# Foundational Aspects of Smart Cities Leading the Digital Economy - An Review

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**Abstract** – Due to the proliferation of advanced computing devices, it is now possible to attain faster data availability, data transportation, intuitive programming, and efficient infrastructures. In addition to enhancing the economy in terms of financial assets, and energy in the management of cities, the projected advantage is that it will have a positive impact on the quality of services provided to urban citizens. This article analyzes the foundational aspects of smart cities within the context of the digital economy by examining the roles of the digital economic developing in the construction of cities using China as a case study. This paper further explores the challenges facing the construction of the digital economy and smart cities, and provides a recommendation to Belarus to enhance its influence of the digital economy in their smart cities and e-government development. Based on a critical survey provided in this article, researchers and city developers are provided with insights and recommendations for bolstering the smart city's "digital radiation drive."

**Keywords** – Urbanization, Smart Cities, Digital Technologies, Digital Economy, Information and Communication Technologies.

## I.    INTRODUCTION

The term "urbanity" refers to a broad definition that centers on the concentration of people in a single urban environment. Urbanization may be used to describe the process by which rural residents adapt to city life and the subsequent expansion of urban areas. Groups, corporations, institutions, and virtual organizations with a wide range of aims and purposes are all contributing to the increasing complexity of modern life. The modern definition of urbanization encompasses a bigger and more varied set of growth-influencing economic, social, and cultural forces. Practically everywhere in the globe has experienced a shift toward a more urban lifestyle and a more advanced ethnography. There are many different measures of globalization, but one key indication is the speed with which information may be shared between advanced and emerging urban centers. Presently, different nations take various approaches to enhance urbanization. However, inadequate resources prevent economically impoverished nations from realizing the benefits of urbanization in the same manner that more developed nations have.

Urbanization, a byproduct of both globalization and technological progress, has emerged as a leading cause. Population expansion reflects commercial and societal requirements, but we alter those requirements by prioritizing social awareness within quality of life considerations. In a similar aspect, the economy, culture, and environment adapt to the ways in which individuals choose to live their lives. Opportunities to provide for the requirements of quality of life, equality in urbanization and urban populations are all affected by technological progress and innovation. In terms of the number and quality of the changes that are taking place and how well they are meeting the requirements of the community, we might say that this is a constructive process. One of the most acknowledged signs of globalization are the spread of knowledge from advanced to less-advanced urban centers. Increasing the quality of life is a central tenet of many urban development frameworks at the continental and national levels, notwithstanding the high price tag associated with these plans.

Studies conducted over the last 40 years have shown a number of causes and mechanisms for urbanization, as well as the challenges that come with it [1]. The current period of urbanization can be broken down into four distinct epochs: (1) the transition from quasi-urbanism to full-fledged urbanism; (2) the urbanization's collapse and subsequent re-urbanization; (3) the economic theory based on components such as national market outputs, and (4) the reception and dissemination of extensive data to serve the public in both the rural and urban environments. Industrial developments not only focus on the process of urbanization but also have a significant impact on both infrastructure and fragmentation of cities. According to the external impact hypothesis, the degree of economic and social development determines the kind, extent, and intended direction of urbanization processes. Disparities in spatial development have different kinds of external impacts, and most human activities happen in very small regions.

For instance, metropolitan regions are not immune to the effects of the outside world. To attract new businesses and residents, urban renewal projects in recent years have often prioritized improving a city's competitive environment. It is essential that we keep our natural environment in pristine shape, and this is a key tenet of sustainable development (which is especially pertinent to environmental operations). Environmental, social, economic, and geographical factors may all play a role in how we approach this evolution. For this reason, we must put an end to careless actions and shift our attention to preventative measures that will have a positive effect on urban renewal. It's also important to remember that zones are evaluated according to the level of activity they support. Human and socially resource-rich departments and institutions are linked through a network.

In addition, we argue that the metropolitan process shows itself in a novel fashion, as shown by the zoning, financing, knowledge, and power of the metropolitan process, which are all markedly different from those of the preceding urban region. This is possible by establishing a distinct spatial order that gives us an edge over similar regions elsewhere in the world. It forged new interconnections between the urban core and its environs, resulting in the development of sprawling metropolises and very intricate settlement networks with many points of entry and exit. It all begins with the growth of cities and continues with increased exports and the creation of exemplary practices that are then exported to other regions via the use of comparative methods. In terms of regional growth, creativity is an important consideration (and a factor in urban development)

Urban management is often challenged by the unexpected "black swan" or "Gray rhinoceros" type events such as COVID-19, which served as an "examination" to gauge the state of smart city development around the globe [2]. This was demonstrated by efforts to prevent and control the spread of the virus, which reflected a failure to appropriately apply intelligent technology. As work on smart cities continues to center on a unified data infrastructure and departmental lines continue to open up, we should expect to see a more fully formed, mature mode of smart city creation. As a result, there is now an additional criterion for the improvement and development of smart cities, and that is the need to increase the development efficiency of urban wisdom programs and system disaster reaction time. The fast spread of the pandemic necessitates the rapid digitalization of joint preventive and control applications, and the smart city cognition can provide an effective basis for organizational development, allowing for micro-models, low-codes, agile development, and rapid digitalization for upper-level business application, all while enhancing the resiliency of urban environments, and the quality of live for citizens.



**Percentage of cities under construction**
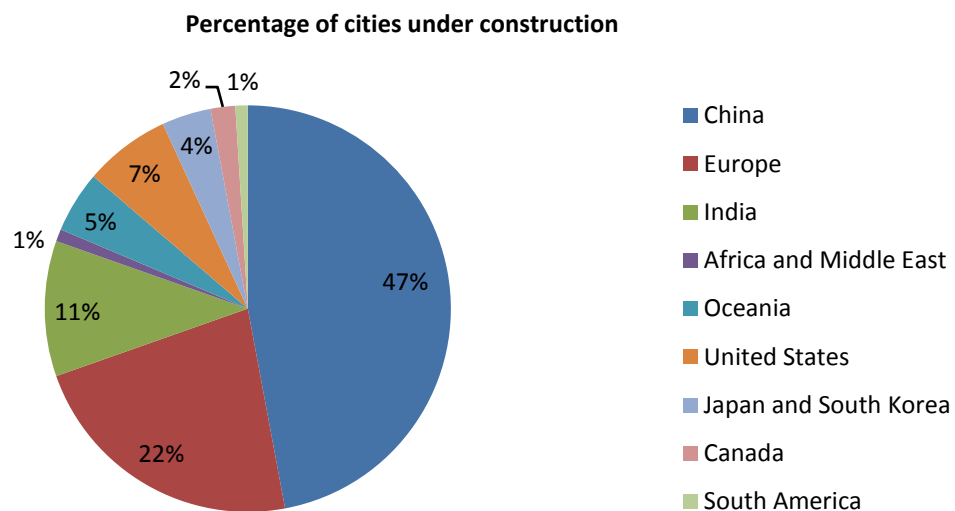
**Fig 1.** International numbers of smart cities being constructed based on the country's share

**Fig 1** shows the global numbers of smart cities that are under construction. By 2050, approximately 70% of the globe's population will live in the urban centers, according to a report released by the UN. This represents a doubling of the global urbanization rate within a single century. Rapid urbanization can be guided toward sustainable development and a brighter

future with the aid of cutting-edge technologies. On November 1st, China presented an application to be included in the "Digital Economy Partnership Agreement" (DEPA) [3]. Constructing smart cities is a priority for China's economy because it will help spur the development of a more advanced economic system, which in turn will help optimize the city's processing and manufacturing framework and stimulate the economic growth of a nation to novel heights. "Sustainable Cities and Communities" is Goal 11 of the UN' 2030 Agenda for Sustainable Development. The employment of sophisticated technologies to attain sustainable urban development is rapidly rising to the top of the list of hopes for the future of urbanization. This is especially true of the smart city, which will steer the course of urbanization with the help of artificial intelligence.

The data-driven digital economy [4] will speed up the process of incorporating digital technologies into smart city infrastructure. Roughly two-thirds of the global population will be residing in urban areas by the year 2050. The Asian continent, home to giants like China and India, will experience unprecedented rates of urbanization. Building smart cities is a global phenomenon, with Europe, Japan, Korea, and North America at the forefront. Smart cities can be located all over the globe, from the developed United States and Europe to the developing Asia and Africa (**Fig. 1**). The highest number of "smart" cities in the world may be found in China, where smart city pilot projects are being aggressively pursued. The "smart city" idea is based on a systematic approach to corresponding solutions that take into account the highest possible long-term cost savings and quality of life. The term "smart city" refers to a relatively recent approach to urban management that emphasizes the use of cutting-edge, eco-friendly technology (such as information and communication technologies). It continues to take an eco-friendly tack while producing ground-breaking advances in technology. In example, the widespread use of computer and communication technology has made modern cities much more efficient.

This article goes into further detail about the difficulties that come with building a digital economy and smart cities, and it makes a suggestion for Belarus to increase its effect on the digital economy's growth of smart cities and e-government. Researchers are given insights and suggestions for enhancing the smart city's "digital radiation drive" based on a critical survey offered in this article. The remaining part of this article is organized as follows: Section II discusses the concept of smart city and digital economy. Section III reviews the China's smart city development posture and stage. Section IV provides recommendations for Belarus, while Section V draws conclusion to the research in this paper.

## II. DIGITAL ECONOMY AND SMART CITY

*Digital Economy*

The term "digital economy," a combination of the words "digital computing" and "economy," is used to refer to the widespread changes brought about by the widespread adoption of digital computing and networking technologies such as the Internet, the World Wide Web, and blockchain in the context of traditional "physical economy" activities such as production, distribution, and trade [5]. There is no significant difference between two forms of integrated economies since the digitalized economy is rapidly replacing and developing the old economy. World Wide Web, Internet and blockchain technologies facilitate billions of dollars' worth of daily online transactions between individuals, businesses, schools, and nonprofits using a wide variety of decentralized computing devices (servers, laptops, smartphones, etc.). The Internet is crucial to the continued development of the digital economy, which is fast transitioning towards an IoT. The proliferation of ICT in all areas of business is a key driver of the digital economy. Businesses, consumers, and governments all need to adjust to new regulatory problems as a result of the digital revolution of the economy. The digital economy is also bolstered by developments in the labor market, particularly in the wake of the COVID-19 epidemic. As the number of individuals who do their jobs online grows, so too does the amount of money made by the businesses that provide infrastructure for the Internet.

Don Tapscott, often referred to as the "father of the digitalization," characterizes the digital economy as an emerging economic model based on digitalized communication architectures and augmented productive capacity, ascertained by digitalization and intelligence, that can accomplish global economic relationships through advancements and self-service [6]. In China, the phrase "digital economy" is commonly used to refer to a wide variety of economic activities that depend significantly on data resources as a component of production, contemporary information networks as a vital carrier, and the effective deployment of ICT infrastructure as a major driving force toward improved productivity and a more rationalized economic structure. To a large extent, the success of smart city initiatives depends on the extent to which the digital economy contributes to the industrialization of urban economic growth. This is because the amount of market economy development is directly related to the success of digital innovations.

Sub-Saharan Africa has used ICT to improve education since the 1960s. From its inception in television and radio, it brought education into people's homes and to parts of the world that had previously been inaccessible. As the technology improved and gained popularity, so did the number of people working to bring it to Sub-Saharan Africa. A large-scale initiative to introduce students and faculty to the use of computers in the classroom was launched in the 1990s. Since then, several projects have been considered to further ICT's development across the area, e.g., the OLPC project (One Laptop Per Child) that has provided over 2.4 million computers to approximately 2 million teachers and students by 2015. In Sub-Saharan Africa, teachers are able to reach more students and keep better tabs on their progress because to the widespread adoption of mobile learning (or M-Learning). This attempt has been greatly aided by the advent of the mobile phone. The usage of mobile phones is pervasive, and the reach of mobile networks exceeds that of internet services in the region.

Student, instructor, and parent all feel comfortable using the gadgets, which boosts interaction and access to course content. Besides the obvious advantages for learners, M-learning also presents an opportunity for improved teacher training and cognitive development, which in turn amounts to more unified curriculum in the entire educational service domain. In 2011, UNESC established Mobile Learning Week as an annual conference to bring together interested parties to debate the M-learning project.

There will be problems during implementation. While the rate of growth in mobile phone and internet usage in Sub-Saharan Africa is higher compared to other developing countries, it is still modest when compared to other developing countries, with the usage of smartphones reaching 20% in 2017. In addition, the severity of issues related to gender, society, and politics that impede people from gaining access to education varies widely from one nation to the next. In 2012, political instability, the importance of socio-economic beginnings, gender inequality, and social structure all added to the fact that approximately 29 million students in Sub-Saharan Africa were not enrolled in an academic institution. Once in school, pupils still encounter obstacles to receiving a high-quality education, such as unqualified teachers, inadequate resources, and poor data management.

Over three billion individuals worldwide now have Internet connection, proving the pervasiveness of ICT in today's society. The exponential growth of data and information may be directly attributed to the fact that almost eight out of ten internet users now possess a smartphone. ICT has grown at such a rapid rate, especially in less developed nations, that it is now an integral part of people's daily lives; in fact, it is difficult to imagine modern society functioning without at least some form of technological assistance, especially for more mundane and administrative tasks. The percentage of internet users in developing nations had increased from 2009 to 2014, and approximately two-thirds all online users are now found in developing nations, according to the most current authorized statistics, which was published in 2014.

However, there are still substantial obstacles to overcome. The majority of the world's 4.3 billion individuals who are not online at this time are based in developing nations. There are 2.5 billion people living in the world's 42 Least Connected Countries (LCCs), and most of them don't have access to information and communication technologies (ICTs), especially in their rural areas. Many developing countries still have no Internet at all, and ICT access is limited even in the wealthiest countries. This is also true for the availability of other electronic data transmission channels, such as fixed and mobile telephone networks, and the World Wide Web. Despite the growth in cellular data coverage, the latest "Assessing the Information And communication technology Report" warns that this increase is largely illusory because "many users have several subscriptions" and "global growth projections often interpreting into little real change in the great extent of correlation of those at the very bottom of the pyramid; an anticipated 450 million people in many countries reside in geographic areas which are still out of reach of mobile cellphone connectivity." Nanotechnology is ushering in a new age of information and communication technology (ICT) and electronics. In today's ICT-centric electronic settings, fresh additions include smart wristbands like the Nike + Fuel-Band, smart Televisions like the Google TV, and smartwatches like the Apple Watch. ICT progresses to transform and permeate the ever-developing world, with desktops becoming relics of the past technological development and laptops replacing them as a standardized mode of computing.

Modern information and communication technology contribute to the increased diversity of today's social movements. In [7], "the process of issue group development and action" is being "accelerated by the internet," and Bimber [8] has invented the phrase "accelerated pluralism" to describe this new phenomenon. As a result, ICTs may be used to "enable social movement leaders and empower dictators", hastening the process of social transformation. Because of the internet's capacity for direct interventions and political debate with the government policy, ICTs have the potential to alter how governments respond to citizen concerns and rally support for a cause at the grass-roots level. Women who have access to ICTs at home are less likely to accept an abusive partner's excuses for their behavior. As one 2017 research put it, "access to ICTs exposes women to diverse ways of life and different conceptions about women's role in society and the family, particularly in culturally conservative locations where conventional gender norms contradict perceived alternatives."

*Smart City*

The term "smart" is used to describe people who are able to reason effectively, spot patterns, learn and adapt to new circumstances, grasp opportunities, avoid dangers, act proactively, think critically, analyze information, make decisions, and consider potential outcomes. Taking the "smart city" idea into account led us to the conclusion that these features should be standard in municipal administration. Although humans (enterprises, society, consumers, and politicians) are the ones who obey the rules of the notion, technology and innovation support "smart" governance in both the urban and rural organizations. Hernandez-Munoz et al. [9] pioneering work outlined the potential applications of a smart city model based on information technology in urban planning. In this article, we use the Internet and other forms of information technology to implement the spirit of the data society and establish "virtual spaces of cities". The ability to recruit professionals or the capacity to produce and absorb innovation is topics of subsequent publications. As was discussed before, the current concept of a smart city places an emphasis on the many roles played by a city, including those played by transportation and communication networks, information and communication technologies, digital media, the creative economy, and cultural activities. New methods of communicating with government officials have been used to increase economic, social, and political productivity and public knowledge.

According to Martins, Patrão, Moura, and de Almeida [10] comprehensive description, "smart cities" are characterized by a high level of efficiency, as well as learning, innovation, creativity, digital infrastructure, ICT, and university-based

research and development institutes. Smart cities, as discussed in the literature, rely heavily on cutting-edge technological infrastructure. This notion offers a number of strategies for urban revitalization that prioritize efficiency, sustainability, and innovation. The last two decades have seen the most productive usage of computers ever. Politicians on a global scale, both at the national and municipal levels, are attempting to establish guidelines that would encourage the employment of ICT to stimulate the development of urban environments. However, they lack a standard by which to compare the IQ of knowledge-poor and -rich urban areas. That said, there are other measures of "intelligence and knowledge" that are just as valid as the prevalence and efficacy of cutting-edge technology. The connection between the physical foundations of ICT systems and their monetary value has been a topic of study for certain academics. Some scholars argue that an "intelligent society," a network of individuals, who share an interest in human capital and innovation, is the key to resolving the issue of excessive inclusion. Because of this, smart cities should center their efforts on developing novel solutions that allow for the growth of contemporary cities by means of both qualitative and quantitative increases in efficiency.

The idea of "smart cities" merges traditional city planning with technological advancements. The European Union's smart city strategy prioritizes lowering carbon emissions and increasing energy efficiency across the board to better serve citizens. Smart cities, in the European view, are communities where public and private sectors work together to reduce wasteful consumption of resources, increase efficiency in resource utilization, and improve the quality of life for residents all while minimizing their impact on the environment through reduced greenhouse gas emissions. We may safely presume that cutting-edge smart city technology has contributed significantly to the environmentally responsible growth of European metropolises. The transition to low-emissions usage will begin in European cities. The United States has spent the last three decades perfecting its ideas for using cutting-edge technology and innovative practices in urban settings. In order to succeed as a "knowledge-based city," a city must prioritize areas such as creativity, lifelong learning, smart capital development, education, and innovation. The city's current information and communication technology infrastructure is crucial to the growth of the digital city. Eco-city development is propelled by a commitment to the use of renewable energy sources and an emphasis on environmental preservation operations. It mirrored the difficulty of identifying the parts of a smart city, which was reflected in the search for appropriate nomenclature. While experts disagree on the precise meaning of the term "smart city," they do concur on its widespread media coverage.

The term "smart city" defines an emerging movement in urban planning that seeks to improve the lives of city dwellers by applying cutting-edge technology and creativity to old problems. Environmental pollution, land use, urban development, and traffic congestion are major problems that have prompted several governmental efforts, ranging from the construction of new transportation infrastructure to the promotion of imaginative products. Smart cities are one of the most talked about concepts in the world of territorial administration right now. There have been several attempts to define what a "smart city" is in the academic world. The concepts of the network model, industrial district, knowledge management, e-governance, smart capital, novel public management, smart specialization, local foresight, learning cities and regions, value-oriented management, innovation firms, and so on all demonstrate this. In general, a smart city consists of the following components (see **Table 1**):

**Table 1.** General components of the smart city

| Smart component | Brief description |
|---|---|
| **Smart Economy** | Knowledge-based industrial approaches, a progressive environment, and an adaptable labor market should all come together to make cities very productive. In order to thrive, an economy has to be open to new ideas and able to quickly adjust to shifting conditions. This use linked the phrase not just to the development of the commercial and technological sectors, but also to the "based-knowledge" ICT sector. |
| **Smart Transportation** | As the information and communication technology (ICT) industry transforms cities into a vast network of interconnected resources, both analog and digital, it is important that cutting-edge technologies leverage preexisting networks. |
| **Smart Environment** | By reducing emissions and instituting waste management regulations that adhere to principles of sustainable development, "smart cities" increase the efficiency with which renewable sources of energy and other ways are used to generate electricity. An extensive amount of environmental education is also necessary for environmental operations. |
| **Smart Citizen** | For cities to become hubs of innovation and learning, citizens must be at the center of any and all change. Once they have access to necessary technology, they can reduce wasteful energy use and pollution, and instead focus on raising living standards. |
| **Smart Living** | Accessibility to public services, social and technological infrastructures, higher degree of security, recreational and cultural options, environmental stewardship, and flora in the region should all be in line with one another to create a welcoming atmosphere. |
| **Smart Supervision** | For this progress to occur, new technology needed to be implemented into municipal administration, as well as a suitable structure of governance, processes needing the collaboration of local authorities, and users. Knowledgeable government that can both generate new information and implement it effectively is also a part of this. |

From a sociological point of view, the goal of the development of a "smart city" is to increase the city's standard of living and its tax base. The cloud computing, and Internet of Things (IoT), and other next-generation information technologies [11] are at the heart of the conceptualization of smart city" that focuses on revolutionizing the way in which governments, businesses, and residents collaborate to address pressing issues like poverty, pollution, crime, and inadequate infrastructure for housing, transportation, healthcare, and other essential services, as well as for the expansion of economic opportunities in urban areas. Efficient and accessible public services, reliable and regulated social administration, economic and industrial cooperation and development, smart and concentrated infrastructures, and a safe and controlled network environment are all essential components of the new smart city, as are the underlying concept and concept of perpetual innovations, and growth; and information sharing, the basic strategy and the necessity of development strategy, data-oriented reforms; and basic need for a data-open and openly shared environment. We will encourage the thorough integration and sharing of the latest iteration of information technology with the city's many sectors, as well as the synergistic growth, so that people and society may flourish in harmony with the natural world.

The six smart city components highlighted in **Table 1** above are measured in various ways, but they are all crucial to what makes a city smart. As vital as it is for governments to push smart city development forward, it is just as crucial to understand the trajectory of smart cities worldwide. These days, many nations understand the significance of smart city growth and ongoing improvement. In any case, governance or criteria are also crucial. Smart city growth shouldn't be stymied by poor governance or regulation; rather, it should be in line with official government policy. With cooperation, smart cities are conceivable. The indicators of a "smart city" include not only the environmental, economic and quality of life, and governing but also the related departments. Agile communication management, ICT system management, energy management, water management, waste management, ecology/landscape, public service principles, facility, municipal performance, and building are all variables linked to urban growth. The interactions between these components may be seen in practice. This connection illustrates the dynamic interaction between municipal infrastructure, the "smart city" paradigm, and methods for organizing public events and programs.

Public management is founded on widely-used management and organization ideas, but it is quite different from the management of public and private [12]. These two areas account for a majority of the dissimilarities. The first and most obvious distinction is that government agencies work on behalf of the public. Among its many duties is the provision of essential services and amenities to the general population. The magnitude of an organization's activities, the number of its workers, or its proximity to the political system may all have a significant impact on its aims, structure, and operations. Public management is based on the critique of Max Webber's ideal bureaucracy. In spite of what the literature review stresses, even the latter types of public management had to focus of particular principles. Through rules and regulations, outcome control, fiscal discipline, resource conservation, and competitiveness, New Public Management seeks to bring professional management to the public sector. Second, participative management is when all stakeholders are included in governance, there is openness in all processes and decisions, and there is a dedication to responsibility and sustainable growth. The term "public sector management" may be used to mean both the organization of public affairs and organization in the government. Only management aims (including the subjective nature of public affairs management and the goals of public sector management) differ.

## III.    CHINA'S SMART CITY STAGE OF DEVELOPMENT

*Smart Cities Novel Stage of Convergence and Integration*

There have been three distinct phases in China's smart city development: the first idea introduction (2008–2012), the pilot exploration (2012–2016), and the current general promotion (2016-2020) [13]. Stimulate by the networking and digitalization of industrial application, including the advent of Fiber broadband, wireless communication, remote sensing, GIS, and other technological advancements, the conception of smart city was presented during the phase of concept introduction. These developments helped to realize the informationization of individual systems, paving the way for the creation of a smart earth and digital city.

Emerging technologies such as RFID, LTE networks, cloud computing, etc. were presented and discussed during the pilot phase of our project, which aimed to develop a platform for data sharing and exchange. The city's digitization progress is hastened by the pervasive use of IT in building infrastructure. The advent of data-driven and the incorporation of big data, 5G, Narrow Band Internet of Things (NB-IoT), machine learning and other generational computing models, the novel smart city developing in the integrated promotion stage concentrates on the intensive and integrated, effectiveness-oriented, and people oriented model, establishing a model of vertical and horizontal joints, functional-based urban eco-city brain to aid cities in attaining smart evolution.

Since 2020, the digital twin has been the driving force behind the smart city's integration and convergence, allowing for the growth of several sectors that are ecologically and mutually dependent. In the future, cities will enter a novel phase of decision-making competency and fulfill an evolution from smartness to discernment, and smart administration will initial a viable development of economy and life through the increased application and adoption of novel features such virtual-real simulation and interaction. The city's ongoing push toward digitization, networking, and smart development has allowed for the realization of the development model, construction concepts, implementation route, operational mode, and

technological approach of all-round iterative development, welcoming the smart city into a new phase of development that is more focused on the needs of its residents and emphasizes integration, intensity, collaboration, and effectiveness.

As 5G, big data, AI, blockchain, and other data technologies are increasingly put to use, and as all-factor affirmation, modeling, virtual-real assimilation as well as other capabilities mature, the digital twin city is developing from a theoretical framework to an actual practice, eventually becoming the "novel choice" and "novel upgrade" of the intelligent city. The ultra-smart city 2.0 is being promoted by the digital twin city, which is progressively evolving from idea to reality as the "novelupgrading" and "novel option" of the modern digital city via intense platform integration, resource assimilation and sharing, complete empowerment and effective development.

*The Novel Phase Presents the Main Development Trend*
From planning to execution, digital transformation encompasses the four pillars of nation, city, industry, and enterprise, with nations providing legislative backing at the strategic level and typical cities taking a piece of the smart city pie at various points along the strategy's development. The Beijing Municipality in China, for example, postulate becoming the Beijing framework" for the development of the Chinese digital economy, as well as a "Beijing benchmark" for the expansion of the international digitalized market. The Beijing Municipal Administration was the first in the world to completely promote the digitalized development of a municipality, and its "latest release" was the result. The blueprint advocates for Beijing to become a "novel highland" for the advancement of the globalized economy in 6 fundamental areas: the showcasing of smart city intelligent transformation; a globalized data factor assignment center; the integration and leadership of creating digitalized businesses; a source of global digital technical innovation; a service for digital administration in China; a solution to problems in the digitalization; and a foreign collaboration and openness policy.

*Tiered Classification to Promote*
Categorization and benchmarking are essential to encourage the creation of innovative urban settings, since the "urban illnesses" of megacities are severe, medium cities lack appropriate incentive for sustainable growth, and the number of smaller cities lags behind. The development of smart urban ought to be fostered in an organized manner based on the different developmental frameworks and maturity aspects, and progressively accomplishing a higher basis of cognition, based on the geography and functionality of the urban environment, living standards of citizens and the economic level of the governments.

Supported by policy, the present phase of fostering the creation of smart cities requires an understanding of the whole progression from the foundational information technology stage, through the application of digital technology, to the full systematization stage. At this point in time, the new smart city is the primary vehicle for establishing a digital China and a smart society. The creation of the new smart city is now focused on developing a high-quality ecosystem and creating sustainable development approaches, moving away from general planning and toward people-oriented, effectiveness-oriented, integrated and intense, collaborative innovation. Particularly after COVID-19, the construction of new cities and infrastructure in the disciplines of energy, infrastructure, education, medicine, society, and governance has increased, and the trend toward building smart cities that are tailored to the needs of the surrounding area has emerged.

*Deep Learning and Digital Twin Reconfiguring Smart City Technologies*
The development of smart cities receives a shot in the arm thanks to the use of digital twin technology. IoT perception, satellite imagery and mapping, modeling, virtual reality, and data exchange are all maturing at an accelerated rate, allowing for ever more precise indexing of spatial information within urban big data governance systems. Deep learning based on big data is helping urban administration become more self-sufficient, while widespread cross-technological multi-integration breakthroughs are re-establishing the technical paradigms of intelligent cities. The city knowledge modeling framework is developed to assist smart cities in active cognition via the intelligent differentiation, comprehension, processing, and evaluation of different data involving urban space, voice and image. A comprehensive cross-industry information system is developed, allowing the city to make smarter judgments, spur universal innovation, and greatly enhance the accuracy of urban administration.

Knowledge mapping and data fusion across several modes of communication in the business world Fragmented dataset in form of video, speech, and photos progressively emerges as data sources and formats in numerous sectors diversify, necessitating the ongoing improvement of the smart city's brain capacity to identity and access data and its capability to interpret cross-modal dataset. Presently, urban environments are changing from the perceptual to the cognition phase of smart development; knowledge graph technology is one of the most fundamental technological advancements, which might close the gap; it is a stairway from AI to big data, and the basis of AI to comprehensible cognitive intelligence. The futuristic outcome of the city brain will integrate cognitive intelligence due to the interactions between cross-modal data graphs and data learning that will project the employment of smart city cases and the valuation realized from big data, constructing city-level industry-wide cognition graph via big data, provide a globalized and real-time knowledge of the general condition of urban environments, and provide a complete framework of solutions across a variety of disciplines and industries.

Virtual-real interaction, smart definition and one-by-one modeling are just a few of the smart benefits of digital twin technology, which combines a number of cutting-edge technologies like new mapping, simulation and modeling deep

learning, and intelligent control [14]. This technological advancement has presently been considered as a futuristic path for the research and development of smart cities. By using a city data model to restore the city data model, the digital twin part of the city will integrate the business and spatial-temporal properties of goods in the urban environment into a single digital interface at the city level. By combining IoT perception with AI technology, the digital and physical space of the city will be intelligently run and accurately mapped; all city elements will be digitally connected based on the administration, operation and control; and a system of "everything connected" will be created. Using the city vision systems and the digital twin city as a foundation, businesses may do tasks such as location tracing, early warning, surveillance, remote control, human-machine interactions, spatial calculations, etc., develop new forms of "de-sectoralized" intense governance as well as one-stop service.

*Demands for Construction*
There has been a shift in emphasis from the piecemeal construction of individual information systems to the coordinated development of city brains as a means of promoting the establishment of new smart cities. This shift can be seen in the increased emphasis placed on coordinating the construction demands of different government agencies and the increased interest in developing an integrated collaborative and smart management and service framework for urban environments. More than 500 Chinese intelligent cities have released their plans for municipal administration systems, as reported by Shan et al. [15]. Many local governments have called for the ability to build a "app-driven" "big platform for convergence, big data for dissemination, and big networking for synchronization and linking" as part of their governmental informational infrastructure goals.

*Data Privacy and Security*
City operations are ensured by data security technologies such asblockchain and privacy computing. Given that data is already one of the five elements of production, and that AI technology is beginning to push beyond the limitations of algorithmic processing power, the ability to ensure the secure and orderly transfer of data is likely to become a major barrier to the widespread adoption of smart cities. It is challenging to share and apply urban data in a secure and efficient manner because of the existence of different types of data as "data islands", the separation of processors, data owners, and applications, the difficulty in determining and tracing data ownership, and the numerous privacy complexities associated in each party's data. On the assumption that data security is maintained and that data is not exposed for unauthorized access, block-chain, privacy computing, and other quickly evolving and widely adopted data security technologies may effectively address the problem of data silos, make the accessibility of data but not visible, and materialize information that is verifiable, traceable, and completely unlock data value.

*Decision-Making Intelligence*
National policies actively support the construction of city brains to enhance recognition and artificial intelligence of urban environments, and address issues of data cognition, and data processing. Most artificial intelligence systems, however, remain in a "weak artificial intelligence" condition where they primarily perform tasks like pattern recognition, data analysis, and information presentation. Intelligent cities now have the capability of perceptual intelligence, meaning they can observe their surroundings and react accordingly; intellect, and then develop into a level of intelligence capable of making choices.

Synergy in urban administration is aided by the merging of government and societal data. In the present moment, smart city development is mostly government-led with some corporate involvement. The existing data sharing platform lacks a method for docking social data and governmental data, creating a gulf between the two. There is a lack of depth in docking practices, docking resources, and docking software. Companies are urged to dock their social data with platforms, and the process of data consolidation and interchange in the public sector is speed up. Incorporating accurate predictive image of forms and dace data of the state security sectors to insure proper face recognition and rapid data collecting, analysis, and dispatching might help security police make good judgments and investigations, for example, is essential to accelerating digital governance.

## IV.    RECOMMENDATIONS FOR BELARUS

*Construction of Urban Digital Infrastructure*
Minsk, the capital city, and the headquarters of the Commonwealth of Independent States (CIS), both located in Belarus, need a world-class level of digital infrastructure, as well as re- service space for future improvements, because to their central location in Eastern Europe. The government, in its role as supplier of public services, should hasten the creation of next-generation data infrastructures, stimulate digitalized and smart upgrading of the present infrastructure, and enhance adopt an extensive ecosystem effective to the development of digitalized transformations. The effectiveness of data set sharing, the full exploitation of data's commercial value, the provision of precise analyses of regional economic situations, market data, consumer demand dynamics, and other information services to businesses, the aiding of businesses in resolving development issues, and the promotion of AI's ability to more closely mimic and understand the real economy. As a result, not only will the city's R&D expenditure and operating costs be reduced, but the Move industry will also flourish, and the digital economy will be propelled forward.

*Promotion ofIndustrial Digital Upgrading*

Belarus promotes digital transformation in industries by advocating for the modernisation of traditional industries, the reversal of the traditional pathway of low-level repetitive fabrication of traditional industries of deeper integration between internet and industrial systems, and the development of smart and digital modernization and advancement of industries; for the use of artificial intelligence as the engine of this transformation. Meanwhile, with AI technology as the catalyst, we can use the Zhong-Bai Industrial Park to advance integrated circuits, biotechnology, intelligent manufacturing, and other AI-centric sectors. We can also use high-tech industrial parks to speed up the creation and transformation of new scenes in order to digitally change established businesses; and encourage the concentration of digital economy firms in strategic industrial parks and the entry of a diverse set of system solution providers with extensive service capacities. Finally, by continuously exploring new technologies and business strategies in the sectors, we may enhance product quality in ways such as service-oriented manufacturing, mass customisation, and online collaboration.

The integration of the physical economy and the development of innovative industrial Web and Internet of Things applications necessitate the continued promotion of big data, blockchain, machine learning, cloud computing, and other information technology. This promotion increases the extent to which the "Internet Plus" plan for growth is being put into effect. Narrowband IoT industrial clusters may be developed more quickly by (i) learning from the broad adoption of NB-IoT in other countries and then nurturing or introducing several NB-IoT technological advancements and industrial application leaders (e.g., Huawei, etc.). (ii) Assist businesses in moving infrastructures, equipment, and business processes to the cloud, thus fostering the enhancement of smart processing and boosting digitalized transformations for the conventional sectors. (iii) Increasing adaptable transformation of manufacturing lines, enhancing manufacturing efficiency, and enhancing the quality of developing business can be attained through the development and enhancement of industrial Web platforms and experience centers in major industries, as well as the promotion of top companies in traditional industries with advantages in local manufacturing.

*Breaking Information Barriers*

There is a pressing need to establish a reliable model for exchanging data across governments and agencies in order to boost efficiency, broaden government services, and more effectively monitor the employment of digital technology.Belarus should seize the opportunity and join the movement toward technology-enabled government governance. Adopting international standards for data gathering and statistics leads to more standardized statistical regulations and operational norms; establishing and improving institutional channels for information sharing promotes cross-regional, cross-level, and cross-departments data exchange and organizations cooperation and develop a basis for managing e-governance. In the China's digital playbook page, the developers have created "city apps" to serve as a single point of access to all available government services. These apps integrate popular apps like maps and mobile online payment with government resources to bring citizens useful information and facilitate transactions. On the other side, city apps have embraced smart government service search capabilities and incorporated Internet information to provide consumers more accurate and individualized services.

The "city brain" of Belarus is growing into an intelligent hub due to its interconnections with the national data information system (horizontally), the rural data information fulcrum (vertically), and other government institutions. In order to achieve developmental goals, we are hastening the growth of industrial IPv6 and the internet, expanding 5G and IoT infrastructures, expanding connectivity to gigabit bandwidth customers, and more. The installation of rudimentary information distribution nodes in both densely populated and sparsely populated regions. As we boost the creation of innovations and development of city-brain application cases, it will be possible to place a greater emphasis on "innovation" and "people's livelihood." To boost the capacity urban governance and citizens' quality-of-life, we will continue to broaden and deepen the creation of scenarios in a variety of areas, including but not limited to law enforcement, mobility, urban management, housing strategic planning, emergency response, market oversight, medical care, ecological sustainability, and more. Strengthen application backing for smart city development in Belarus by increasing pilot building of digital application areas including e-education, smart tourism and recreation, smart commercial areas, smart neighborhoods, smart medical care, etc.

*Cross-Border Data Flow and Utilization*

The free movement of information across national borders opens up several possibilities for commerce and industry and has the potential to accelerate the process of digitizing economies worldwide. Using its location and resources to their full potential, Belarus should push for the creation of "digital economy innovation islands" across the Commonwealth of Independent States, with a particular emphasis on AI, smart manufacturing, and biomedicine, and the "headquarters economy," and assess the possibilities of establishing an efficient and secure cross-border data flow mode. The process of hardware development will be accelerated, and a direct or dedicated route for global internet transmission will be developed as soon as possible so that information can be transferred easily and quickly. This is all part of our plan to investigate the data flow security evaluation mechanism and define the data use scenarios and primary duties of organizations.

*Development of Digital Skill-Based Talents*

The most important competitive advantage in putting digital transformation initiatives into action is a company's human capital, which is the initial step in creating new technologies. The execution of digital transformation programs requires strong intellectual support, which is why progressive nations and municipalities are actively encouraging the introduction and nurturing of talent to improve people' digital abilities. Singapore is ranked as the third most attractive city in the world for digital talent, according to theCharlton Media Group [16]. Singapore's favorable business climate and good quality of life in terms of employment, starting a company, and general quality of life attract a huge number of highly trained digital workers. In addition, governments are formulating workforce policies to cultivate a pool of digital technology experts with expertise in data science and analytics. Artificial intelligence (AI) has built a talent pool program, for instance. The acquisition and development of digitally proficient personnel is likewise a top focus in Luxembourg. Despite its landlocked location in Europe, the government of tiny Luxembourg has embraced a worldwide strategy to lure the worlds' best and brightest. In 2018, Luxembourg began a nationwide initiative called "Bridging Skills" [17] to improve its citizens' digital literacy. In order to assist workers acquire skills, the "Bridging Skills" program has been developed.

## V. CONCLUSION

Much effort is needed to execute a smart city project since it involvesecological development, landing operation, project delivery, investment and finance, consultation, and top-level design. In that regard, smart cities need collaborative efforts of different professionals such as network operators, product manufacturers, industry integrators, etc. who work together in a variety of ways to fund, provide technology, provide services, operate systems, and integrate new ideas. The development of smart cities will base on the state's digital transformation and utilize the platform enterprise as a pivotal point, guiding the market to fixate investments on digitalization value chain components that will create the "pull of line," and determine the establishment of local digitalized economic industries. Urban environments will be able to establish an ecosystem from the "lines-to-surfaces" and point-to-line" allowing for the most efficient use of urban resources considering thefruitful collaboration amongst various stakeholders. While certain cities and regions may ahead in the smart city transformation than others, most of them have significant room for improvement in areas such as data processing and analysis and autonomous response.

There is a lack of a "strong pulling" impact on city-related sectors because of the limited involvement of firms and social forces and the big investment, lengthy cycle, and short-age of essential skills associated with smart city projects. There is also a lack of the creation of an integrated smart city, despite the fact that efforts have been made to promote and use cutting-edge technology and equipment and "wisdom outcomes." Optimising the city brain's organizational structure and bolstering the ability to secure data have also risen to the top of the list of concerns making accurate and effective municipal management services to be essential for their growth and development. Service levels for platform data and platform big data smart analysis technologies need to be launched in order to benefit not only urban managers, but also the contents and objects under their purview. It is also vital to advocate for the lawful and appropriate application of data on the aspect of safeguarding data security and data resource ownerships based on the applicable laws. Legal data linked to itself and other state programs that are open pursuant to the law may be accessed via a registration application at any time, from any location, on demand, and the platform could completely utilize AI and big data technology in order to address the challenges of effective classification of data summarized by the platforms and offer a subscription service for legal data information to companies and individuals who have registered with the platform.

**Data Availability**
No data were used to support this study.

**Conflicts of Interests**
The author(s) declare(s) that they have no conflicts of interest.

**Ethics Approval and Consent to Participate**
The research has consent for Ethical Approval and Consent to participate.

**Competing Interests**
There are no competing interests.

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