ARTICLE

Legal Framework and Development Models of Smart Cities: Key Takeaways across BRICS Jurisdictions

Alexander Larichev,
HSE University (Moscow, Russian Federation)
https://orcid.org/0000-0002-6452-6787

Larisa Soldatova,
HSE University (Moscow, Russian Federation)
https://orcid.org/0000-0001-7731-4153

https://doi.org/10.21684/2412-2343-2025-12-3-101-119

Received: June 26, 2025
Reviewed: July 14, 2025
Accepted: August 7, 2025

Abstract. This study analyzes the experience of smart city development in core BRICS jurisdictions, namely Brazil, Russia, India, China, and South Africa. The legal frameworks, as well as approaches towards management and implementation of the smart city concept, are examined. The research is methodologically based on a multidisciplinary approach, incorporating the analysis of academic literature, legal acts, and program documents. The authors explore top-down and bottom-up approaches to the development of a smart city and conclude that both of the approaches have distinct advantages as well as certain limitations, which suggests the necessity of a combined model for both the regulation and implementation of relevant projects. The authors also maintain that BRICS as an institution may itself serve as a platform to share and create appropriate tools. Additionally, a specialized mechanism for knowledge exchange and capacity building could be instituted within BRICS, aimed at systematically documenting and disseminating best practices, technical standards, and key insights on smart city development among member-states.

Keywords: smart cities; BRICS jurisdictions; top-down and bottom-up approaches; legal regulation; implementation.

To cite: Larichev, A., & Soldatova, L. (2025). Legal framework and development models of smart cities: Key takeaways across BRICS jurisdictions. *BRICS Law Journal*, *12*(3), 101–119.

Table of Contents

Introduction

United Nations demographic data indicates that urban areas currently contain more than 55% of the world's population, with projections suggesting this figure will rise to 68% by 2050.[1] This relentless urban transition coincides with the worldwide digital transformation of society and its physical surroundings. The scientific and technological progress achieved in recent decades has become deeply embedded in urban residents' everyday experiences. Today, automated management systems such as "smart home" and "smart office" technologies, which regulate building engineering systems, have achieved widespread adoption. Having gained substantial footholds in private and professional domains, these intelligent systems are now being systematically implemented in public spaces, particularly in urban centers and major rural communities.

The "smart city" paradigm embodies the convergence of diverse digital innovations and Internet of Things (IoT) applications, which are principally aimed at optimizing urban infrastructure management. This developmental model seeks to improve living standards through urban informatics that enhance the provision of services and address citizen needs. Crucially, urban intelligence transcends the simple

[1] 68% of the world population projected to live in urban areas by 2050, says UN. (n.d.). U.N. Department of Economic and Social Affairs. https://www.un.org/uk/desa/68-world-population-projected-live-urban-areas-2050-says-un

deployment of information technologies by municipal authorities; its application fundamentally involves the ways in which these technological solutions enable comprehensive analysis, real-time monitoring, strategic planning, and effective governance of the urban ecosystem.[2] It is also worth noting that a smart city effort is a problem-oriented policy initiative. Its popularity resides in its technological promise to address wicked urban problems in traffic, public transportation, energy consumption, environment, public health, food safety, and social and economic disparities. It is apparent that cities with more serious urban pathologies are more likely to adopt and implement smart city initiatives.[3]

Russia launched its "Smart City" digital urbanization project in 2018 under the dual auspices of the national "Housing and Urban Environment" project and the "Digital Economy" program. This strategic initiative aims to develop an efficient, technologically advanced urban infrastructure management system while enhancing living standards through improved comfort and safety in urban areas.

The pandemic years accelerated digital technology adoption in Russia, even across sectors where online solutions were previously uncommon. However, digitizing urban spaces faces significant challenges, primarily in two areas. First, resource constraints limit progress. Russian city municipalities often lack funding and technical capacity to implement smart technologies. While major cities like Moscow, St. Petersburg, and Kazan, which often lead current nationwide smart city ratings,[4] benefit from state grants and private investment, smaller towns and rural areas continue to struggle despite a pressing need for better services and governance tools. In response, Russia has started developing smart city startups and solution packages suitable for various municipality sizes.

Second, citizen engagement remains challenging. Although federal authorities have actively promoted digitalization through legislation, effective implementation requires more than just technology. Successful adoption requires coordinated efforts between state and local governments, particularly municipal bodies that directly interact with citizens. Local authorities must not only develop digital tools but also actively promote their use in community governance. These challenges highlight the need for balanced approaches that address both infrastructure gaps and participation barriers in Russia's smart city development.[5]

---

[2] Larichev, A., Kozhevnikov, O., & Korsun, K. (2023). Legal regulation of smart city technologies in solving local issues in urban areas. *Law. Journal of the Higher School of Economics*, *16*(3), 56, 59. (In Russian); *see* also Mills, D., et al. (2022). Evidence-based public policy decision-making in smart cities: Does extant theory support achievement of city sustainability objectives? *Sustainability*, *14*(3), 1–23.

[3] Yu, W., & Xu, Ch. (2018). Developing smart cities in China: An empirical analysis. *International Journal of Public Administration in the Digital Age*, *5*(3), 76, 82; *see* also Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart cities: definitions, dimensions, performance, and initiatives. *Journal of Urban Technology*, *22*(1), 3–21.

[4] Information and analytical portal "Smart City." https://russiasmartcity.ru

[5] Larichev, Kozhevnikov & Korsun, 2023, pp. 73–74.

The legal foundation for smart city development remains fragmented, currently relying primarily on ministerial decrees from the Ministry of Construction, Housing, and Communal Services. Key regulatory instruments include the Order of April 24, 2019 No. 235/pr (which provides recommendations for the digitalization of urban infrastructure), as well as the Order of February 4, 2019 No. 80/pr (which facilitates the selection of municipalities for the purpose of implementing pilot initiatives within the framework of the project for the digitalization of urban infrastructure).[6]

According to the Ministry of Construction of Russia, "smart cities" in the country should adhere to the following principles: (a) human-centric design; (b) formation of a sustainable and safe urban environment; (c) observance of the balance of interests, principles of development, and opportunities; (d) accessibility and convenience of services; (e) integration, interaction, and openness; (f) continuous improvement of management quality; (g) emphasis on economic efficiency; (h) primacy of long-term solutions over short-term benefits; (i) application of the best available technologies.[7]

This context raises crucial questions regarding the priority domains for implementing "smart city" mechanisms as complex urban ecosystems. The challenge encompasses two key dimensions: (a) identifying innovative solutions that optimize urban processes through appropriate legal frameworks, and (b) ensuring effective technological integration into citizens' daily lives. Comparative analysis of international experiences becomes particularly valuable in this regard, as it enables the identification of empirically validated smart city solutions while mitigating risks through incorporating lessons learned from other jurisdictions.

The BRICS countries hold particular significance in this context, where, in recent decades, serious attention has been paid to both digitalization processes and the development of innovative urban infrastructure. It is important to note that digital transformation is one of the main areas of partnership within BRICS, as evidenced by the Strategy for BRICS Economic Partnership 2025. The major BRICS documents also encompass declarations adopted at summits. For example, the Second Johannesburg Declaration of the BRICS countries, which was adopted at the XV Summit in 2023, contains provisions stating that the BRICS countries recognize the dynamism of the digital economy in enabling global economic growth.[8] At the same time, it is understood that not all BRICS countries are at the same level of digital development (and this is also acknowledged in the above-mentioned Johannesburg declaration);

---

[6] Larichev, Kozhevnikov & Korsun, 2023, pp. 60–61.

[7] Order of the Ministry of Construction of December 25, 2020 No. 866/pr. Laws of the Russian Federation on Amendments to the Constitution of the Russian Federation. https://legalacts.ru/doc/prikaz-minstroja-rossii-ot-25122020-n-866pr-ob-utverzhdenii/. (In Russian).

[8] XV BRICS Summit Johannesburg II Declaration, Sandton, Gauteng, South Africa, August 23, 2023. 15th BRICS Summit. https://brics2023.gov.za/wp-content/uploads/2023/08/Jhb-II-Declaration-24-August-2023-1.pdf

therefore, it is the role of BRICS to address respective challenges, including the various digital divides. In this regard, the best practices of the individual member countries can serve as a benchmark for other participants, including in the sphere of introducing smart technologies into the urban environment.

The BRICS organization is rapidly expanding, now comprising ten member countries, as well as many more observer jurisdictions. However, for the purposes of this research, the experiences of only four member states, in addition to the aforementioned Russia, are examined. The states under review are either ones with very high percentages of urbanization, which leads them towards the search and implementation of innovative solutions for urban infrastructure development and management, or nations with a very extensive role of the central government within the process (such as India and China), or countries that rely mainly on local initiative in the analyzed sphere, demonstrating certain unique examples of smart city development and approaches to solving respective issues that are worthy of being explored (namely, Brazil and South Africa).

1. A Top-Down Approach: Cases of India and China

1.1. India: The Smart Cities Mission

India, with its 1.4 billion inhabitants, is not only the most populated country on Earth but also very urbanized. According to the 2011 census,[9] there are 52 million-plus urban agglomerations in India. With sharp income gaps between various groups of urban dwellers, their unequal access to infrastructure and public services, and rapid territorial expansion of the countries' agglomerations, national and state public power systems have been faced with multiple challenges, prompting the search for structured solutions, which include the implementation of smart city mechanisms.

Much like Russia, India has been demonstrating a top-down approach to smart city development, largely driven by the Smart Cities Mission, a significant national initiative launched in 2015 with the ambitious goal of developing 100 smart cities across the country by the year 2020, although this deadline has since been extended.[10] The project is being implemented by the Government of India through the Ministry of Housing and Urban Affairs, which, in turn, cooperates directly with the governments of the respective states.

The project's objectives, based on the program documents, include the creation of a favorable and sustainable urban environment; stimulation of economic growth and improvement of people's quality of life through development of local areas; and the effective use of technologies. According to the project, this BRICS state has

[9] Population Census 2011. https://www.census2011.co.in/

[10] Smart Cities Mission Data Portal. https://smartcities.data.gov.in/

planned to modernize 100 cities and thus improve the quality of life of more than one hundred million people.

A key feature of the Smart Cities Mission's implementation structure is the establishment of Special Purpose Vehicles (SPVs) in each selected city.[11] These SPVs are registered as limited liability companies under the Companies Act 2013 and are responsible for overseeing the entire lifecycle of smart city projects, including project appraisal, approval, the release of funds, implementation, evaluation, and ongoing monitoring.

The cities also have so-called Smart City Advisory Forums, which ensure interaction and consideration of the opinions of various stakeholders. At the state level, the implementation of the project mission is overseen by a High Powered Steering Committee (HPSC), which provides guidance and a specialized platform for the exchange of ideas regarding the development of smart cities. At the national level, implementation is overseen by an Apex Committee, which approves proposals for the Smart Cities Mission, monitors its implementation, allocates funds, and carries out a quarterly review of the activities of the entire system.[12]

The project is financed through multiple channels. The project's financial resources include central government funds and states' own resources, which are obtained from a variety of sources, such as user fees, beneficiary charges and impact fees, land monetization, debt, loans, etc. The project also provides for the use of innovative financing mechanisms (such as municipal bonds, pooled finance mechanisms, and tax increment financing (TIF)); leverage borrowings from financial institutions, including bilateral and multilateral institutions and both domestic and foreign sources; and the use of funds from the National Investment and Infrastructure Fund (NIIF).[13]

The Smart Cities Mission adopts a dual approach to urban development, focusing on area-based development and pan-city smart solutions. Area-based development involves targeted interventions in specific parts of the city through retrofitting existing areas, redeveloping brownfield sites, or developing entirely new greenfield areas. Pan-city initiatives, on the other hand, involve the application of selected smart solutions to enhance the existing city-wide infrastructure. Most importantly, the Mission provides a degree of flexibility, allowing individual cities to define their own unique concept, vision, and plan for becoming "smart" based on their specific local context and ambitions.[14]

---

[11] Gupta, S. (2019). Smart city paradigm in India: Gwalior, a case study. *Humanities & Social Sciences Reviews*, *7*(4), 341, 343.

[12] Ministry of Urban Development, Government of India. (2015). *Mission Statement and Guidelines – Smart Cities* (pp. 16–17). http://164.100.161.224/upload/uploadfiles/files/SmartCityGuidelines(1).pdf

[13] Ministry of Urban Development, 2015, p. 14.

[14] Anand, A., Sreevatsan, A., & Taraporevala, P. (2016). *An overview of the smart cities mission in India*. Centre for Policy Research (CPR), India. https://smartnet.niua.org/sites/default/files/resources/scm_policy_brief_28th_aug.pdf

Some of the project's achievements that are worth highlighting are the digitalization of public services in the country's largest agglomerations, which leads to improved coverage of citizens with public services for citizens, as well as the introduction of electronic platforms for residents' appeals. Many cities have launched digital services for managing city resources, increasing efficiency.

However, interim monitoring of the project's outcomes shows mixed results. As of April 2025, 567 out of 8,058 approved projects have not been completed.[15] Some of the drawbacks include an increase in the tax burden; increased supervision of citizens; failure to achieve a significant improvement in the quality of life of residents; inefficient spending of a significant portion of allocated funds; and weak involvement of citizens in consultations in the decision-making process.

Another problem is that despite their stated goals, India's smart cities do not in reality function as a tool for addressing chronic development imbalances. Some cities have more developed infrastructure and access to smart city technologies, while others remain lagging behind (Indian researchers S. Prahaj and H. Han refer to them as "edge cities,"[16] which shows the difference in resource distribution and uneven management).

Under the "smart city" label, numerous initiatives are being pursued, including the establishment of big data processing centers and projects to modernize public spaces, infrastructure, and urban amenities. However, a substantial share of these projects fails to align with sustainable development objectives. For instance, roughly 40% of transport-related initiatives focus on expanding road networks, while only a small percentage prioritizes public transport development. Similarly, although around one-third of the projects target urban area development, issues related to public safety, environmental security, and technological risks–particularly in the context of the Internet of Things–receive comparatively limited attention. Overall, India's approach to smart urban systems remains fragmented.[17]

The examples of India's top-ranked smart city development areas illustrate this problem. For example, Bhubaneswar, located in the state of Odisha, consistently ranks among India's top ten smart cities. However, the city prioritizes area-based development, and the city's growth is mainly propelled by its concentration of educational institutions and Special Economic Zones (SEZs), accelerating urbanization and increasing its investment appeal. Key infrastructure such as the Information and Technology (IT) Incubation Center and the Golden Quadrangle NH-5 corridor significantly contribute to this attractiveness.

---

[15] Ministry of Urban Development, Government of India. (2025). *National progress–smart cities mission (dashboard)*. https://smartcities.gov.in/mission-dashboard

[16] Praharaj, S., & Han, H. (2019). Building a typology of the 100 smart cities in India. *Smart and Sustainable Built Environment*, *8*(5), 400–414.

[17] Shedrov, I. (2022). *Smart cities in India*. Russian International Affairs Council. https://russiancouncil.ru/analytics-and-comments/analytics/umnye-goroda-v-indii/. (In Russian).

Indore, a leading smart city in the state of Madhya Pradesh, has gained recognition for its advanced waste management systems and sustainable urban retrofitting approaches. The city has implemented technology-driven waste collection and processing mechanisms that have become benchmark solutions. However, a closer examination of Indore's Smart City Proposal reveals distinct investment priorities, with the majority of allocated funds directed toward slum redevelopment projects, parking infrastructure modernization, and road network improvements.[18]

The same, despite the presence of the program guidelines, can be said about the existing legal framework governing smart city development in India. There is no single, overarching law or regulation that specifically addresses the unique and multifaceted needs of smart cities. Instead, a patchwork of different laws and regulations applies to various aspects of smart city development, which can create challenges in coordination, implementation, and ensuring compliance.

1.2. China: Success through Centralization and Coordination

Similarly to India, China is densely populated and in recent decades has been experiencing rapid urbanization. To advance sustainable urban development, the establishment of smart cities has become a practical reality in China as well as a key direction for future urbanization. Currently, several hundred Chinese cities are undergoing smart city development, with four major clusters emerging in the Bohai Economic Rim, the Yangtze River Delta, the Pearl River Delta, and the central-western regions.[19]

The notion of "information cities," which emerged in the mid-2000s, has centered on urban informatization through the digitization of diverse public systems–including municipal governance and urban infrastructure–alongside their integration with information technology and the upgrading of telecommunications networks.[20]

China's regulatory approach to smart city development is distinctly characterized by a strong, top-down directive from the central government,[21] with the integration of smart city initiatives into overarching national strategic plans. Since 2014, smart city development entered a phase of national standardization. In December 2015, the government established the Inter-Ministerial Coordination Working Group for Promoting Smart City Development and issued the "Guiding Opinions on Promoting

---

[18] Top 10 Smart Cities in India [2025 New Updated List]. (2025). Propacity. https://propacity.com/blogs/top-10-smart-cities-in-india-2/

[19] Zabuzov, O. N. (2022). "Smart cities": Experience of Russia and China. *Great Eurasia: Development, Security, Cooperation*, *5-1*, 1150–1153. (In Russian).

[20] Reshetnikova, M. S., Vasilyeva, G. A., & Tretyakova, S. S. (2021). China's place in the global smart cities market. *Innovative Economy Issues*, *11*(4), 1997–2018. (In Russian); *see* also Qianzhan Industry Research Institute. (2019). *2019 market layout: Outlook on 2019 China smart city development competitive landscape*. https://www.qianzhan.com/analyst/detail/220/190618-4ce4b615.html

[21] Yu & Xu, 2018, p. 81.

the Healthy Development of Smart Cities" to enhance interdepartmental coordination. Concurrently, propelled by emerging technologies including 3G/4G networks and cloud computing, pilot cities initiated explorations of localized collaborations across various application domains.[22]

The Standardization Administration of China oversees the formulation of a comprehensive national smart city standard framework. This system spans multiple critical domains, including foundational principles, enabling technologies, infrastructure development, built and living environments, governance and service delivery, industrial and economic applications, as well as security and safety protocols. This focus on standardization aims to ensure interoperability, promote efficiency, and provide a clear framework for smart city construction and operation across the country, with numerous national standards already officially published.[23] Despite these efforts, China faces critical legal governance challenges in its smart city development. Prominent among these are issues related to data security, particularly given the vast amounts of data collected and processed in smart urban environments. Another significant challenge is data alienation, a phenomenon where individuals' data seems to become separate from them, often in the commercial sector, raising concerns about control and potential misuse. The effectiveness of smart city data utilization is critically constrained by fragmented approaches to public data sharing, characterized by inconsistent implementations and a failure to establish standardized protocols across administrative levels.[24] These data governance issues frequently occupy an uncertain legal status, resulting from fragmented and delayed regulatory development.

However, in contrast to the Indian urban experience, Chinese cities have achieved significantly more coordinated and effective digital infrastructure implementation. One example of the application of smart city technologies is Beijing–the country's capital and a large agglomeration. Beijing has emerged as a national leader in developing intelligent urban transportation services, implementing five core systems: (a) an integrated transportation information platform; (b) a comprehensive passenger information service system; (c) an advanced bus dispatching system utilizing continuous regional schedule analysis to optimize route allocation and service capacity; (d) an intelligent taxi dispatch system; and (e) an electronic toll collection (ETC) system employing vehicle-mounted transceivers with rapid-read capabilities.[25] Collectively, these intelligent transportation systems have dramatically

[22] Qin, B., & Qi, S. (2021). Digital transformation of urban governance in China: The emergence and evolution of smart cities. *Digital Law Journal*, *2*(1), 29, 35.

[23] Wu, J., & Novokshonova, Z. (2023). A comparison study of central governments' participation in smart city projects in China and Russia. *E3S Web of Conferences*, *435*, 05006.

[24] He, W., Li, W., & Deng, P. (2022). Legal governance in the smart cities of China: Functions, problems, and solutions. *Sustainability*, *14*(15), 9738.

[25] Asaul, A. N., & Shuan, L. (2021). Current challenges and problems in building smart cities in China. *Scientific Review. Economic Sciences*, *2*, 5–9. (In Russian).

enhanced Beijing's traffic management, providing an effective framework for addressing urban congestion and improving overall transportation efficiency.

Thus, China's experience in the field of "Smart Cities" is characterized by a high level of centralization and coordination, which can quickly and effectively introduce new technologies and solutions to urban problems. China has been actively investing in infrastructure development and building a digital ecosystem that includes a wide range of services for citizens. As Chinese scholars Wenxuan Yu and Chengwei Xu note, smart city initiatives are not only a technical policy solution, but also a political mission. Political and institutional support has been crucial for smart city development in China,[26] allowing the country to lead in the analyzed field.

2. Relying on Local Initiative: Cases of Brazil and South Africa

2.1. Brazil: Striving for National Policy and Thriving Local Practices

Brazil's legal and regulatory landscape for smart cities is currently evolving, with the Brazilian Charter for Smart Cities (CBCI),[27] published in 2020, being a significant guiding document. This charter serves as a political document outlining a public agenda for the digital transformation of Brazilian cities, along with a strong emphasis on both sustainable urban development and the integration of digital technologies across various sectors.

An important factor that contributes to the efficiency of smart technologies development at the urban level in Brazil is the existence of "Smart Cities" ("Cidades Inteligentes") definition, which frames the parameters of such, creating a benchmark for cities, communities, and authorities at various levels. This definition, outlined in CBCI, reads as follows:

> cities committed to sustainable urban development and digital transformation, in their economic, environmental, and sociocultural aspects, which act in a planned, innovative, inclusive, and networking manner. They also promote digital literacy, collaborative governance and management, and the use of technologies to solve concrete problems, generate opportunities, offer services efficiently, reduce inequalities, and improve the quality of life of all people, ensuring the safe and responsible use of data and ICTs.

The definition reveals a strong emphasis on digital transformation, while acknowledging that smart city development extends beyond purely technological processes. Notably, Brazil's conceptualization of smart cities appears more circumscribed than India's broader interpretation, where virtually any urban improvement initiative qualifies under this designation.

---

[26] Yu & Xu, 2018, p. 87.

[27] Brazilian Charter for Smart Cities. (2020). Ministry of Regional Development, Brazil. https://www.gov.br/mdr/pt-br/assuntos/desenvolvimento-regional/projeto-andus/carta-brasileira-para-cidades-inteligentes

Although the CBCI offers a comprehensive framework of principles and recommendations, the City Statute (Law No. 10.257/2001) serves as a foundational legal instrument for urban policy in Brazil. It establishes sixteen core guidelines designed to steer municipal governance in fulfilling the social functions of cities and urban property. These guidelines are structured around key objectives, including environmental sustainability, collective welfare, public security, and the enhancement of citizen well-being. However, it is important to note that the majority of these established urban policy norms predate the emergence and widespread adoption of the smart city concept, indicating a potential need for more contemporary and specific regulations.[28]

The development of a formal regulatory framework for smart cities in Brazil is further evidenced by the ongoing discussions surrounding the National Policy for Smart Cities. This national policy, currently under deliberation in the National Congress, is built upon the foundational principles and recommendations laid out in the CBCI. It aims to integrate digital transformation into sustainable urban development policies, programs, and actions, while also addressing the persistent issues of urban inequality present in Brazilian cities.

In 2021, Bill 976/2021, which establishes the National Smart Cities Policy (PNCI), was introduced in the Chamber of Deputies of the National Congress of Brazil. However, as of 2025, the bill was still under consideration.[29]

Although the federal government encourages smart city development through programs and partnerships, at the national level the implementation of smart city performance and sustainability indicators is still in its infancy and the approach may vary from city to city. In this regard, there are various studies commonly found in the analytical literature that aim to identify basic indicators by which the development of smart cities in a country can be assessed.[30]

Overall, the trends in Brazilian cities reflect the country's specific challenges and opportunities, such as issues of urban mobility, public safety and quality of life, as well as a growing recognition of the importance of technology and innovation for urban development. These trends are in line with global efforts to create smarter and more sustainable cities around the world.

The following are among the most frequently present indicators:

1. Energy Efficiency: the majority of Brazilian cities are interested in improving the energy efficiency of buildings, public transport, and urban infrastructure.

---

[28] Lima, E. G., et al. (2020). Smart and sustainable cities: The main guidelines of city statute for increasing the intelligence of Brazilian cities. *Sustainability*, *12*(3), 1–26.

[29] https://www.camara.leg.br/propostas-legislativas/2274449/

[30] Felicio, E. A., et al. (2023). Smart cities: Practices and indicators adopted in Brazil. *Concilium*, *23*(20), 458–472; Fachinelli, A., et al. (2022). *Smart cities of Brazil 2022: Performance of Brazilian capital cities*. Australia-Brazil Smart City Research and Practice Network. https://www.citylivinglab.com/report-bra-aus

2. Waste Management: waste management is a growing concern in this country, with particular attention being paid to the reduction, reuse and recycling of urban solid waste.

3. Air Quality and Environment: given the air pollution and environmental problems in urban areas, air quality and environmental preservation are key indicators.

4. Sustainable Transport: with intense urban traffic in major Brazilian cities, sustainable transport is becoming increasingly necessary, such as the use of efficient public transport and electric vehicles.

5. Smart Urban Planning: smart urban planning involves the efficient use of space, connectivity, and the creation of friendly public spaces.[31]

Despite the lack of uniform norms and standards for the development of smart cities at the national level in Brazil that are explicitly established by law, the Brazilian experience is interesting for its wide range of tools and approaches to the construction of smart infrastructure. A distinctive feature here is the presence of best practices for combining various elements of smart technologies, working synergistically to achieve the goals of creating a comfortable and sustainable urban environment. The significant powers and autonomy that municipalities possess to address local issues coupled with a relatively stable and adequate financial framework, within which city governments operate, contribute to the success of certain local practices.[32]

One of the leaders in the rankings of smart cities not only in Brazil but also around the world is Curitiba, the capital of the state of Paraná, where urban transformation began in the late 1970s. The massive experiment in urban transport, greening, and social welfare developed in Curitiba allowed the city very early on win the U.N. Prize for its recycling innovative scheme and in 2010, the Sustainable Transport Award in Washington and the Globe Sustainable City Award in Sweden.[33] Curitiba demonstrates a striking example of the synergy of smart technology in the urban environment, featuring a transit system where dedicated bus lanes are combined with traffic light control, providing preferential movement of public transport. Such solutions are worth studying and scaling in agglomerations around the world, including those in the BRICS countries.

2.2. South Africa: Non-binding Framework, Inclusivity and Local Relevance

South Africa's regulatory approach to smart city development is primarily guided by the Smart Cities Framework (SCF), a non-binding framework developed by the Department of Cooperative Governance (DCoG) to support and coordinate smart city initiatives at the municipal level across the country. This framework emphasizes

---

[31] Felicio et al., 2023, p. 469.

[32] *See*, Afonso, J. R. R., & Araújo, E. A. (2006). Local government organization and finance: Brazil. In A. Shah (Ed.), *Local governance in developing countries* (pp. 381–418). The World Bank.

[33] Ferraro, L. (2025). *The first smart city in the world: Curitiba, Brazil*. Whatagreenlife. https://www.whatagreenlife.com/the-first-smart-city-in-the-world-curitiba/

the development of inclusive smart cities that are specifically tailored to the unique local context of South African municipalities and are designed to address the country's significant socio-economic challenges, which include poverty, inequality, and unemployment.

The SCF is built upon six interdependent guiding principles that are intended to inform decision-making related to the identification, planning, and implementation of smart initiatives and technologies. One of these principles includes ensuring that a smart city is "smart for all," meaning that initiatives should benefit all residents and communities, not just a select few. The framework also emphasizes using technology as an instrument to improve citizens' lives, rather than technology being the primary driver of development. Furthermore, it stresses that smart city initiatives should be shaped by and directly respond to the specific local context, taking into account socio-economic factors and the nature of the particular city or municipal area. The SCF also highlights the importance of being informed by the real needs of the community, embracing innovation, partnerships, and collaboration among various stakeholders and ensuring that smart city development is sustainable, resilient, and safe, in accordance with the U.N. Sustainable Development Goal No. 11.[34]

In terms of data protection and privacy, smart city initiatives in South Africa must adhere to the Protection of Personal Information Act (POPIA). POPIA governs how personal data is collected, processed, stored, and shared, mandating that businesses involved in smart city technologies, particularly those utilizing IoT devices that collect personal information, must ensure compliance with this legislation. Additionally, the Cybercrimes Act in South Africa imposes obligations on businesses to prevent cybercrimes, including securing data and systems, which is especially crucial for ensuring the cybersecurity of interconnected devices within smart cities.[35]

The implementation of the SCF in South Africa has a strong focus at the municipal level. The framework provides a structured process for municipalities to assess their "smart-readiness" before embarking on smart city projects. This process typically involves starting with baseline assessments to understand the current situation and the municipality's capacity, followed by the development of tailored support programs to facilitate the implementation of appropriate smart city initiatives.[36]

The experience of two municipalities–the Steve Tshwete Local Municipality and the City of Cape Town–may be addressed to illustrate smart city development at the municipal level in South Africa.

---

[34] Department of Cooperative Governance and Traditional Affairs, South Africa (DCoG). (2023). *A South African smart cities framework*. https://www.cogta.gov.za/cgta_2016/wp-content/uploads/2023/01/Annexure-A-DCoG_Smart-Cities-Framework-1.pdf

[35] Barter, H. (2025). *The legal framework for Internet of Things (IoT) in South Africa*. Barter McKellar. https://www.bartermckellar.law/commercial-law-explained/the-legal-framework-for-internet-of-things-iot-in-south-africa

[36] Department of Cooperative Governance and Traditional Affairs, South Africa (DCoG), 2023.

The Steve Tshwete Local Municipality (STLM) is mostly rural with several urbanized centers, including Middleburg (with a population of more than 80,000 residents). Despite this, the municipality is actively working towards implementing the national Smart Cities Framework and has introduced its own Smart City Initiative. The municipality defines its smart city vision as one that makes decisions and governs through technologically enhanced engagement with its citizens, committed to providing universal access to services and information with socio-economic development and efficient service delivery at its core. The STLM's initiative, supported by the Anglo-American Municipal Capability and Partnership Programme (MCPP), aims to localize the principles outlined in the SCF. The process follows a structured, multi-phase methodology encompassing (a) the evaluation of municipal smart readiness and (b) comprehensive data collection to support evidence-based decision-making for smart urban development. This approach prioritizes the identification of city-scale smart interventions that progressively optimize public service delivery and elevate living standards, while ensuring alignment with the Smart City Framework's foundational principle of social inclusion.[37]

The City of Cape Town has adopted a strong data-driven approach in its journey towards becoming a smart city. The city has established a Digital City Strategy as its guiding framework for smart city development. Key initiatives include the development of an Open Data Portal in 2015, which provides public access to various city datasets, promoting transparency and enabling research and innovation. The city has also invested in the development of its IT infrastructure in order to improve administration and service delivery.[38] The Emergency Policing and Incident Command (EPIC) system is being integrated with the city's back-office platform and civil society groups to enhance public safety. Additionally, Cape Town has established a data science team to leverage data analytics for better decision-making.[39] These initiatives are guided by the city's transversal data strategy and research framework, which emphasize evidence-based decision-making and the importance of data sharing and partnerships. The city's approach is business-led rather than purely technology-led, ensuring that technology investments respond to clearly defined business needs.

To sum up, South Africa's regulatory strategy for smart cities is characterized by a decentralized, bottom-up approach, guided by a non-binding framework that places a strong emphasis on inclusivity and local relevance. This approach reflects

---

37 CSIR. (2022, June). *A guide to establishing a municipal smart city initiative*. Urban Knowledge Exchange Southern Africa. https://www.ukesa.info/files/DMiCy0Yxm7eIAczn4GUSrQft1u6F8gKj/Smart_City_Guide_CSIR.pdf

38 International Growth Centre. (2023, January 23). *Data and research journey of a 'smart city': The City of Cape Town's practical approach towards evidence-based decision-making*. https://www.theigc.org/blogs/data-and-research-journey-smart-city-city-cape-towns-practical-approach-towards-evidence

39 Boyle, L. (2020). *The way forward for the City of Cape Town and what it means to be 'smart' in Africa* (p. 32). Urban Real Estate Research Unit. https://open.uct.ac.za/handle/11427/32097

the country's diverse socio-economic landscape and aims to ensure that smart city development benefits all communities. Existing legislation on data privacy and cybercrime provides a foundational layer for responsible and secure implementation of smart city technologies.

Conclusion

The comparative analysis of smart city initiatives across BRICS nations reveals diverse approaches shaped by distinct governance models, socioeconomic contexts, and regulatory landscapes. While the overarching goal of enhancing urban livability through technology is shared, the pathways to achieving it vary significantly, offering valuable lessons for BRICS alliance.

Firstly, it is obvious that both the top-down and bottom-up approaches to smart-city development have certain distinct advantages as well as limitations. The top-down approach (employed in India and China) enables rapid scaling and centralized resource allocation but risks overlooking local needs, exacerbating inequalities (as seen in India's "edge cities"), and creating rigid implementation frameworks. China's emphasis on national standards fosters interoperability but faces challenges in data governance. The bottom-up approach (adopted in Brazil and South Africa) prioritizes local context, inclusivity, and community needs (e.g., South Africa's "smart for all" principle). However, these kinds of models often struggle with fragmentation, inconsistent progress, and reliance on municipal capacity and funding.

Therefore, it is evident that there is a need to foster hybrid governance models, which combine the strategic direction and resource allocation strengths of top-down approaches with the contextual sensitivity and innovation potential of bottom-up initiatives. National frameworks (like India's Mission or China's standards) should provide goals and minimum standards while empowering cities with the autonomy and resources to tailor solutions (like Brazil's municipalities or South Africa's SCF process). Cities across BRICS nations would greatly benefit from the implementation of such a model to address problems in securing resources for smart city development.

A common challenge across all analyzed jurisdictions is the lack of comprehensive, dedicated legal frameworks specifically designed for the complexities of smart cities. Brazil, India and Russia rely heavily on guidelines, orders, or policies under development, creating uncertainty. Therefore, it is particularly important to prioritize the enactment of comprehensive national laws on "Smart Cities" to provide a stable legal foundation beyond ministerial orders. laws and guidelines, that explicitly embed principles of human-centricity, sustainability, and inclusivity. Brazil's attempt to pass such a law may serve as a valuable case example for consideration here.

It is also evident that critical issues such as data security, privacy (addressed partially by South Africa's POPIA), public data sharing, algorithmic accountability, and

citizen rights in digital spaces remain inadequately regulated across the majority of BRICS nations.[40] BRICS member countries should therefore collaborate to share best practices and develop model legislative principles to address these issues.

The analysis in this paper underscores the risk of technology becoming an end in itself[41] rather than a tool for solving concrete urban problems. India's focus on road expansion over public transport and the potential for increased surveillance highlight misalignments with sustainable development and social equity goals. On the contrary, success stories like Curitiba's integrated transport system or Cape Town's data-driven service delivery demonstrate the power of technology applied strategically to enhance sustainability, efficiency, and inclusivity.

Furthermore, truly smart cities require active citizen participation in planning and decision-making. Frameworks like Brazil's CBCI and South Africa's SCF explicitly emphasize collaborative governance; however, translating this into practice remains a challenge. Therefore, clear mechanisms for multi-stakeholder engagement (including citizens, academia, and private sector) within national and city-level governance structures (e.g., strengthening bodies like India's Smart City Advisory Forums) should be established in order to address this demand.

Although smart technologies are innovative, the emphasis within their implementation should rather prioritize equity, sustainability, and concrete problem-solving. It is therefore crucial that smart city investments are explicitly linked to the U.N. Sustainable Development Goals (SDGs), particularly SDG 11 (Sustainable Cities and Communities).[42] Moreover, smart city investments should also envisage mandates for rigorous sustainability and equity impact assessments for all smart city projects. It is worth noting that most BRICS declarations refer to the SDG, particularly stressing the need to proliferate sustainability in development in all spheres, including city growth (for instance, the Goa Declaration 2016, Brasilia Declaration 2019, and Johannesburg Declaration 2023).

Not only are certain aspects of smart cities development worth studying, but BRICS as an institution may also serve as a platform for sharing and creating appropriate tools. Support for smart city development initiatives is reflected in several BRICS declarations (Xiamen Declaration 2017, New Delhi Declaration 2021). The BRICS member states also host several large-scale events, dedicated to discussion of urban and local issues and finding solutions to connected problems. Among them are the BRICS Urbanization Forum, the Forum of BRICS Sister Cities and Municipalities, and the International Municipal BRICS Forum. In 2019, as part

---

[40] *See* also Vinogradov, V., & Estelle, Ch. (2024). IT giants vs. states in human rights regulation in digital space: A comparative review. *A&C-Revista de Direito Administrativo & Constitucional*, *24*(98), 11–38.

[41] *See* Isaev, I., Zenin, S., & Rumyantseva, V. (2023). 'Power' and technological machines: Dreams are replaced by goal-setting. *BRICS Law Journal*, *10*(1), 171–185.

[42] *See* also Gladun, E. (2018). BRICS development through socially responsive economy. *BRICS Law Journal*, *5*(3), 152–159.

of the latter forum, a draft roadmap for interaction between municipalities of the BRICS countries was developed, which included proposals to strengthen interaction between municipalities; transition to renewable, environmentally friendly energy sources; separate collection and appropriate recycling of waste, etc.[43] The already existing framework suggests that a more thorough knowledge exchange and capacity-building instrument within BRICS may be established, for instance, the BRICS Smart Cities Knowledge Hub, to document and disseminate best practices, technical standards, and lessons learned (both successes and failures) across member states. Such a center could facilitate peer-to-peer learning programs for city officials, technologists, and policymakers, as well as explore joint R&D initiatives and pilot projects addressing common BRICS challenges (e.g., affordable sustainable mobility, resilient infrastructure, and inclusive digital service delivery).

The journey towards truly smart, sustainable, and inclusive cities in the BRICS context is complex and ongoing. There is no single blueprint here. Success hinges on learning from diverse national experiences. This means acknowledging the pitfalls of fragmented implementation, top-down rigidity, technological determinism, and regulatory gaps, while embracing the opportunities presented by local innovation, strong standards, inclusive frameworks, and strategic technology application. By prioritizing human well-being, environmental sustainability, and social equity within robust legal and governance structures, and by harnessing the collective knowledge and collaborative potential of the BRICS alliance, member states can transform the promise of smart cities into tangible improvements in the quality of urban life for hundreds of millions of citizens. The imperative is to ensure that the "smart" city is fundamentally humane and sustainable.

Acknowledgements

The study presents the results of the project "Model of Legal Overcoming of Inequality," carried out within the framework of the Basic Research Program at the National Research University Higher School of Economics (HSE University) in 2025.

References

Afonso, J. R. R., & Araújo, E. A. (2006). Local government organization and finance: Brazil. In A. Shah (Ed.), *Local governance in developing countries* (pp. 381–418). The World Bank.

Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart cities: definitions, dimensions, performance, and initiatives. *Journal of Urban Technology*, *22*(1), 3–21. https://doi.org/10.1080/10630732.2014.942092

[43] The International Municipal BRICS Forum. https://imbricsforum.com/about-forum/. (In Russian).

Anand, A., Sreevatsan, A., & Taraporevala, P. (2016). *An overview of the smart cities mission in India*. Centre for Policy Research (CPR), India. https://smartnet.niua.org/sites/default/files/resources/scm_policy_brief_28th_aug.pdf

Asaul, A. N., & Shuan, L. (2021). Current challenges and problems in building smart cities in China. *Scientific Review. Economic Sciences*, *2*, 5–9. (In Russian).

Barter, H. (2025). *The legal framework for Internet of Things (IoT) in South Africa*. Barter McKellar. https://www.bartermckellar.law/commercial-law-explained/the-legal-framework-for-internet-of-things-iot-in-south-africa

Fachinelli, A., et al. (2022). *Smart cities of Brazil 2022: Performance of Brazilian capital cities*. Australia-Brazil Smart City Research and Practice Network. https://www.citylivinglab.com/report-bra-aus

Felicio, E. A., et al. (2023). Smart cities: Practices and indicators adopted in Brazil. *Concilium*, *23*(20), 458–472. https://doi.org/10.53660/clm-2243-23r03

Ferraro, L. (2025). *The first smart city in the world: Curitiba, Brazil*. Whatagreenlife. https://www.whatagreenlife.com/the-first-smart-city-in-the-world-curitiba/

Gladun, E. (2018). BRICS development through socially responsive economy. *BRICS Law Journal*, *5*(3), 152–159. https://doi.org/10.21684/2412-2343-2018-5-3-152-159

Gupta, S. (2019). Smart city paradigm in India: Gwalior, a case study. *Humanities & Social Sciences Reviews*, *7*(4), 341–347. https://doi.org/10.18510/hssr.2019.7444

He, W., Li, W., & Deng, P. (2022). Legal governance in the smart cities of China: Functions, problems, and solutions. *Sustainability*, *14*(15), 9738. https://doi.org/10.3390/su14159738

Isaev, I., Zenin, S., & Rumyantseva, V. (2023). 'Power' and technological machines: Dreams are replaced by goal-setting. *BRICS Law Journal*, *10*(1), 171–185. https://doi.org/10.21684/2412-2343-2023-10-1-171-185.

Larichev, A., Kozhevnikov, O., & Korsun, K. (2023). Legal regulation of smart city technologies in solving local issues in urban areas. *Law. Journal of the Higher School of Economics*, *16*(3), 56–77. https://doi.org/10.17323/2072-8166.2023.3.56.77. (In Russian).

Lima, E. G., et al. (2020). Smart and sustainable cities: The main guidelines of city statute for increasing the intelligence of Brazilian cities. *Sustainability*, *12*(3), 1–26. https://doi.org/10.3390/su12031025

Mills, D., et al. (2022). Evidence-based public policy decision-making in smart cities: Does extant theory support achievement of city sustainability objectives? *Sustainability*, *14*(3), 1–23. https://doi.org/10.3390/su14010003

Praharaj, S., & Han, H. (2019). Building a typology of the 100 smart cities in India. *Smart and Sustainable Built Environment*, *8*(5), 400–414. https://doi.org/10.1108/sasbe-04-2019-0056

Qin, B., & Qi, S. (2021). Digital transformation of urban governance in China: The emergence and evolution of smart cities. *Digital Law Journal*, *2*(1), 29–47. https://doi.org/10.38044/2686-9136-2021-2-1-29-47

Reshetnikova, M. S., Vasilyeva, G. A., & Tretyakova, S. S. (2021). China's place in the global smart cities market. *Innovative Economy Issues*, *11*(4), 1997–2018. https://doi.org/10.18334/vinec.11.4.113971. (In Russian).

Shedrov, I. (2022). *Smart cities in India*. Russian International Affairs Council. https://russiancouncil.ru/analytics-and-comments/analytics/umnye-goroda-v-indii/. (In Russian).

Vinogradov, V., & Estelle, Ch. (2024). IT giants vs. states in human rights regulation in digital space: A comparative review. *A&C-Revista de Direito Administrativo & Constitucional*, *24*(98), 11–38. https://doi.org/10.21056/aec.v24i98.1931

Wu, J., & Novokshonova, Z. (2023). A comparison study of central governments' participation in smart city projects in China and Russia. *E3S Web of Conferences*, *435*, 05006. https://doi.org/10.1051/e3sconf/202343505006

Yu, W., & Xu, Ch. (2018). Developing smart cities in China: An empirical analysis. *International Journal of Public Administration in the Digital Age*, *5*(3), 76–91. https://doi.org/10.4018/ijpada.2018070106

Zabuzov, O. N. (2022). "Smart cities": Experience of Russia and China. *Great Eurasia: Development, Security, Cooperation*, *5-1*, 1150–1153. (In Russian)

Information about the authors

Alexander Larichev (Moscow, Russian Federation) – Professor, Department of Public Law, Faculty of Law, HSE University (Myasnitskaya St., 20, Moscow, 101000, Russian Federation; e-mail: alarichev@hse.ru) – **corresponding author**.

Larisa Soldatova (Moscow, Russian Federation) – Associate Professor, Department of Public Law, Faculty of Law, HSE University (Myasnitskaya St., 20, Moscow, 101000, Russian Federation; e-mail: lvsoldatova@hse.ru).