracy are put front and center in all technology creation for smart city developments and that citizens have appropriate channels and rights to file complaints in case of any misconduct.

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