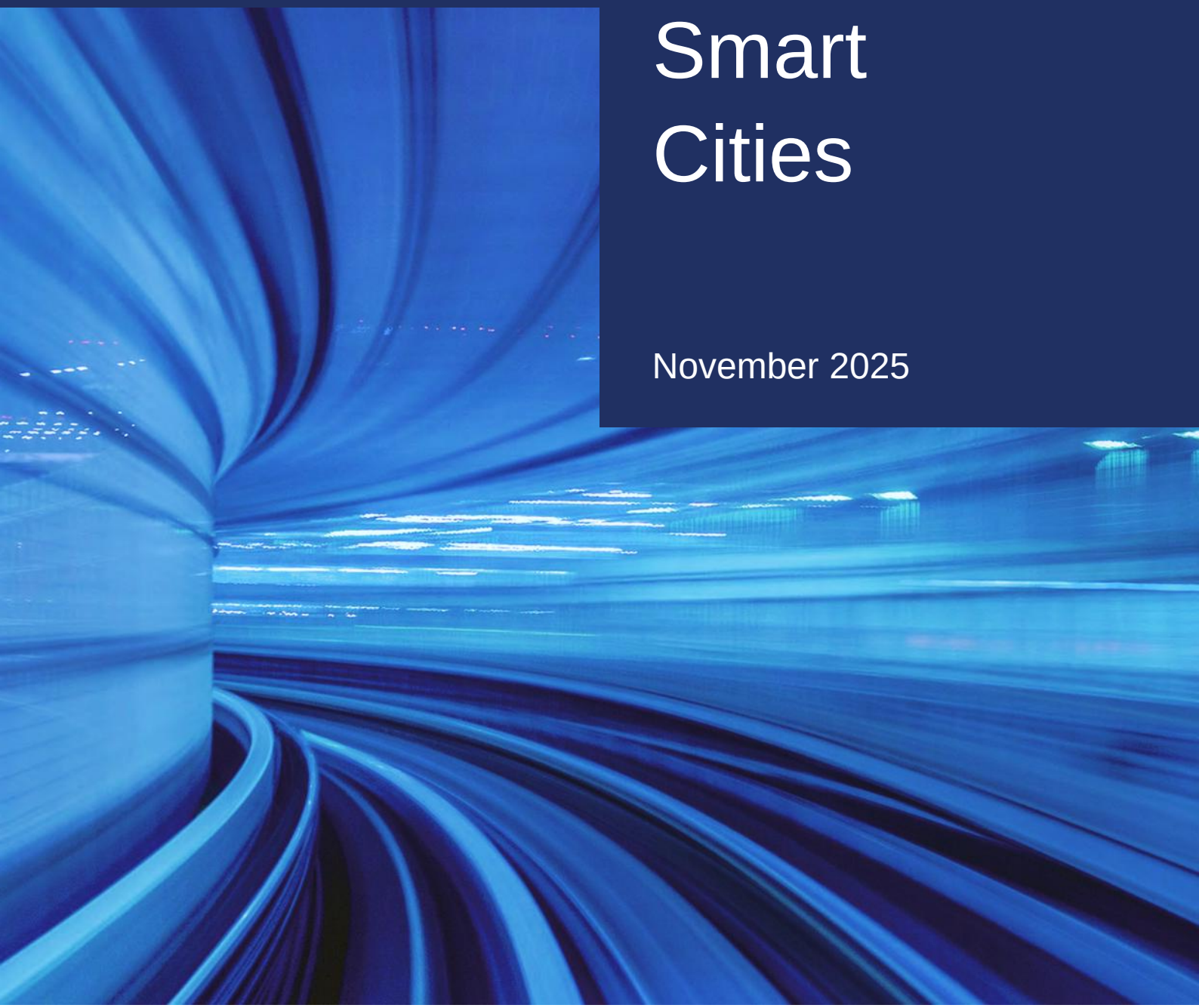
SW TENET

Smart Cities

November 2025



Catalyst for success

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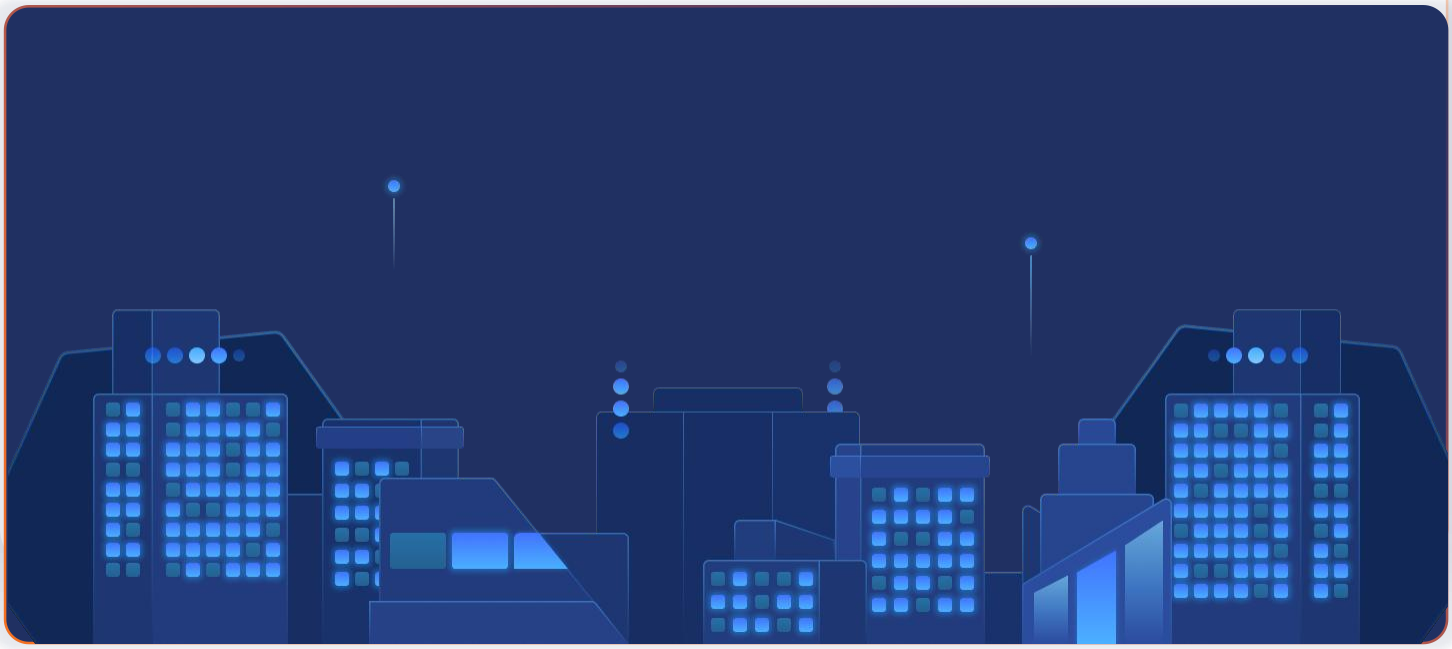
Foreword

SW Tenet presents the smart cities ranking for some BRICS+ countries. A sample of cities from different countries enables the study of different approaches to digitalization, the introduction of new technologies in municipal management, education and medicine, business and the hospitality industry, along with the monitoring of the environment and improvement of sustainability parameters. The cities are compared with each other, with London, New York and Singapore also analyzed as benchmark cities to collate the selected cities with global leaders.

The study of smart cities is not merely an analysis of the level of penetration of advanced technologies into various spheres of life of modern cities, but primarily a study of how technologies and digitalization affect the quality of life of citizens. In practice, the rating results allow assessing the leaders and identifying the areas for the development of cities with lower scores – this can be in demand both by representatives of the city administrations and by businesses acting as providers and users of smart solutions in city life.

The key conclusion of the new study is that the high rating is the outcome of a comprehensive city development program. Such a program is not necessarily formalized and does not introduce the concept of "smart city" in each case, however, it is important that the city administration be interested and facilitate the penetration of technology where business cannot always do so on its own.

At the same time, the specific development aspects of different countries and cities cannot be ignored. For example, Singapore is an example of government initiatives, while in London the decisions of residents of certain areas and horizontal ties are more important. At the same time, the lack of due attention by the authorities of the CIS countries and cities to the issues of sustainable development, adaptation of infrastructure to the requirements of new technologies and the introduction of technologies into everyday life is the key reason for the low results of the CIS cities.



Survey results

No.	City	Score
1	Singapore	54.6
2	Moscow	54.3
3	Beijing	53.5
4	London	53.4
5	Shanghai	52.3
6	New York	52.1
7	Dubai	52.0
8	St. Petersburg	51.8
9	Astana	49.4
10	Abu Dhabi	48.7
11	Riyadh	47.9
12	Istanbul	47.7
13	Tashkent	44.5
14	Delhi	44.3
15	Mumbai	43.1

Leading cities (52.3–54.3 points)

The leading cities demonstrated high results in implementing advanced technologies and solutions aimed at improving the quality of life of the population in all five categories.

The innovation are introduced in the cities in a comprehensive way. The development of urban infrastructure is based on the requirement to improve the comfort and safety of residents. Well-developed services sector reflects the modern nature of the economic structure, and the share of R&D in the economy proves that the administration and business are interested in the development of technologies.

Middle group (50.0–52.2 points)

The middle group included cities with sustainable results across all categories. These cities have no significant bottlenecks, however, their results, both in terms of qualitative and quantitative criteria, are inferior to the leading cities.
Further implementation of advanced technologies in the areas of governance, business infrastructure, education, and healthcare will contribute to improving the position of the cities of the middle group.

Cities with development potential (<50 points)

The cities of this group were scored below 50. For certain cities, this result stems from lagging behind the leaders in adopting e-services for residents, digitalization of healthcare and education, development of transport infrastructure and micromobility options. In some cases, the lower scores are due to an insufficient disclosure of information on the criteria under assessment.

The adoption of smart city technologies in this group has a high development potential. The most promising areas are digitalization of interactions between citizens, business and the government, a growing services sector, as well as sustainable development to improve the environmental quality.

Brief profiles of leading cities

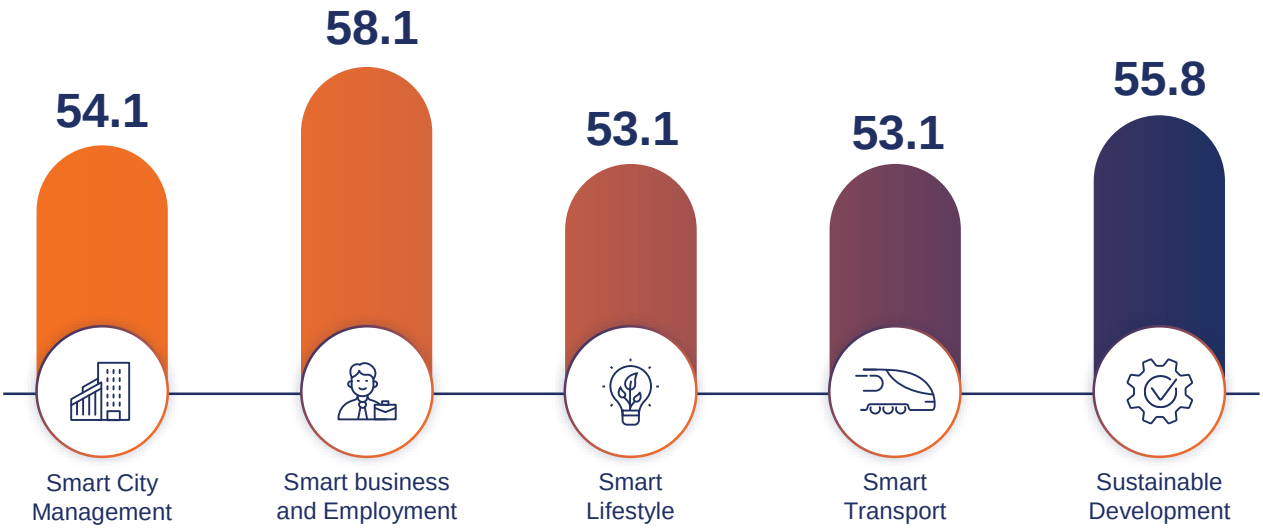
Singapore **54.6**

Smart city develops in a balanced manner

Singapore tops a new ranking of smart cities. The city demonstrates balanced development across all five categories under analysis. The high score is due to an improved city portal, the IT infrastructure of the city, the development of electric vehicles and micromobility options, as well as doubled R&D expenses. Singapore maintained strong performance in the Smart Business, Smart Lifestyle and Sustainable Development categories. In general, the city's progress is the result of government policies aimed at achieving a leading global position in technology and innovation, coupled with a special focus on environmental quality and the life of its citizens.

Singapore's innovative development has been carried out since 1991 as part of its national strategy – Research, Innovation and Enterprise (RIE) and its current version, the RIE2025 Plan. The RIE initiative is the foundation for Singapore's development as a knowledge- and innovation-based economy and society. According to the strategy, the government has maintained investments in innovation, education and industrial production at no less than 1% of GDP (or about USD 25 billion in 2024) throughout 2021–2025.

RIE2025 identifies four areas of development: industry and trade; healthcare and human capital; urban solutions and sustainable development; smart nation and digital development. As a result, innovative development covers all areas of the city's life, from school education to industrial facilities and transport infrastructure. The adoption of advanced technologies in industry helps reduce pollutant emissions and noise levels, which contribute to a higher quality of the city environment and is reflected in quality-of-life indicators, such as life expectancy and resident satisfaction with the city's cleanliness.



Brief profiles of leading cities

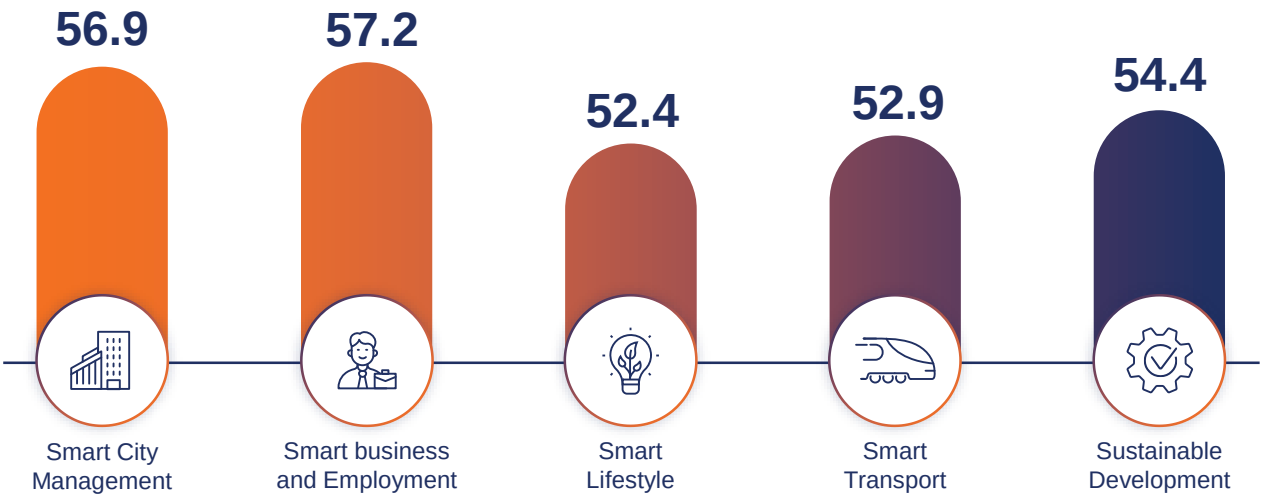
Moscow **54.3**

Leadership through digitalization of services

Moscow is the second in the smart cities ranking. As in the previous rating, the city maintains a high level of digital interaction between residents and the administration, primarily due to the development of the city portal, which provides services for both citizens and businesses, while disclosing information on various areas of the city life.

Moscow has increased investments in science and technology, with R&D expenses accounting for 3.4% in the city's economy. Notable improvements have been made in micromobility and car sharing services, the adoption of electric vehicles and related infrastructure. Moscow provides favorable conditions for residents in terms of air and water quality. Key development areas include telecommunications, in particular, the full commercial rollout of fifth-generation networks, as well as an increase in the number of hotels and hotel room capacity.

Moscow's strong performance is due, among other things, to its city administration's efforts to adapt international best practices to implement innovation and sustainable development projects. Such experience includes close cooperation with business in the development of infrastructure and the urban environment, as well as the city's attention to education and healthcare. City administration authorities play an active role in innovations development and implementation in Moscow. The city administration provides financial (grants, preferential loans, sureties) and non-financial (consultations, educational and acceleration programs, contests, projects on cooperation with investors and major customers) measures to support the city's business.



Brief profiles of leading cities

Beijing 53.5

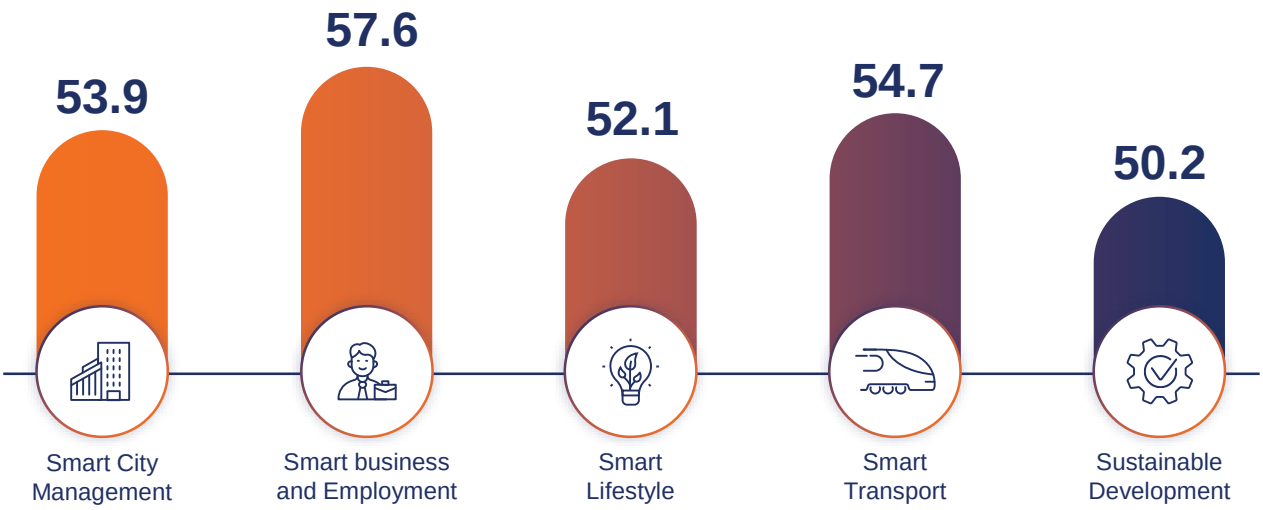
Science, infrastructure and governance

The spread of smart city technologies in Beijing is in line with other top five cities of the ranking. The city stands out by its significantly higher penetration of electric vehicles and charging infrastructure, as well as the density of the route network and the high Internet speed. Beijing is the leader in innovation spending with a 6% R&D share in the city's economy, with a focus on basic research in such areas as space and oceanography, in addition to applied research in bio- and medical technologies, microelectronics and IT, as in other cities.

Like other leaders, Beijing benefits from a strong educational base: it is home to China's leading universities and research centers, which regularly enter the global rankings and are known for their programs in engineering, computer science, medicine and nanotechnology. To implement R&D projects, Beijing has established a scientific and technical innovations site – "Three Science Cities and One Area" (Zhongguancun Science City, Future Science City, Huairou Science City, and Beijing Technical and Economic Development Area).

The city's high ranking are facilitated by transport infrastructure developed under national programs. High-speed railways ensure the population mobility and attract highly skilled professionals. Advanced IT infrastructure enables companies and research centers to leverage up-to-date communications, data storage and processing technologies. A mature startup ecosystem and venture investments provide financial support for technology and innovation businesses.

Further improvement of the city's ranking could be achieved by enhancing water and air quality. Weaker performance in development of car sharing and e-scooters is compensated by the high penetration of bike-sharing services.



Brief profiles of leading cities

London 53.4

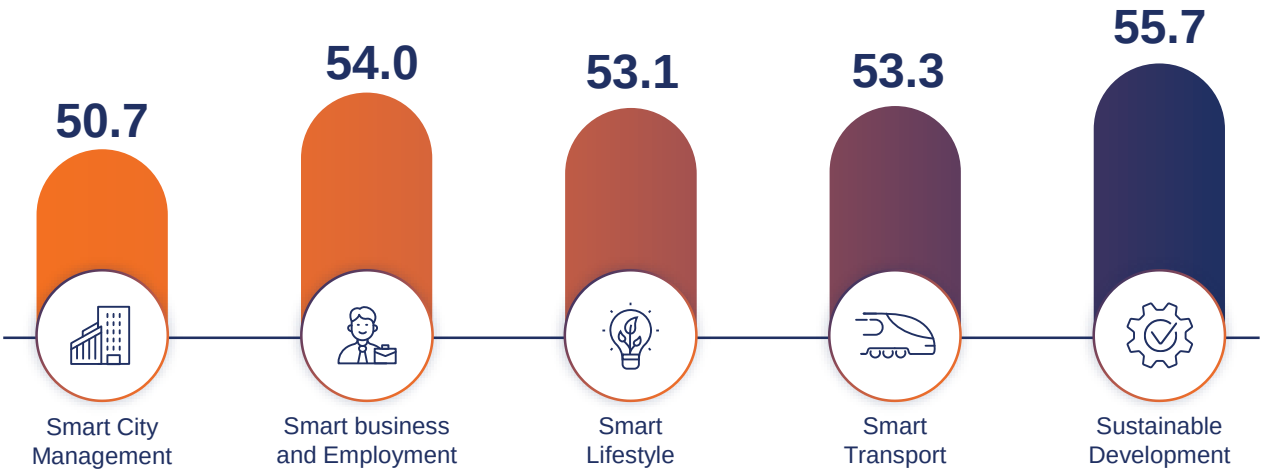
British approach to smart cities

London is rightfully ranks among the leaders for integrating up-to-date technologies into everyday life while maintaining high standards of sustainable development. A lower positions compared to the top three is due to the specific way of organizing life in the city and in the UK, where certain decisions are made not centrally, but by individual participants. For example, the lack of a single educational platform exists because schools are free to choose their own solution providers based on their needs. Similarly, instead of a unified citizen engagement portal, London districts use their own local portals that meet the needs of their users.

To ensure smart city development, the administration of London fosters private initiatives by supporting national and city-wide programs. It encourages collaboration between businesses and scientific organizations located in London, which work on fundamental research and create applied solutions for urban and transport development, water and air consumption and quality improvement.

London is home to the largest number of research organizations in the world – 2,000, according to the Global Research Identifier. The London Office of Technology and Innovation (LOTI) is an example of the administration's involvement in promoting innovation beyond conventional funding. LOTI acts as a link between suppliers and city authorities, serving as a technology consultant and providing information on existing and available technologies to solve practical challenges.

At the same time, the London administration places significant emphasis on the restoration and conservation of natural resources, such as rivers and parks, which greatly enhance the quality of life for its citizens.



Brief profiles of leading cities

Shanghai 52.3

Smart city for business

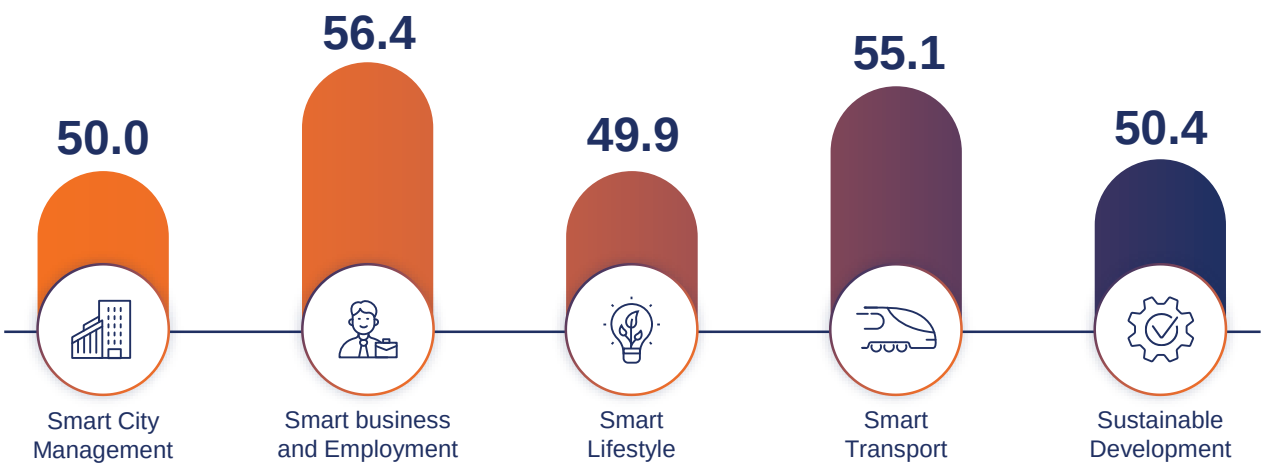
Shanghai rounds out the top five cities in the rating. Its position was primary driven by high scores in the Smart Business and Employment and Smart Transport categories. The city boasts well-developed services for interactions between administration and business, including small and medium-sized enterprises. Existing platforms allow for the remote registration of businesses, filing reports, obtaining construction permits and hiring personnel of various categories using the city's electronic job exchange.

Business opportunities are supplemented by a developed transport infrastructure, which includes a road network, public transport, high-speed trains. A state-of-the-art telecommunications system enables both the city administration and business to implement modern solutions to solve practical challenges in the megalopolis, including education and healthcare.

Like Beijing, Shanghai stands out for its high level of R&D spending – 4.3%. The tech parks, such as the Zhangjan High-tech Park or Caohejing Hi-Tech Park, attract startups to the city, providing funding at various stages of project development and access to cutting-edge technological capabilities. Although Shanghai's services sector share is lower than that of other leading cities (75%), this is more a consequence of its highly developed industrial sector rather than underdeveloped related services.

For interaction between the city administration and residents, the city uses the Suishenban Citizen Cloud platform, which capabilities are largely similar to the Mos.ru platform.

Similar to Beijing, Shanghai's low score in the Sustainable Development category is a consequence of the administration's low focus on the environmental protection issues in the past. However, the situation has changed in recent years. The introduction of smart sensors across the city allows for pollution monitoring and the automatic regulation of production processes in accordance with environmental standards. The use of digital twins and smart buildings enables the simulation of various scenarios for urban infrastructure, help optimize transport, energy and water management, and helps to predict and prevent potential problems. Alongside the wide-spread adoption of electric vehicles, these initiatives will help improve the city's environmental quality.



Research methodology

Geography

Comments

- A crucial element in developing smart cities is having a strategic program document detailing the specific actions and phases for implementing modern technology and digitalizing interactions between citizens and city institutions across various aspects of city life.
- **Among the cities analyzed,** an active smart city program is only found in Moscow and Istanbul. Istanbul's smart city development concept is the first document of its kind at the local government level in Turkey. Singapore implements a national-level strategy, given its status as a city-state.
- **London** has a range of initiatives united under the common goal of Smarter London. The projects and initiatives being implemented foster the development of innovative urban services and enhance the quality of life for the city's residents.
- **In Tashkent, Mumbai, and Riyadh**, smart city functions are being developed as part of their national strategies, rather than specific city-level strategies.
- **Cities such as St. Petersburg, New York, Dubai, Abu Dhabi, Shanghai, and Beijing** are taking steps to integrate individual smart city components – like intelligent transport systems, security, and telecommunications – within the framework of their municipal development plans.

15 cities

12 cities under analysis

3 benchmark cities

Research methodology

Rating structure

The ranking incorporates five key categories. These categories reflect the core areas of activity of the modern metropolis that define the convenience and efficiency of its various urban systems for residents.

The categories encompass an assessment of various smart city development parameters, for example, the availability of a strategy, penetration of technologies into practical applications – from educational platforms to street lighting systems, sustainable development, etc.

Analysing these categories allows for conclusions to be drawn about which aspects of city life are more developed and which require additional attention.

Smart City Management

- Smart city development strategy
- Online city profile
- Availability of city management data
- Potential electronic interaction between city residents and municipal authorities, participation in city life
- Availability and level of development of the city's open data portal

Smart Lifestyle

- Smart education
- Smart healthcare
- Safety
- Tourism and leisure
- Development of telecommunications

Smart Transport

- Transport infrastructure quality
- Development of micromobility solutions
- Development of electric vehicles
- Availability and technological sophistication of paid parking systems
- Use of technologies for transport system development
- Level of technology for public transport user convenience

Smart Business and Employment

- Development of knowledge-intensive industries and the services sector
- E-services for business and employment
- Trade innovation
- Employment for men and women
- Accessibility of the city environment for people with limited mobility

Sustainable Development

- Air quality
- Pollution and waste management
- Water quality
- Energy efficiency

SW Tenet developed the list of indicators included in these groups on the basis of a review of international practices of similar research studies based on the availability of source data for the cities under analysis.

Each category comprises 4–6 groups of indicators. The research study has analysed 76 indicators, including 48 qualitative (primarily measuring the presence and/ or level of development of a particular technology) and 28 quantitative indicators.

Research methodology

Reference

The ranking was complied based on the information provided in public data sources

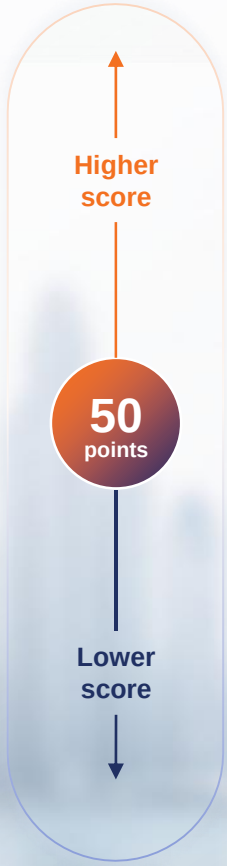
- National statistics
- Open city data
- Data of state authorities and city administrations
- Population survey data
- Corporate websites
- Mass media websites
- Special purpose industry research studies
- Information portals and databases

City-level data were used in priority order for all indicators in the survey. If the relevant information was not available, district-, region-, or state-level data were used. In some cases, country-level data were applied.

For the purposes of this ranking, the most recent data available in Q1 2025 were used, except in certain cases, where data from 2020–2023 were utilized to ensure accurate analysis or due to the unavailability of other data.

Data standardization and rating calculation

- To assess qualitative indicators, data obtained from the study of open sources were used. The evaluation used either a simple "Yes" (1 point) / "No" (0 points) scale or a more detailed 0 to 5-point scale that allowed for a more precise assessment of technology development / adoption in a city, provided sufficient detailed information was available.
- The indicators considered for each smart city development category were normalized to a unified scale that reflects the deviation of each city's indicator value from the average value of that indicator across the entire sample of cities. This approach enables to assess the aggregation of diverse indicators with different characteristics (e.g., qualitative parameters, percentages, absolute values, etc.) onto a common scale.
- Each indicator was assigned a specific weight based on its significance within the respective smart city development category, considering the number of indicators within each group representing a distinct development factor.
- A city's total score for each category was calculated as the weighted average of all indicators within that category. The final overall ranking was determined as the average results for each smart city development category.



Smart City Management ranking

No.	City	Score
1	Moscow	56.9
2	Singapore	54.1
3	Beijing	53.9
4	Dubai	53.4
5	Istanbul	51.2
6	London	50.7
7	Shanghai	50.0
	St. Petersburg	50.0
8	Tashkent	49.3
9	New York	49.2
10	Riyadh	47.7
11	Mumbai	47.1
12	Astana	46.8
13	Abu Dhabi	45.9
14	Delhi	43.8

Global capitals (benchmark cities)

Cities under analysis

Methodology

- 14 quantitative and qualitative indicators were collated and presented as a single numerical scale to calculate the Smart City Management rating. For several qualitative criteria, instead of a simple "yes" (1 point) and "no" (0 points) scale, a more detailed scale (0–3 points) was used. This allowed for a more accurate assessment of gradations within individual indicators.
- Each indicator was assigned a specific weight based on its significance in forming a smart city management system, as well as in connection with allocation of several indicators to a transport single development factor.
- **Groups of analyzed indicators with their weights in the ranking are given below:**

I. Smart city development strategy – 5%
II. Online city profile: the availability of a comprehensive electronic portal,
its utilization by city residents, the number of social networks where the city has valid accounts – **20%**
III. Availability of city management data to residents – 25%
IV. Electronic interaction between city residents and municipal authorities, participation in the life of the city – **25%**
V. Availability and level of development (number of data sets and providers, provision of timely updates) of the city open data portal – **25%**

Results

1. The leaders in the Smart City Management category are Moscow, Beijing, and Dubai. Moscow and Beijing demonstrate high results across all analyzed indicators. The difference in their scores arose because Beijing lacks a consolidated smart city development strategy. Dubai stands out due to its modern city e-portal, which is actively used by its residents.
2. Istanbul distinguished itself with its advanced system for citizen interaction with municipal authorities and public participation in city life.
3. Delhi ranks last due to lagging behind other cities across all studied indicators related to Smart City Management.
4. The benchmark cities London and New York are in the middle of the ranking due to their specific approach to structuring resident-administration interaction, the absence of a comprehensive city portal, and a remote electronic voting system.
5. Among the benchmark cities, Singapore stands out thanks to a large number of digital platforms for citizen-government interaction, the development of a strategy to advance Singapore as a smart city under the Smart Nation initiative, an active city profile on social media, and an advanced level of functionality for its open data portal.

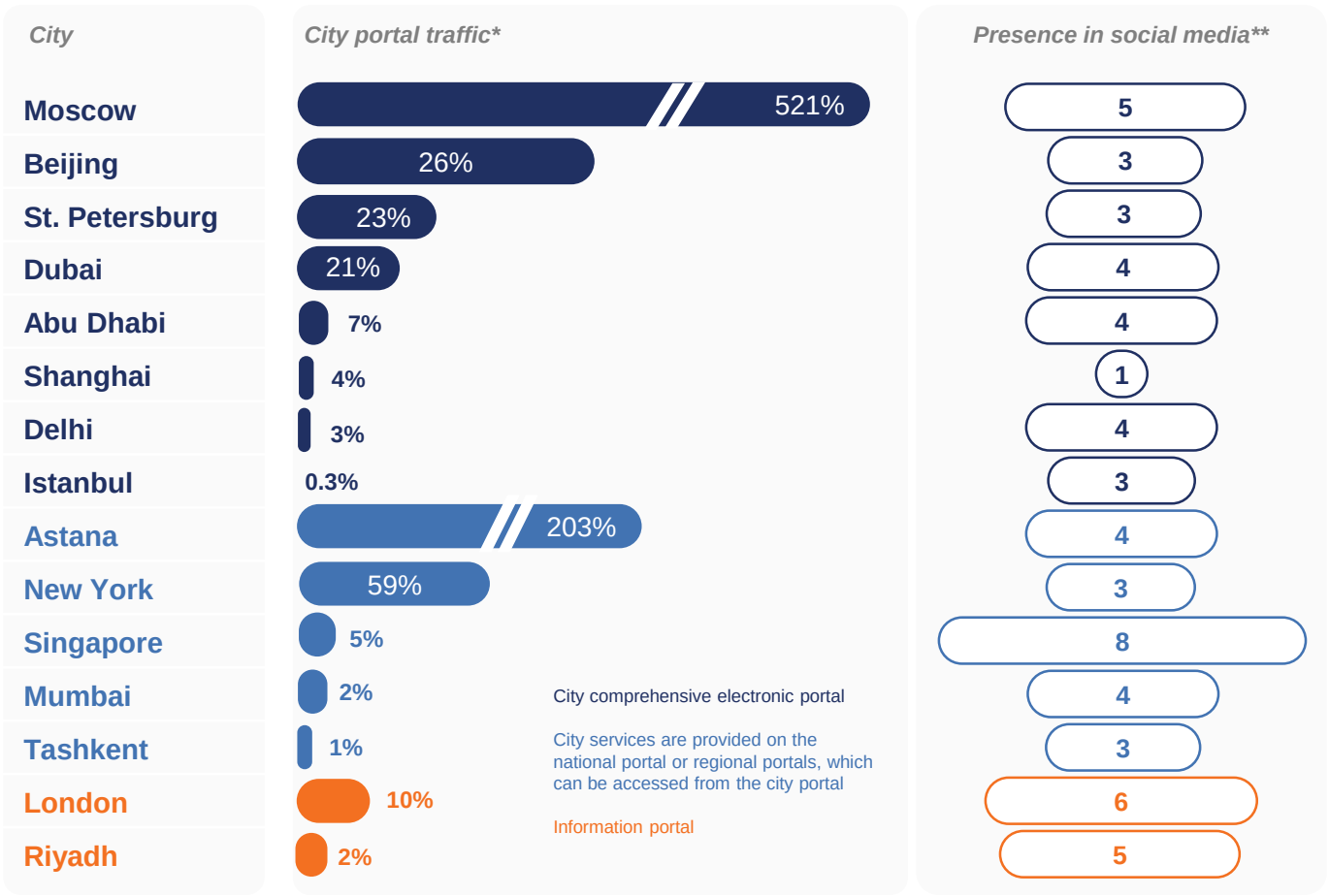
Smart city development strategy

Comments

- A crucial element in developing smart cities is having a strategic program document detailing the specific actions and phases for implementing modern technology and digitalizing interactions between citizens and city institutions across various aspects of city life.
- **Among the cities analyzed,** an active smart city program is only found in Moscow and Istanbul. Istanbul's smart city development concept is the first document of its kind at the local government level in Turkey. Singapore implements a national-level strategy, given its status as a city-state.
- **London** has a range of initiatives united under the common goal of Smarter London. The projects and initiatives being implemented foster the development of innovative urban services and enhance the quality of life for the city's residents.
- **In Tashkent, Mumbai, and Riyadh**, smart city functions are being developed as part of their national strategies, rather than specific city-level strategies.
- **Cities such as St. Petersburg, New York, Dubai, Abu Dhabi, Shanghai, and Beijing** are taking steps to integrate individual smart city components – like intelligent transport systems, security, and telecommunications – within the framework of their municipal development plans.

Sources: official websites of municipal authorities, city portals, information and legal systems of legal regulations, the media

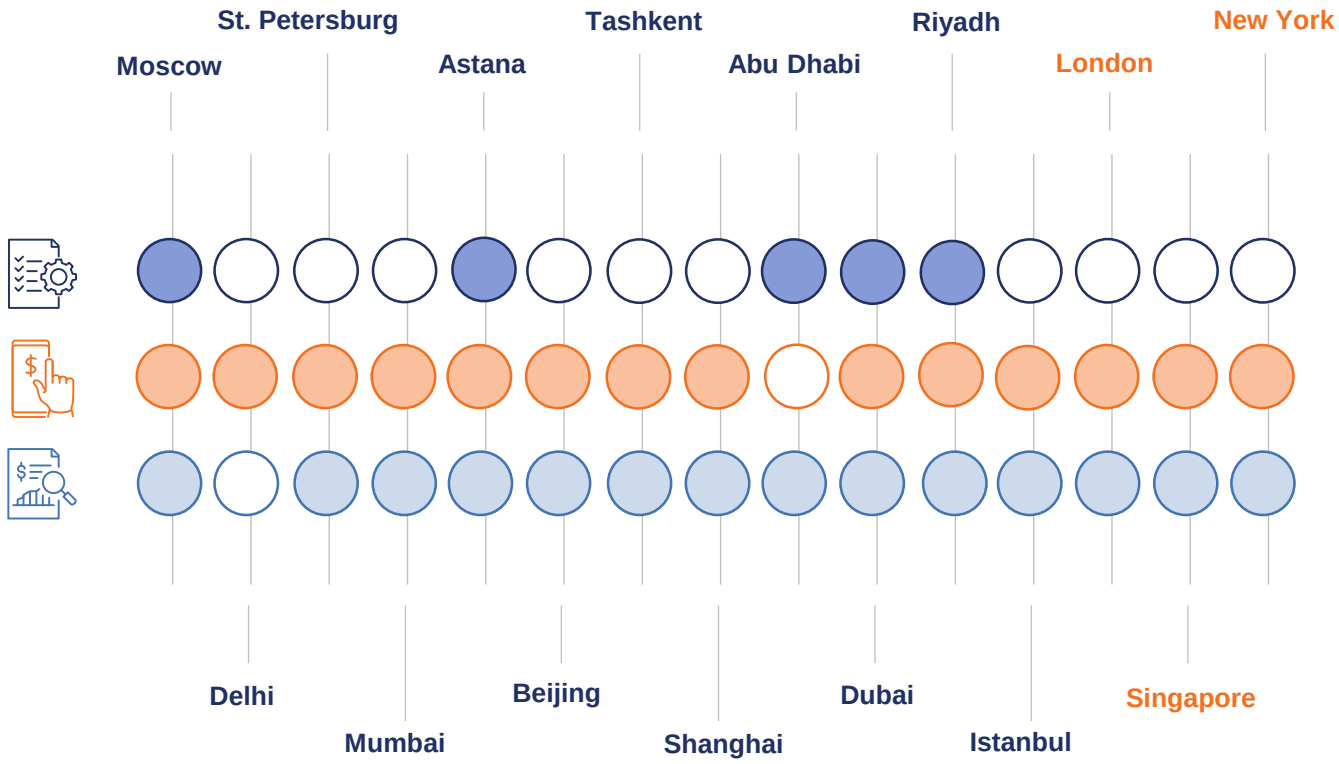
Online city profile



- Among the studied BRICS+ cities, the most comprehensive portals offering online services directly on the city website are found in **Moscow, Beijing, Shanghai, St. Petersburg, Dubai, Abu Dhabi, and Istanbul.**
- **The Moscow portal** is the leader among the cities in the ranking for average monthly visits, confirming its popularity with diverse user groups. The portal assists in resolving issues related to daily life, including utilities, education, healthcare, and other areas. It also serves as a platform for effective interaction between small businesses and the city administration.
- In some of the cities studied, the portals remain information aggregators. To access services online, the system redirects visitors to other digital platforms: comprehensive nationwide or regional portals, or specialized services focused on specific aspects of city life.
- Examples of this are the portals of the Tashkent and Astana administrations, which redirect users to a single national resource. The New York City portal follows a similar approach.
- **London**'s main city website primarily performs an informational function. To resolve issues related to daily life and access services, residents use the websites of individual city districts.
- The most popular and active social platforms for the majority of the analyzed cities are Facebook and Instagram***. Among the CIS cities, **Telegram** is the dominant platform.
- **Beijing and Shanghai** use local social networks, such as **WeChat and Jingtong.** These are "super-apps" that combine the ability to access services from various providers, ranging from payments to obtaining city government services, booking medical appointments, applying for benefits, and more.

** - Ratio of the average number of visits to the city's electronic portal in 2024 to the city's population.*
*** - Number of social networks with active city accounts *** - Owned by Meta, a company recognized as extremist and banned in Russia*
Sources: official websites of the regional authorities of state statistics services, city portals, pro.metrica.guru, the media, SW Tenet assessment

Availability of city management data



– Access to online voting on election-related issues

– On-line public access to the city budget

– Availability of information on local government decisions

– Available

– Not available

Comments

- The adoption of online voting systems is not yet widespread. Moscow, Dubai, and Astana are the only cities that have implemented digital technologies for organizing elections through the use of Remote Electronic Voting (REV) systems.
- Online access to information on the city budget is restricted to residents only in **Abu Dhabi**. Among the cities that do provide access to their budget, Moscow and St. Petersburg are particularly noteworthy; they publish interactive charts, allowing the data to be examined in a more comprehensive and convenient way.
- The ability to review decisions made by local government authorities is available in all the cities studied, with the exception of **Delhi**.
- In **Moscow, Beijing, Shanghai, Dubai, and Abu Dhabi** access to a wide range of documents is provided directly on the city portal.

Sources: official websites of local authorities, city portals, the media

City government relations

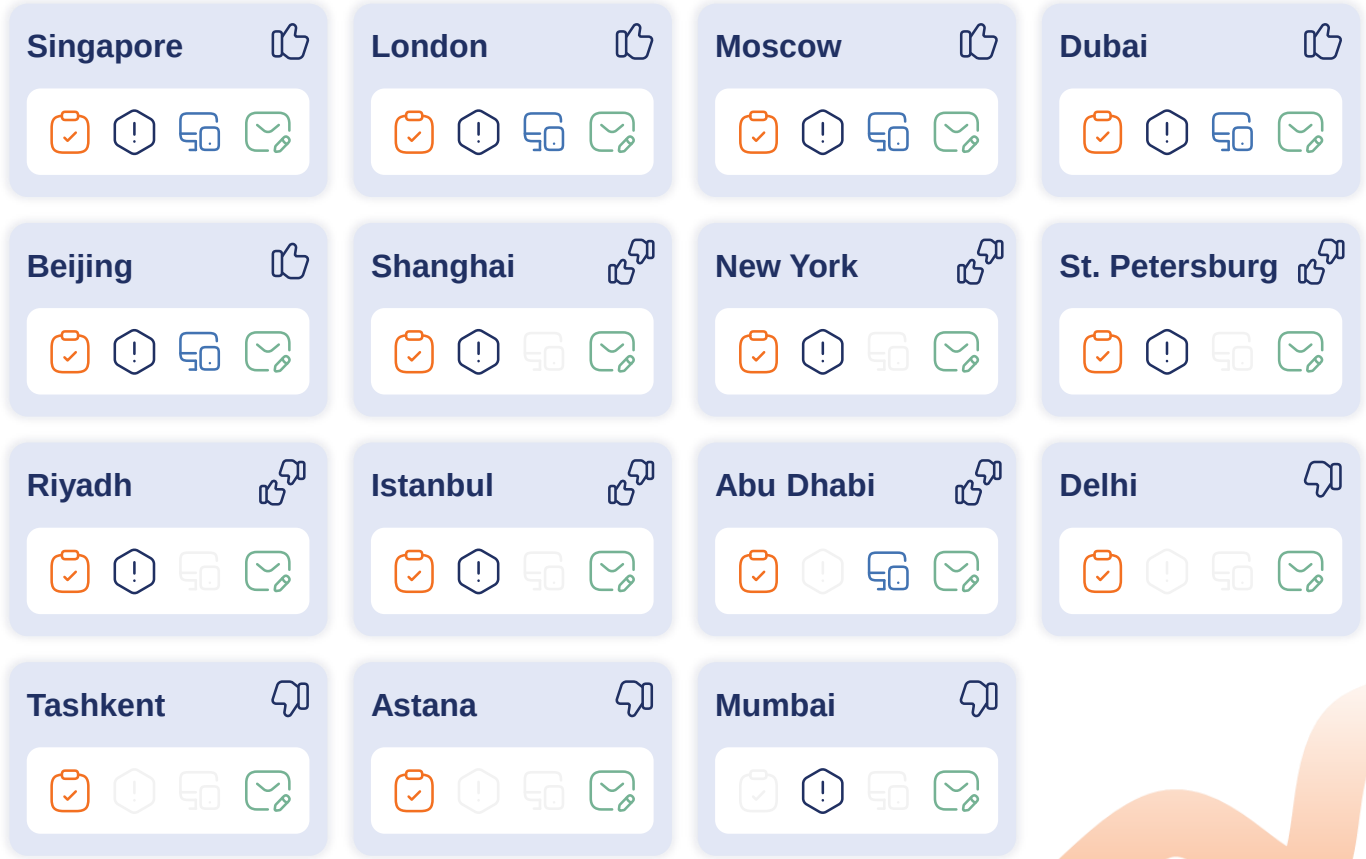
Feedback from residents on local government projects:

– Electronic front office to submit requests to the executive city authorities

– Online notification of the authorities of issues that require troubleshooting

– Website special features

– Feedback by email or general request form



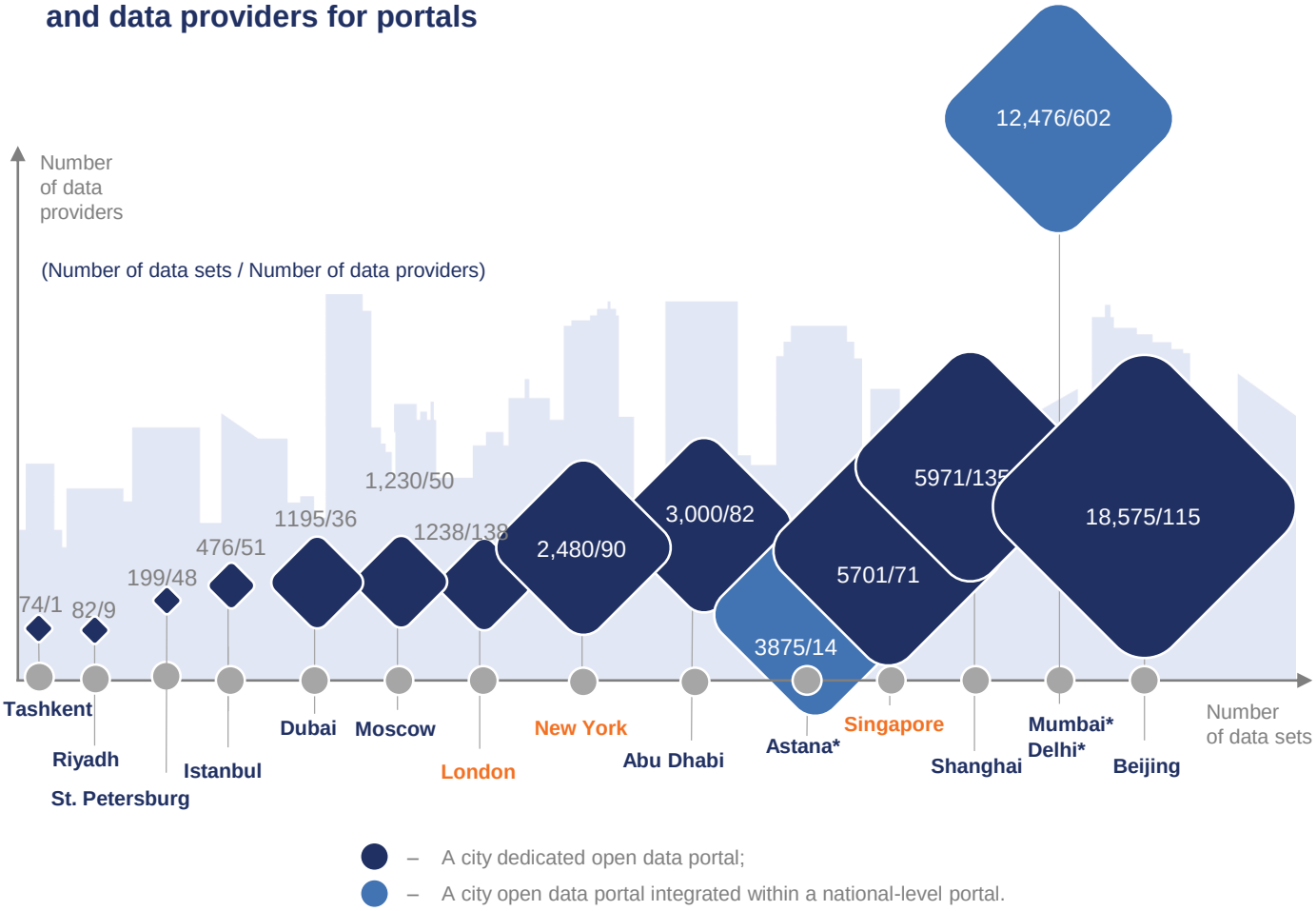
Comments

- This set of criteria is important for assessing the transparency of government activities due to services that allow residents to learn about new initiatives, submit various requests, and monitor the effectiveness of the city administration.
- Interaction between the population and municipal authorities through online channels is well-developed in the analyzed cities of Russia, CIS countries, BRICS+, and the benchmark cities. **Moscow, Dubai, and Beijing** are particularly notable, as requests to municipal bodies can be submitted online directly on the city portal without being redirected to other feedback forms.
- Among the benchmark cities, the leaders are London and Singapore, which have dedicated, unified platforms for collecting feedback. Talk London platform uses open surveys and discussions to gather residents' opinions and suggestions on key areas of public life. This feedback is subsequently considered when preparing city strategies and development plans. Singapore's REACH platform forward the received feedback directly to ministries through a unified analytics system.
- **Beijing and Shanghai** use messengers and social networks to interact with the authorities. Specifically, the WeChat network allows residents to submit appeals to city services without additional registration on various portals. Furthermore, in Shanghai, each of its 16 districts has its own social media pages where residents can participate in city life.
- Residents of **Riyadh** have access to dedicated sections on the city portal that provide an opportunity to share their opinions and comments on upcoming legislation and projects related to economic and development issues.

Sources: official websites of local authorities, city portals, the media

Open data city portals

Number of available datasets and data providers for portals



Comments

- Among the analyzed cities, the leaders in the number of available datasets by a significant margin are the Chinese cities of Beijing and Shanghai, as well as Singapore. These cities are substantially ahead of the others both in the volume of data provided and the degree to which it is structured. The information presented offers insight into a wide areas of city life and administrative details, from the operation of retail facilities and public transport to the development of city infrastructure and environmental conditions.
- Furthermore, the operators of the Beijing and Shanghai open data portals have managed to build the broadest network of data partners, with 115 and 135 data providers respectively (as of January 2025).
- The majority of cities in the ranking has their own dedicated open data portal. However, the portals for Astana, Mumbai, and Delhi are integrated within their respective national data portals. The study presents information on the quantity of data at the country level; city-specific data are not separately highlighted.
- In most cities where open data portals have been created, the websites provide current information and are updated at least once every few months. An exception is Tashkent, where the city portal is still in a testing phase. The lack of current data reduces the reliability and quality of the information provided to the public.

Sources: official open data city portals, the media Data as at January 2025

** - country data are provided, city data are not highlighted*

Smart Lifestyle ranking

No.	City	Score
1	Dubai	53.3
2	London	53.1
	Singapore	53.1
3	Astana	52.6
4	Moscow	52.4
5	Beijing	52.1
6	Abu Dhabi	51.6
7	New York	51.4
8	Shanghai	49.9
9	Istanbul	49.2
10	Riyadh	48.9
11	St. Petersburg	48.0
12	Mumbai	46.6
13	Delhi	44.9
14	Tashkent	42.9

Global capitals (benchmark cities)

Cities under analysis

Methodology

- 20 quantitative and qualitative indicators were collated and presented as a single numerical scale to calculate the Smart Lifestyle rating. For several qualitative criteria instead of a simple "yes" (1 point) and "no" (0 points) scale, a more detailed scale (0–2 points) was used. This allowed for a more accurate assessment of gradations within individual indicators.
- Each of the five groups of indicators was assigned the same weight of 20%. Individual indicators in each group were attributed a certain weight in accordance with their relevance to a particular Smart Lifestyle factor.
- **Groups of analyzed indicators:**

1. **education**, including indicators related to the digitalization of educational services and digital literacy
2. **healthcare**, including the remote receipt of sick leave and medical certificates, online access to medical records, and the availability of telemedicine for city residents
3. **safety**, including the number of traffic monitoring cameras, the traffic fatality rate, and the development of smart security monitoring systems
4. **smart tourism and leisure**, including availability of accommodation facilities and single solutions for access to travel services and city events
5. **telecommunications development level**, including the number of Internet users and free city Wi-Fi access points, Internet speed, and the availability of 5G

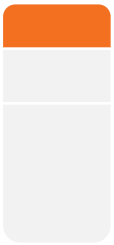
Results

1. The scores of the top six cities fell within a narrow range of 52.1 to 53.3 points. This result is due to these cities having a high penetration of modern technologies in education and healthcare driving strong performance in qualitative criteria. Leadership in specific quantitative metrics pushed these cities to the top. For instance, the development of Dubai's hotel industry secured its lead in the Smart Lifestyle category. Dubai also stands out for its commercial use of 5G networks, high Internet access speeds, and an Internet penetration rate exceeding 93%.
2. Among the benchmark cities, New York's lower score is primarily linked to a relatively lower Internet penetration rate (less than 86%) and incomplete functionality of patient-hospital interaction systems.
3. Unlike CIS cities, where Moscow and Astana lead due to strong qualitative criteria but face limitations in telecommunications and hotel business development, the Middle Eastern cities stand out for their comprehensive development of digital services, higher Internet speeds, and active 5G deployment. Abu Dhabi and Riyadh show strong performance across most criteria: electronic services are implemented in education and healthcare, and up-to-date IT platforms are in place.
4. The weaker results for Tashkent, Delhi, and Mumbai are connected to insufficiently high rates of PC and Internet access among the population, which hinders the development of digital services in other Smart Lifestyle areas.

Education: access to digital solutions

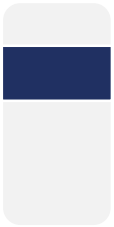
Share of residents using PCs

> 85%



7 out of 15 cities have a PC penetration rate above 85%. In Moscow, Astana, and Istanbul, the share of residents using a PC is slightly above 90%. The benchmark cities – London, New York, and Singapore – have a similar PC penetration level.

< 85%
> 70%



In Beijing and Shanghai, the share of the population using PCs ranges from 70% to 84.99%.

< 70%

In Tashkent, Abu Dhabi, Dubai, Riyadh, as well as in Delhi and Mumbai, the share of the population using a PC is below 70%, which can be assessed as a low level of PC penetration. A relatively small number of PC users can be an obstacle to the development of digital services, including in the fields of education and healthcare.

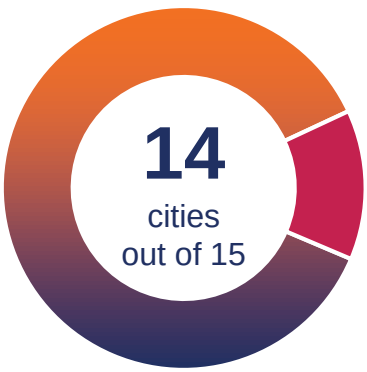
Data on the share of the population using PCs varies by year and coverage. Information for Russian cities (Moscow, St. Petersburg, Kazan) and Tashkent is provided for 2020, with data for Tashkent covering the entire country. Data for Astana, London (covering the entire UK), Istanbul, and Riyadh were updated in 2023. For New York, only data as of 2020 are available.

Some cities provide information on households that own PCs: Singapore (2022), Beijing and Shanghai (2023), Riyadh (2023), Istanbul and Delhi (2024), Mumbai (2019). Abu Dhabi and Dubai provide data as a percentage of Internet users who own a laptop or PC.

Access to online higher education

- All cities have access to online higher education except Tashkent. As in the 2023 ranking, this city still lacks distance education offerings.
- **The absence of remote learning formats for first higher education programs is due to several factors:** a lack of official recognition of the capabilities and quality of distance education compared to in-person formats by authorities, underdeveloped Internet infrastructure, insufficient digital literacy among teaching staff and the population, and the absence of a regulatory framework governing online higher education.
- **Benchmark cities** are among the leaders in providing online education opportunities. Educational institutions in these cities offer study programs across a wide range of disciplines with a focus on both domestic and international students.

Moscow, St. Petersburg, Astana, Abu Dhabi, Delhi



Tashkent

Beijing, Shanghai, Dubai, Istanbul, Riyadh, Mumbai

London, New York, Singapore

Sources: state statistics resources, official city portals, educational portals, university websites, Statista, SW Tenet assessment

Education: schools and kindergartens

53% of cities have an educational platform with extensive functionality

87% of cities provide electronic registration of children to school and kindergarten

City	Single free educational platform		Electronic registration in kindergartens and schools
	wide range of functions	limited functions	
Dubai		☺	☺
Abu Dhabi		☺	☺
Riyadh	☺		☺
Moscow	☺		☺
St. Petersburg		☺	☺
Astana	☺		☺
Tashkent	☺		☺
Beijing	☺		☺
Shanghai	☺		☺
Istanbul	☺		☺
Delhi	☹	☹	☺
Mumbai		☺	☺
London		☺	☺
New York	☺		☺
Singapore		☺	☺
	8 cities	**6 cities**	**13 cities**

Digital education platforms and registration in educational institutions

- **Comprehensive functionality** (more than 5 functions) includes sections for different users. **For teachers**: managing homework, conducting online lessons, recording video lessons, maintaining a class-book and student diaries.
- **For students**: access to online and video lessons, a digital diary, and learning materials. **Functions for parents** include information on their child's academic performance, meals, school events, etc.
- **Limited functionality** (fewer than 5 features) provides access to basic information: grades, attendance, and homework.
- **The most advanced platforms are in Moscow, Beijing, Shanghai, and New York.** In the Chinese cities, the platforms can adapt learning materials to individual student needs, provide feedback from teachers, and use AI to identify students' knowledge gaps and weak points.
- **Beijing Smart Education Platform** (mkzkt.bjedu.cn) provides a comprehensive digital learning system with a full set of educational resources and tools for teachers and students. The platform is integrated with the unified municipal portal Jingxuetong created under the guidance of the Beijing Municipal Education Commission, and provides access to digital textbooks, video lessons, interactive assignments, as well as online learning functions and performance monitoring.
- In **London and Singapore**, schools use platforms from different providers and their functionality varies.
- In most cities, it is possible to register children for kindergarten and school electronically; in **Dubai – only for school**; and in **Delhi – only for kindergarten**.

Sources: official websites of state authorities, official city portals, websites of specialized education digitalization services, Sputnik News, SW Tenet assessment

Education: libraries

Remote access to e-books

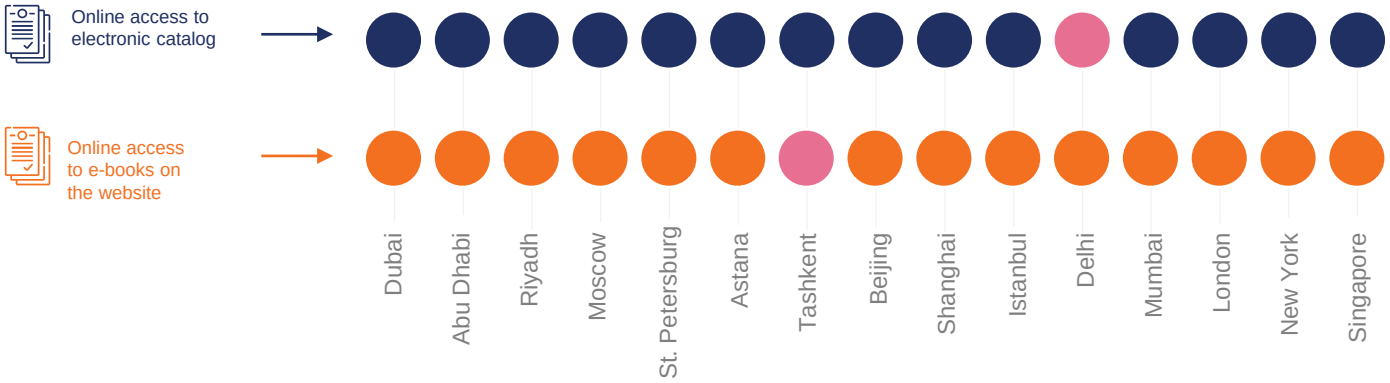
- Online access to electronic library catalogs has been made possible by the digitization of existing library holdings. The creation of digital versions of books and journals has led to the formation of virtual library collections that include books, academic publications, magazines, and articles. This digitization effort has encompassed millions of publications gathered by the world's largest libraries in cities like London, New York, Moscow, and others.
- The libraries of the analyzed cities provide remote access to digitized library stock, digital publications, and scientific publication databases.
- E-books can be accessed using two methods: by downloading an electronic version of a book, or booking and reading e-books online.
- Access to e-books is common in the libraries of all the cities studied.
  In Tashkent, however, only a portion of the library collections have been digitized. The city's libraries currently provide access to digital versions of works by classical Uzbek poets and texts of dissertations defended in Uzbekistan; however, these are not available for remote online access.

Remote access to library electronic catalog

- In Beijing, online access to library collections is provided by the service Reader Cloud, which aggregates state and commercial databases. The service provides access to books, magazines, and audio-visual materials. A similar service exists for Shanghai's digital library.
- Among the cities included in this analysis, library online catalog services are generally well-developed. Delhi is an exception, as the option for remotely reserving physical books from libraries is not currently available.
- An example of successful digitalization in the library sector is Moscow: the city's official portal features a dedicated "Moscow Libraries" section, which provides access to an electronic catalog for all libraries with a booking option in any library.

The websites of benchmark city libraries in the ranking are distinguished by a more convenient interface. Libraries in New York and London provide access to e-books and audiobooks. In addition to the website, the New York Public Library has developed a smartphone app to read books and listen to audiobooks, or to order a virtual library pass to access digital resources and request books/magazines online.

Online functions of libraries



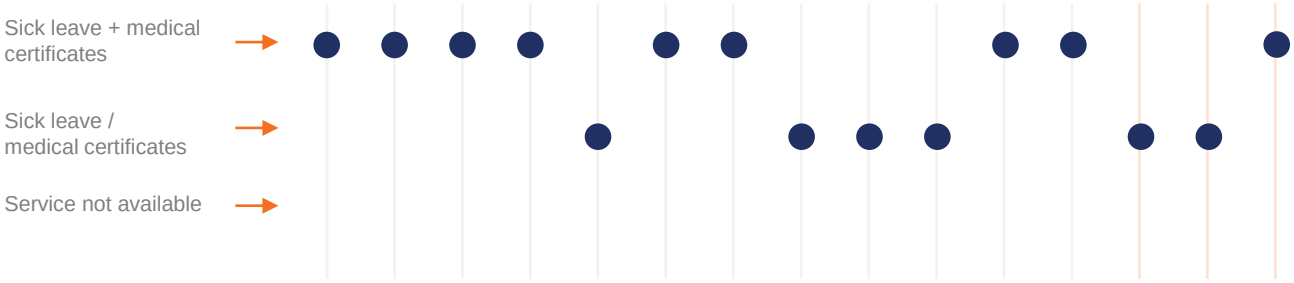
Sources: websites of libraries in the cities under review, official websites of state authorities, official city portals, news websites

Healthcare

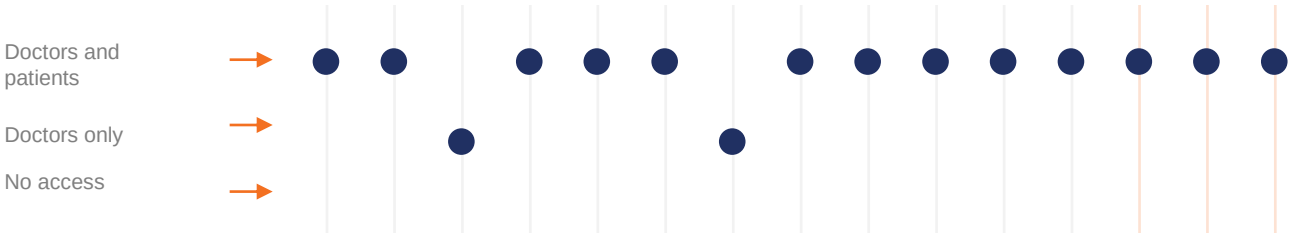
Online sick leaves and medical certificates

** Based on available information from public sources, including official city portals, websites of state authorities, websites of healthcare organizations, the media, etc.*

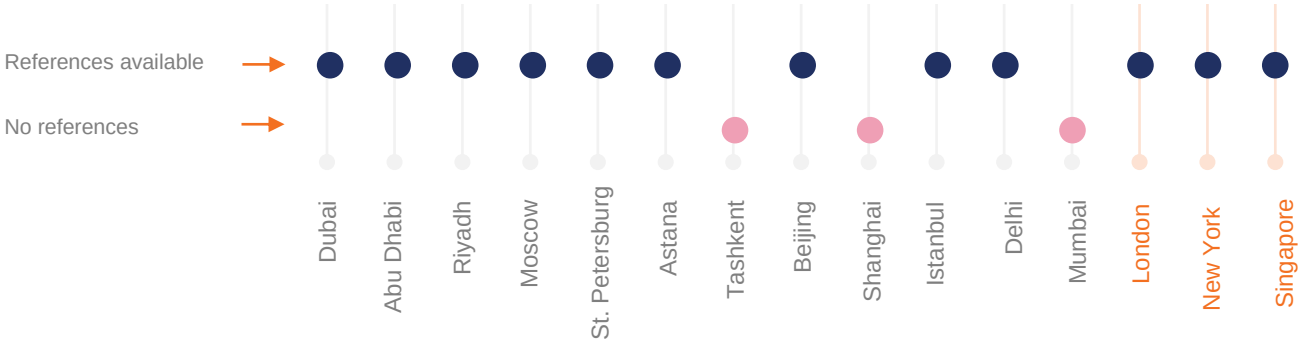
Online sick leaves and medical certificates



Access to electronic health records



References to availability of telemedicine services in public institutions*



Comments

- The cities analyzed are actively digitalizing their healthcare sectors, which increases convenience for patients and improves operational efficiency for healthcare institutions.
- Digital solutions to receive sick leave certificates and medical certificates are being implemented in most of the cities studied. In Moscow, Astana, Tashkent, Dubai, Abu Dhabi, Riyadh, Delhi, and Mumbai, patients can remotely receive a sick leave certificate or a certificate from a medical institution.
- **In 13 out of the 15 cities analyzed, patients have remote access to their medical records.** In **Riyadh** and **Tashkent**, access to medical records is only available to doctors.

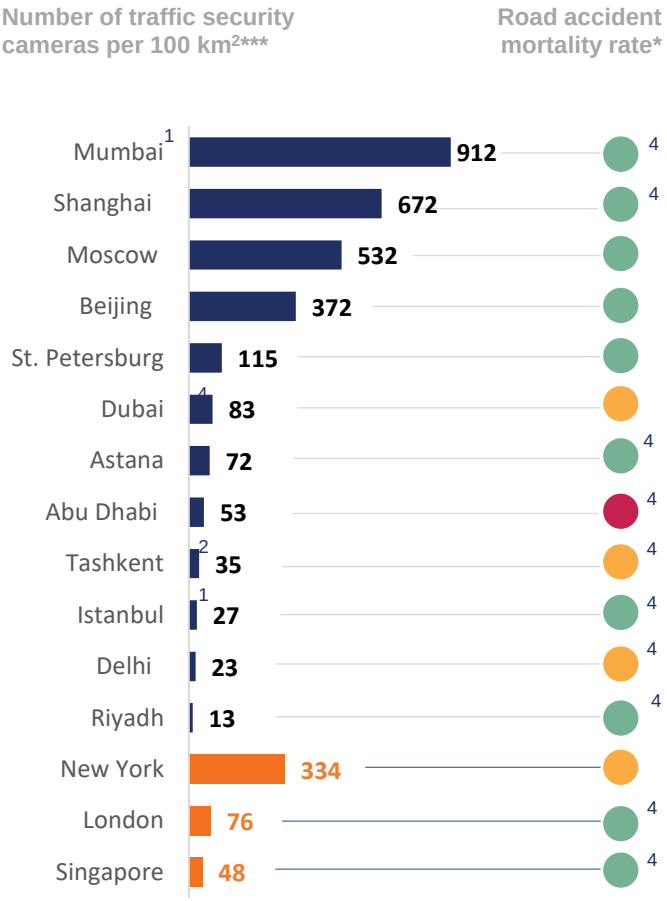
In the benchmark cities, electronic medical records for both patients and doctors have been implemented, and there is the possibility of obtaining sick leave or medical certificates remotely. **The New York City authorities**, in partnership with IBM, are implementing the Watson Health project. This system collects and processes data about the body's functions from various wearable devices, such as smartwatches and fitness trackers. The analysis of this big data helps to improve the efficiency of diagnosis and treatment. In London, healthcare digitalization is taking place as part of the National Health Service's long-term plan. Practical solutions for technology implementation are carried out by DigitalHealth.London, an organization comprising NHS representatives, academics, and technology companies. **Singapore operates the National Electronic Health Record (NEHR) system.** Doctors have access to a patient's medical record, regardless of where the patient was examined or treated. The record includes data from all check-ups, tests, and examinations. In turn, patients can receive messages with information on disease prevention. They can use various applications to undergo rehabilitation, send health updates to their doctors, book appointments, and get diagnoses for certain conditions. These applications for patients and medical organizations are developed by a government IT contractor.

Note: The order of cities on the graphs is based on the development of their smart healthcare systems according to the studied criteria

Sources: WHO, official websites of state authorities, official city portals, the media, SW Tenet assessment

Safety

Road traffic safety



* According to data available in January 2025.

[1] – Data for 2018, [2] – Data for 2021, [3] – Data for 2022, [4] – Data for 2023.

- To reduce the number of traffic accidents, city administrations have long and successfully deployed photo and video surveillance systems to record traffic violations.
- **The highest density of cameras for recording traffic violations relative to the city area is observed in Mumbai, Shanghai and Moscow, the lowest – in Delhi and Riyadh.**
- **A higher number of cameras does not always ensure fewer traffic fatalities:** for example, New York has significantly more cameras than London and Singapore, but traffic fatalities are still higher.
- Reducing road fatalities requires a comprehensive approach. In London, for example, the traffic camera system includes facial recognition technology. There are plans to update these systems with algorithms designed to predict crime in high-crime areas.
- The development of these digital security systems and the installation of cameras often utilize a public-private partnership model. Under this model, private companies handle the installation and operation of the systems, The data captured are provided to the police and emergency services.

Traffic fatalities per 100,000 people:

< 3 people per year

3–6 people per year

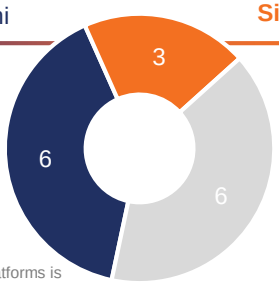
> 6 people per year

City-wide IT platform combining the management of several security monitoring systems**

Comprehensive system

Moscow, St. Petersburg, Astana, Beijing, Abu Dhabi, Delhi

London, New York, Singapore



Separately components of the system:

Mumbai, Shanghai, Dubai, Tashkent, Istanbul, Riyadh

* The proposed classification of platforms is based on information from public sources, including official city portals, state websites, the websites of safe city programs, and the media.

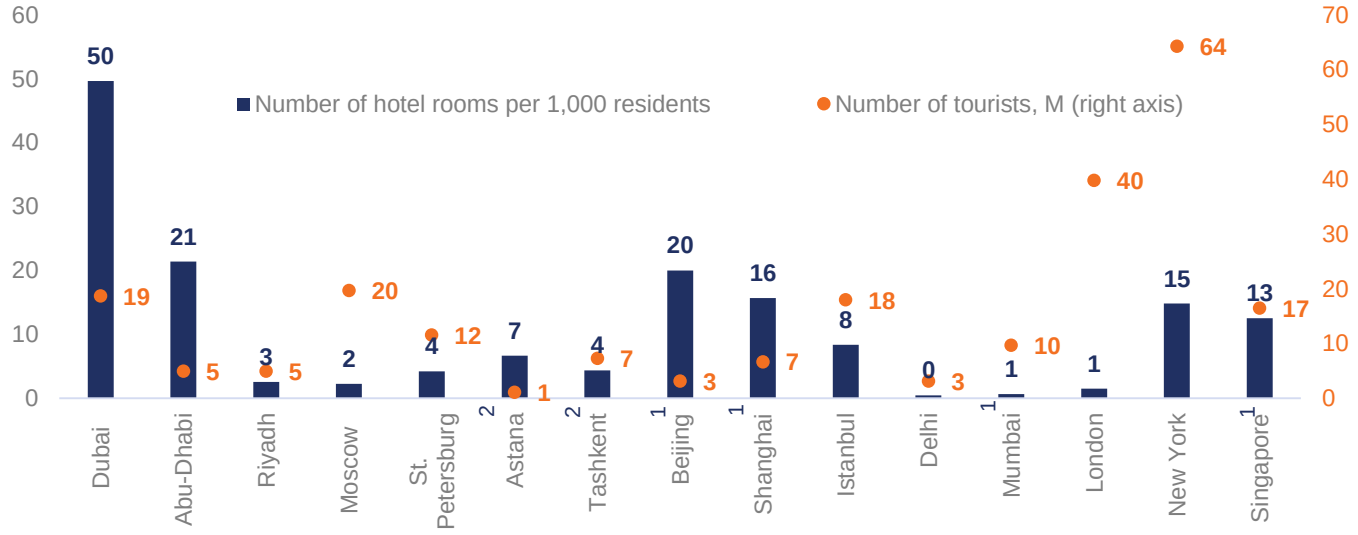
- **A comprehensive IT security system is in use in 6 out of the 12 cities.** The other 6 cities have implemented individual elements of such security systems.
- **All benchmark cities have also implemented and are using comprehensive IT security systems.**
- In Russian cities, the systems are designed to maintain public order, prevent incidents, emergencies, accidents, and threats to the environment. The platforms integrate video surveillance, fire alarm sensors, panic buttons, gas monitoring systems, and more. These security systems use advanced data analysis and object recognition algorithms.

Sources: official state websites, state statistics websites, official city portals, the World Bank, the website of the Russian State Traffic Safety Inspectorate, the media, SW-Tenet assessment

Tourism and leisure

Number of hotel rooms per 1,000 residents*

- **Dubai, Beijing, and Shanghai** are leaders among the analyzed cities in terms of the number of hotel rooms per 1,000 residents. However, in terms of total tourist volume, the Chinese cities outpace Dubai hosting much more tourists. The vast majority (>90%) of this is domestic tourism.
- **The benchmark cities** have between 13 and 15 rooms per 1,000 residents. These cities are visited by a range of 17 million tourists (Singapore) to 40 million (London) and 60 million tourists (New York).
- **Istanbul** follows the three leading cities with 8 hotel rooms per 1,000 residents. It is also one of the most popular tourist destinations, receiving 18 million tourists per year.
- **Moscow and St. Petersburg** are the leaders in tourist numbers among CIS countries, yet their hotel room capacity is relatively low, indicating a potential for further expansion of their room inventory.
- In CIS cities, as well as in Indian cities, the hotel room capacity remains significantly lower. In Astana, this value is 7, in Tashkent – 4, in Mumbai – only 1 room, and in Delhi it is less than 1 room per 1,000 residents. At the same time, the tourist flow in these cities is significantly inferior to the leaders: Astana receives 1 million tourists, Tashkent – 7 million, Delhi – about 2 million tourists, and Mumbai – less than 1 million.

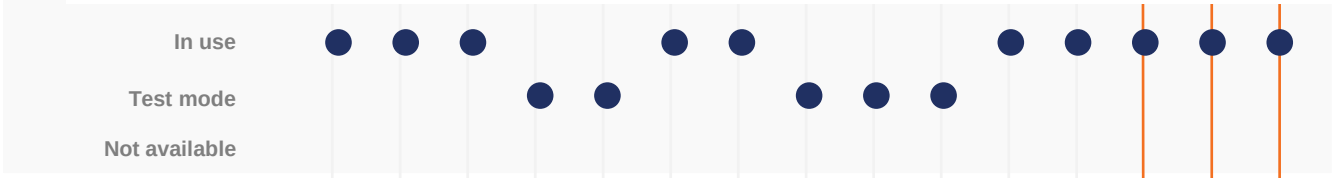


Tourism and leisure solutions

** As of 2024, Number of hotel rooms as of: 1 2023 г.; 2 2022 г.*

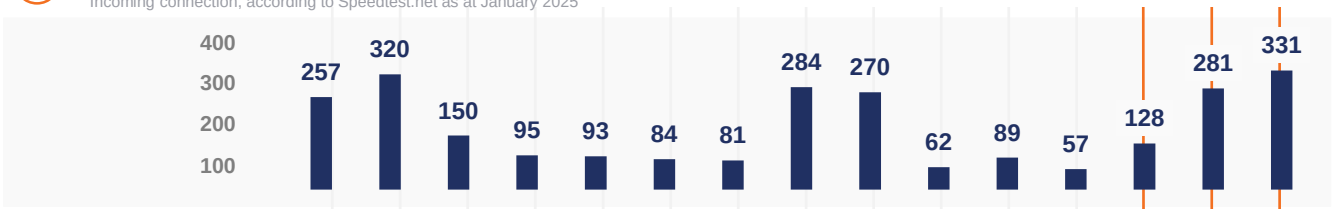
Telecommunications development level

5G networks*



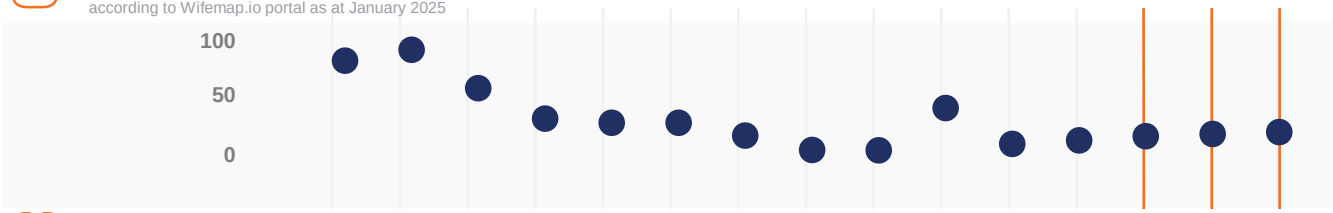
Average fixed speed, Mbit/s*

Incoming connection, according to Speedtest.net as at January 2025

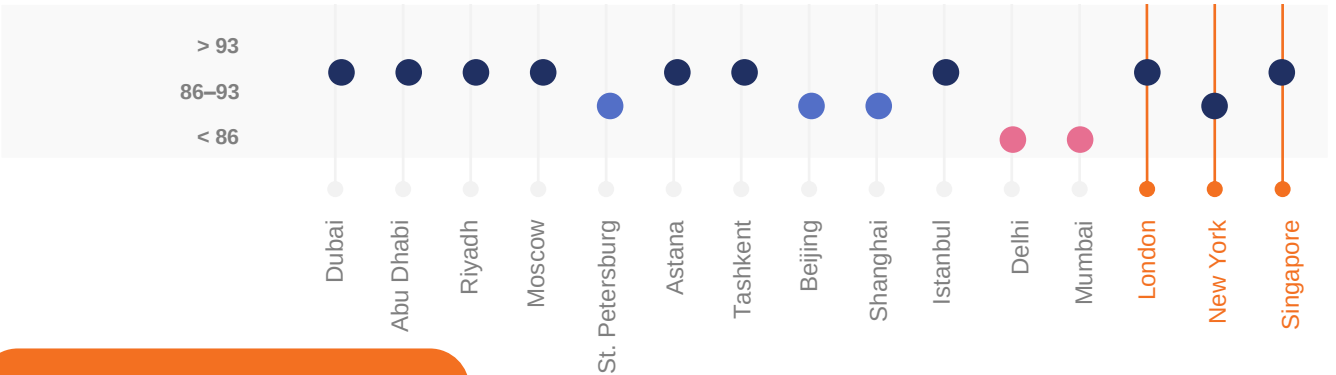


Free Wi-Fi access points per 10,000 residents*

according to Wifemap.io portal as as at January 2025



Internet coverage (users per 100 residents)*



Comments

- In almost all the cities analyzed, the number of Internet users per 100 residents exceeds 90. The lowest number of Internet users is in Mumbai, with 58 users per 100 residents. Among the benchmark cities, only New York (87 users) has fewer than 90 users per 100 residents. This level of Internet penetration indicates a lack of infrastructural barriers to the use of digital services by residents in the cities studied.
- Most cities provide an Internet access speed of around 100 Mbps. The exceptions are Istanbul (62 Mbps) and Mumbai (57 Mbps), where speeds are significantly lower. In the benchmark cities, Internet access speed is above 100 Mbps, with Singapore providing the highest speed in the entire selection at 331 Mbps.
- Abu Dhabi leads with the highest number of public Wi-Fi access points (87 points per 10,000 residents), while Beijing and Shanghai show extremely low results (1.16 and 0.92, respectively). Most European and Asian cities, including Moscow and Istanbul, have a moderate Wi-Fi availability. Mumbai and Tashkent have a limited number of access points, reflecting underdeveloped infrastructure.
- Full-scale 5G network deployment is noted in 10 out of the 15 cities. 5G networks are used in all benchmark cities.

* According to data available in January 2025.

Sources: official websites of government authorities, websites of state statistics, official city portals, mass media, SW Tenet assessment.

Smart Transport ranking

No.	City	Score
1	Shanghai	55.1
2	Beijing	54.7
3	New York	53.9
4	St. Petersburg	53.6
5	London	53.3
6	Singapore	53.1
7	Moscow	52.9
8	Dubai	50.1
9	Riyadh	49.7
10	Astana	48.6
11	Istanbul	47.6
12	Abu Dhabi	47.1
13	Tashkent	44.3
14	Delhi	44.0
15	Mumbai	41.9

Global capitals (benchmark cities)

Cities under analysis

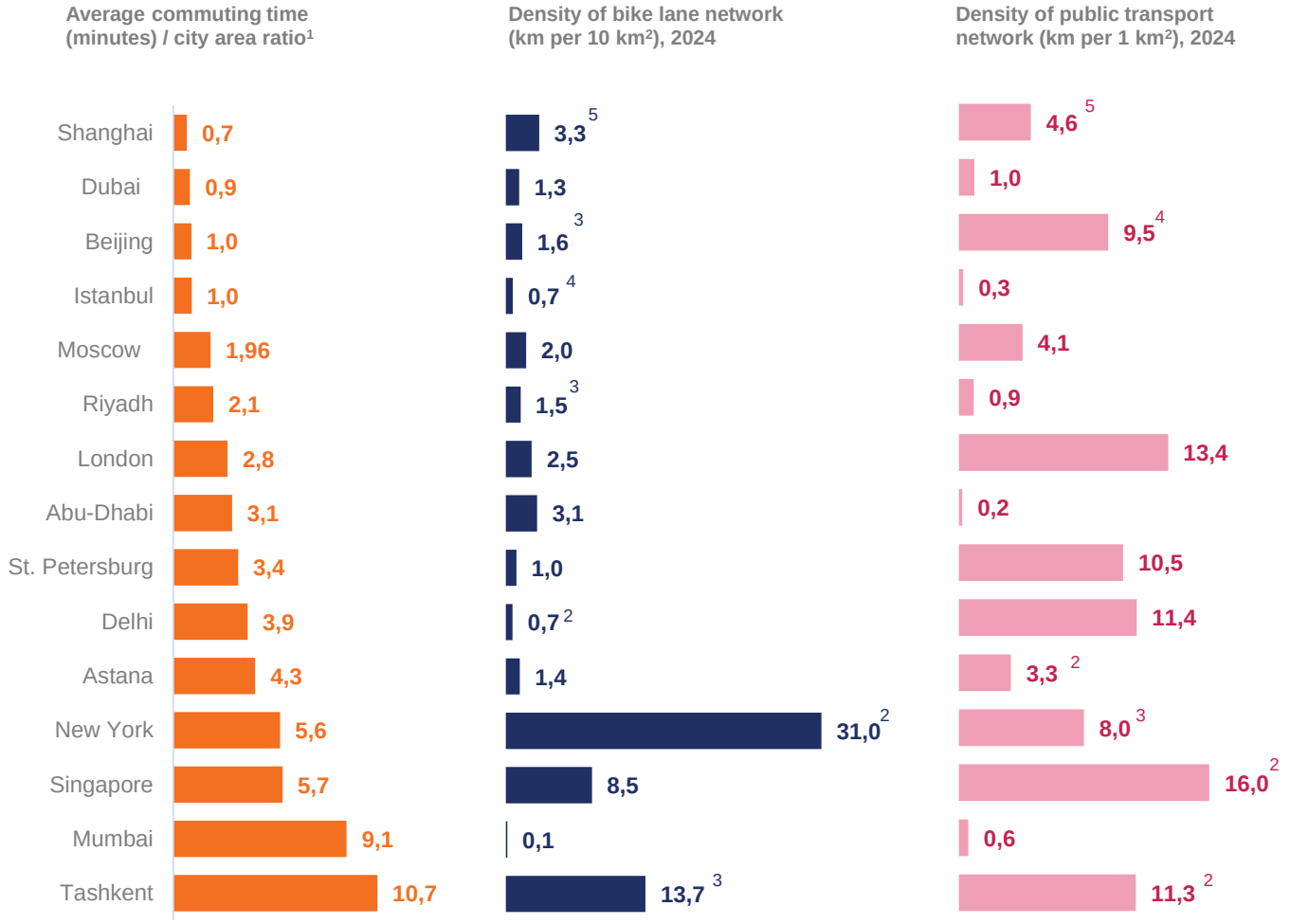
Methodology

- **16 quantitative and qualitative indicators were collated and presented as a single numerical scale to calculate the Smart Transport rating.** For a number of qualitative criteria, instead of a simple "yes" (1 point) and "no" (0 points) grading, a more detailed scale was used (from 0 to 2-3 points). This allowed for a better assessment of the development level / adoption of certain technologies.
- **Each indicator was assigned a certain weight**, in accordance with its significance for the smart transport system, and to take account of the number of indicators in a particular group representing a separate driver for the transport system development
- **Groups of analyzed indicators with their weights in the ranking are given below:**
  - quality of transport infrastructure: density of public transport routes and bike lanes, time to work / city area ratio – **30%**
  - number of vehicles available for short-term rent (bikes, electric scooters, car sharing) – **15%**
  - use of electric vehicles and the development level of charging infrastructure – **10%**
  - availability and facilities for toll parking – **15%**
  - use of technology to develop the transport system (smart traffic lights and transport sensors) – **15%**
  - development level of technology ensuring convenience of public transport, including availability of a single transport payment system – **15%**

Results

1. Shanghai and Beijing take the leading positions in the Smart Transport ranking. The leadership of these Chinese cities is largely due to their high level of electric transport development, the penetration of smart technologies into the transport system, and their developed public transport infrastructure.
2. St. Petersburg and Moscow are leaders among CIS cities, ranking 4th and 7th respectively. Their high positions are due to the successful implementation of intelligent transport systems, the development of short-term transport rental services, and effective urban mobility management. St. Petersburg improved its position compared to the previous ranking thanks to the expansion of its public transport network and an increase in available micromobility vehicles, primarily electric scooters. The lower rankings of Tashkent, Delhi, and Mumbai are due to underdeveloped short-term rental services, insufficient infrastructure, and outdated technologies.
3. Benchmark cities demonstrate a high level of smart transport development. New York's leadership in the ranking is mainly due to its highly developed transport infrastructure, including an extensive network of bicycle lanes, as well as a large number of electric vehicles and one of the world's most developed EV charging infrastructures. Singapore stands out for having the highest density of public transport routes and a well-developed EV infrastructure, achieved against a backdrop of restrictive policies for private car ownership.

Quality of physical infrastructure



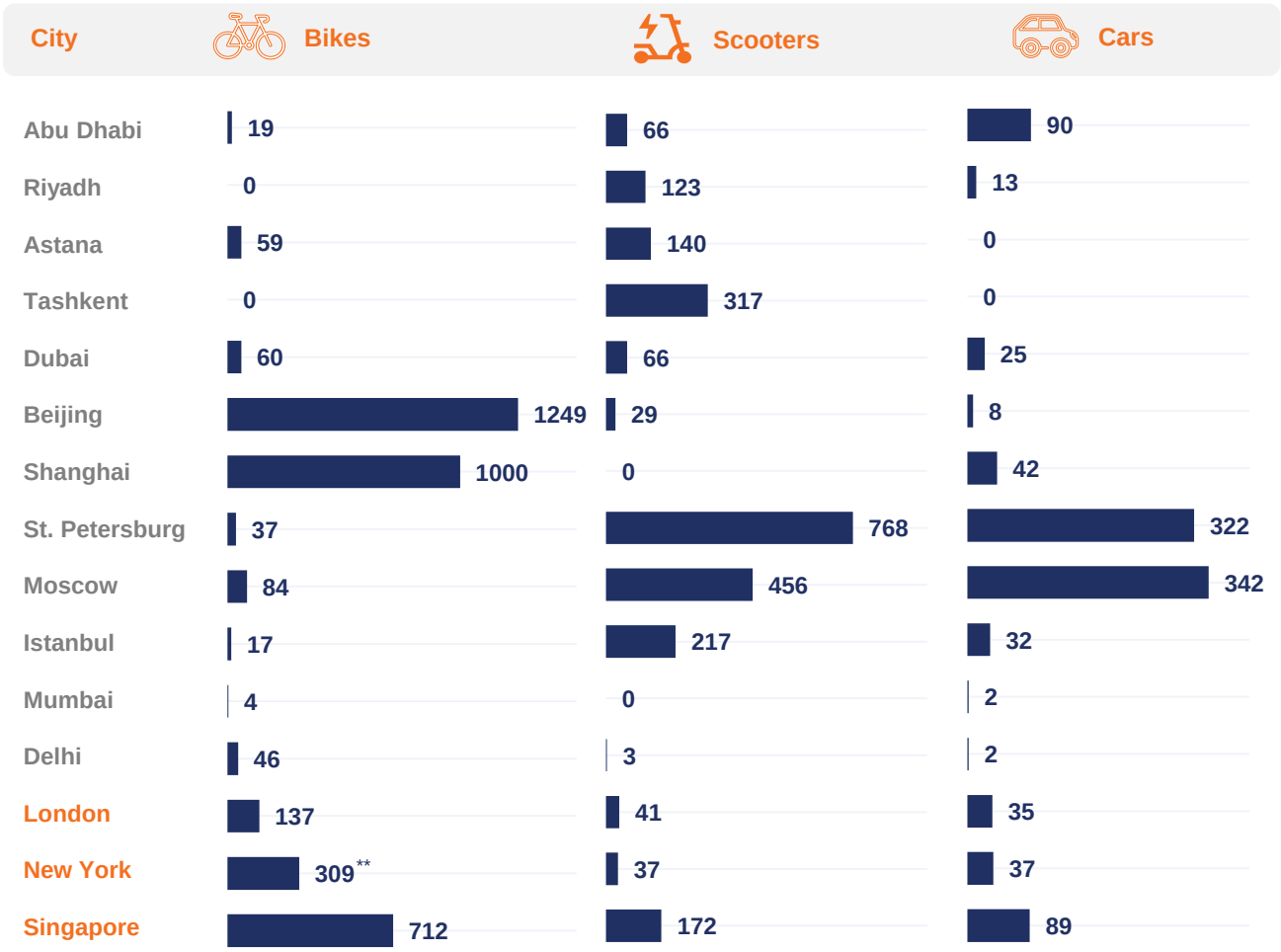
- The development of transport infrastructure in modern metropolises is focused on reducing commute times for residents. To achieve this, city authorities are expanding public transport networks and promoting "last-mile" micromobility solutions to decrease private car usage and reduce road congestion.
- Among the analyzed cities, public transport route density ranges from 0.27 km/km² in Istanbul to 16.02 km/km² in Singapore. London (13.38 km/km²) and New York (7.99 km/km²) combine high density with multimodality; in addition to traditional public transport the cities actively use ferries. Ferries also play a significant role in Istanbul's urban transport system.
- Travel time relative to city area is lowest in Istanbul (0.98), Beijing (0.95), and Shanghai (0.72), while the highest values are observed in Mumbai (9.09) and Tashkent (10.7). In Moscow, the ratio of average travel time to city area is 1.96, reflecting efficient transport organization, partly due to the adoption of intelligent traffic management systems.
- Tashkent leads in bike lane density among the analyzed cities, with 14 lanes per 10 km². Among benchmark cities, New York leads with 31 km of bike lanes per 10 km², followed by Singapore with 8.46 km per 10 km². CIS cities (except Tashkent) have values below 3 km per 10 km². Istanbul has a bike lane network density of 0.7 km per 10 km², while Mumbai has 0.15 km per 10 km² with lanes of fragmented nature.

[1] *According to Numbeo.com users survey in January 2025*
[2] *Data for 2022,* [3] *Data for 2023*
[4] *Data on the length of bus lines for 2022, underground – 2024*
[5] *Data for 2021*

Sources: official websites of state authorities and passenger traffic operators, official city portals, the media, Numbeo.com, CityTransitData.

Vehicle short-term rental services

Number of rental vehicles per 100,000 residents*



- The development of micromobility is a key factor in improving "last-mile" transport accessibility for residents of major cities.
- This growth is due to collaboration between city administrations and businesses. The authorities are responsible for developing the necessary infrastructure, such as bike lanes, parking areas, and charging stations, and the legal framework. Businesses, in turn, build the fleet of vehicles and ensure it meets all safety requirements. As a result, most cities have seen significant growth in micromobility and car-sharing services.
- Moscow and St. Petersburg are the leaders in the adoption of short-term rental vehicles, outpacing other cities in the number of shared cars and electric scooters per 100,000 residents. However, Beijing and Shanghai lead by a wide margin in the number of bike fleet, a direct result of their large-scale government programs for developing cycling infrastructure.
- Overall, in most cities, including the benchmark cities, the short-term rental market is not very well developed. The number of vehicles available for rent per 100,000 residents is significantly lower than in Russian cities. This relatively low level of adoption is primarily due to specific consumer preferences in these locations and a high rate of personal car ownership, which makes sharing services less in demand.

** According to the latest data available in January 2025.*
*** Data on the number of short-term rented bikes in New York per 100,000 residents also include Jersey City and Hoboken because of a single rental system.*

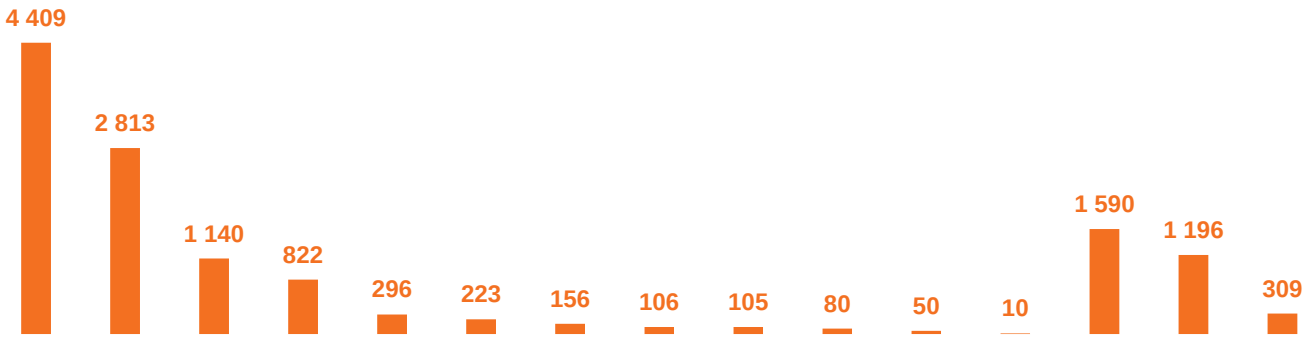
Sources: official websites and rental services mobile apps, the media

Use of electric cars

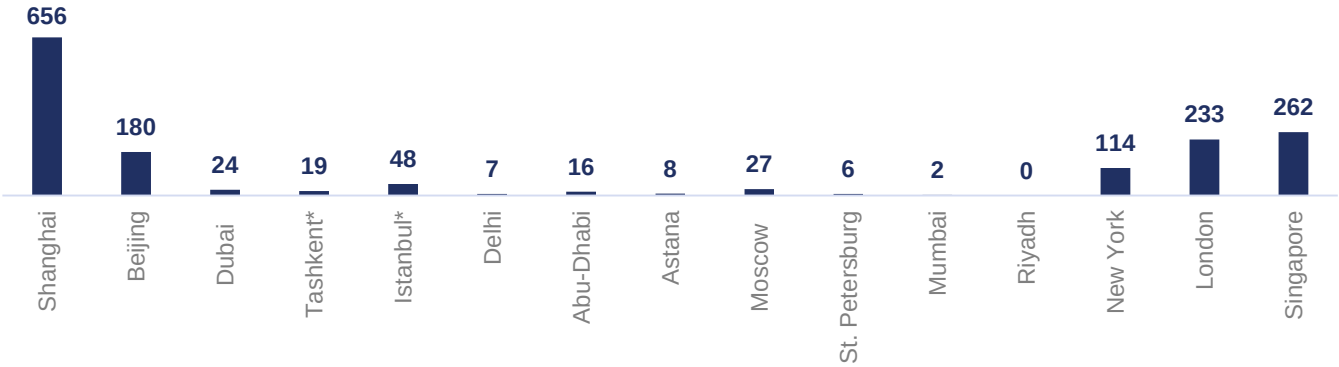
Electric vehicle penetration

- The gradual increase in the number of electric vehicles globally and in the benchmark cities results from measures aimed at reducing CO_2 emissions and replacing internal combustion engine vehicles with electric alternatives. All countries where the analyzed cities are located have implemented support measures for EV buyers, as well as incentives to encourage the production of electric vehicles.
- Beijing and Shanghai are the clear leaders in electric vehicle adoption, including per 100,000 residents. This leadership stems from the Chinese government's policies to improve the country's environmental conditions and support the industry. Incentives include benefits for both EV buyers and manufacturers, such as tax reductions and sales subsidies. At the same time, China is actively developing its electric vehicle infrastructure.
- **Singapore shows the most impressive growth rate in EV adoption among benchmark cities**. In Q1 2025, electric vehicles accounted for 40.2% of all newly registered cars. The share was 33.6% in 2024 and 18.1% in 2023. Fully electric cars make up 24% of new registrations in London, exceeding the UK national average of 19.6%. In New York, significant growth in EV numbers is driven by the expansion of charging infrastructure across the city.
- **Among CIS cities, Tashkent is the leader,** which is attributed to close cooperation with China and imports of electric vehicles from there. Dubai's strong performance results from implementing its Net-Zero 2050 strategy and partnerships with electric vehicle manufacturers from the USA.

Number of EVs per 100,000 residents
(according the latest data available as of January 2025)



Number of EV charging stations per 100,000 residents
(according the latest data available as of January 2025)



- Sufficient charging infrastructure is one of the key factors driving electric vehicle adoption. In recent years, the development of charging networks has become a priority for both city authorities and EV manufacturers. As a result, the expansion of charging infrastructure is keeping pace with the growth of the EV fleet.
- The leaders in charging network development are Beijing and Shanghai, as well as benchmark cities, which is an expected consequence of the higher penetration of electric vehicles in these areas.

** Data on the number of electric vehicles is unavailable for these cities. The study uses approximate estimates based on an analysis by SW Tenet. The estimates are based on the number of cars in the country and the charging stations in the country vs the city ratio.*

Sources: official statistics databases, official websites and mobile applications of electric charging station operators, the media, SW Tenet assessment

City parking services

Introduction of parking services

City	Paid parking	Online parking payment	Platforms or apps showing available car park spaces
Abu Dhabi	✓	○	✗
Riyadh	✓	✓	✓
Astana	✓	✓	○
Tashkent	✗	✗	✗
Dubai	✓	✓	✓
Beijing	✓	✓	✓
Shanghai	✓	✓	✓
St. Petersburg	✓	✓	✓
Moscow	✓	✓	✓
Istanbul	✓	✓	✓
Mumbai	✓	✗	○
Delhi	✓	✗	○
London	✓	✓	✓
New York	✓	✓	✓
Singapore	✓	✓	✓

✓ - available ○ - not fully available ✗ - unavailable

- Paid municipal parking has been implemented in almost all analyzed cities, with the exception of Tashkent, where it is still in the planning stage. Among the CIS cities, paid parking systems are actively developing with Moscow, St. Petersburg, and Astana already having fully operational systems.
- Among benchmark cities, London, New York, and Singapore demonstrate a high level of development in paid parking facilities, which is natural for large metropolitan areas with high population density and intense traffic.
- Asian cities such as Beijing, Shanghai, Istanbul, and Dubai have also implemented paid parking systems, reflecting a global trend toward urban traffic regulation and encouraging public transport use. Mumbai also has paid parking, though its implementation faces challenges due to high population density and limited space.
- Most cities analyzed offer electronic parking payment options through mobile apps.
- Benchmark cities show a high degree of digitalization in parking services: London, New York, and Singapore have advanced mobile payment systems and dedicated apps.
- Among Asian cities, Beijing, Shanghai, and Istanbul stand out for their modern digital payment solutions. Dubai uses a mobile app for parking payments. Mumbai lags in this aspect, lacking centralized solutions for electronic parking payments.

Sources: official city parking websites, paid parking applications, the media

Public transport

Technological advancement in urban transport

Single transport payment system

100% **of cities**

- A unified fare payment system has been implemented in all analyzed cities.
- In Russian and CIS cities, fare payment cards have been introduced. Some cities use branded cards, such as Moscow's Troika or Riyadh's Darb Card. In other cities, unbranded cards are used. In all cases, these cards allow payment across various modes of transport within the respective city.
- In Asian cities – Beijing (Beijing Pass and Vikalongi), Shanghai (Shanghai Public Transportation Card), Mumbai (NCMC Card), Istanbul (Istanbul Kart), and Dubai (NOL Card) – advanced smart card systems have been implemented that can be used not only for transportation but also for parking, taxis, entry to parks and museums, and shopping.
- Benchmark cities demonstrate a high level of payment system integration: London uses the Oyster card, New York – OMNY, and Singapore – EZ-Link. These systems enable payment in all types of public transport.

Public transport tracking

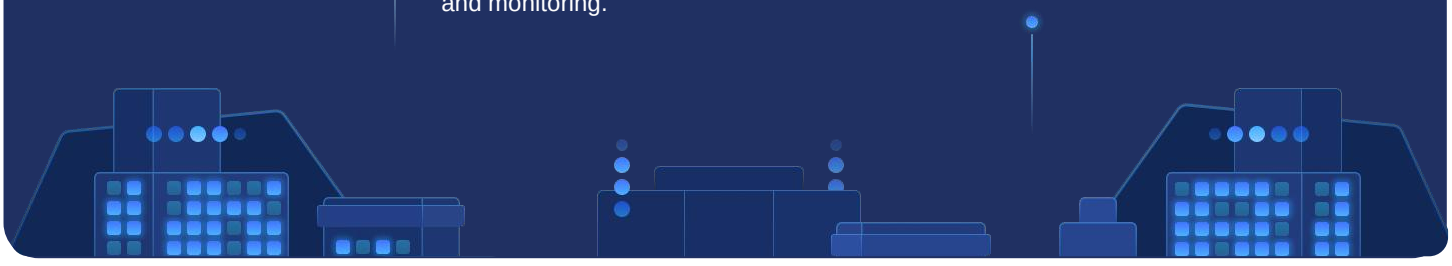
100% **of cities**

- Real-time public transport tracking is available in all analyzed cities. This capability results from collaboration between city administrations, public transport operators, and IT services such as Yandex Maps or Google.
- Benchmark cities – London, New York, and Singapore – offer advanced transport monitoring systems through dedicated apps and web services. Real-time tracking is available in Singapore (via SGBus), New York (via MTA Bus Time), and Beijing (via Baidu Maps). Dubai is currently implementing GPS trackers on its buses.

Online payment for public transport services

93% **of cities**

- Online public transport payment options (via bank card or QR code) are available in all analyzed cities except Delhi.
- Benchmark cities – London, New York, and Singapore – offer advanced electronic payment systems, including mobile apps and contactless payment methods.
- Among CIS cities, Moscow and St. Petersburg lead with a wide range of online payment services. Moscow stands out in particular, having implemented innovative payment methods such as the FacePay biometric system.
- In Asia, Beijing and Shanghai offer solutions integrated with popular payment platforms like Alipay and WeChat. Istanbul and Dubai are also actively developing digital payment methods, including QR codes and mobile apps.
- Even in cities with less developed infrastructure, such as Tashkent, modern online payment systems are being introduced. This functionality is essential both for passenger convenience and for improving public transport management through passenger counting and monitoring.



Sources: official websites of state authorities and passenger traffic operators, official city portals, single transport cards websites, the media, Yandex Maps

Transport system technologies

Sensors in vehicles to calculate passenger traffic or pay for travel

- Sensors in public transport are used for automated passenger counting, which helps determine route congestion and optimize the number of vehicles deployed. Ultimately, the use of sensors allows municipalities to optimize spending on maintaining and developing urban public transport networks while improving passenger service quality. An additional benefit is the ability to identify fare evaders.
- **Among CIS cities, Moscow is a leader in the installation of passenger flow sensors,** with sensors installed in buses and metro systems integrated with payment systems. St. Petersburg is also at the top, having implemented passenger counters in buses. The data is used to optimize routes.
- **Among benchmark cities, London is implementing passenger flow analysis systems in its underground, with plans to expand to buses.** New York uses the MTA app to display real-time bus occupancy. Singapore has been testing and expanding mobile app functionality for passenger counting since 2022.
- **Among Asian cities, Beijing stands out with a passenger counting system that has been in place since 2016.** In Shanghai, solutions have been partially implemented on key routes. Dubai is automating passenger counting, including for fare evasion prevention. In Istanbul, private developments had not yet been integrated into the city's transport system by 2025. In Mumbai, despite modernization plans, public transport still lacks passenger flow analysis tools.

Sensors in public transport

Implemented

Moscow, St. Petersburg, Astana, Beijing, Shanghai, Dubai, Abu Dhabi, Riyadh **London, New York, Singapore**

Not available

Tashkent, Istanbul, Mumbai, Delhi

Smart traffic lights

Introduced

Moscow
St. Petersburg
Astana
Beijing
Shanghai

Abu Dhabi
Dubai
Riyadh
London
New York
Singapore

Planned

Tashkent
Istanbul

Mumbai
Delhi

- Smart traffic lights automatically regulate traffic flow by analyzing real-time road congestion data. Their use improves traffic speed, reduces travel time for drivers and passengers, lowers CO_2 emissions, and decreases vehicle wear and tear.
- Cities in Russia and the CIS are implementing smart traffic lights, including those using AI to adapt signals to real-time traffic conditions. In Tashkent, however, deployment remains limited to pilot projects.
- Beijing, Shanghai, and Dubai are actively integrating AI into traffic light management, while Mumbai has delayed implementation despite ambitious plans.
- All benchmark cities use intelligent systems to prioritize transport.
- New York has implemented the Midtown in Motion system, which analyzes traffic data and adjusts traffic lights to reduce the number of vehicles.
- London uses the SCOOT (Split Cycle Offset Optimization Technique) system for both vehicles and pedestrians. Its implementation has reduced travel times by 12–15%.
- In Singapore, the Land Transport Authority (LTA) is deploying intelligent traffic management systems. The CRUISE system collects and analyzes information from various sources: traffic sensors, GPS data, and weather conditions. This data are used to calculate optimal traffic light timing and adjust signal duration in real time based on changing traffic conditions. According to LTA estimates, the CRUISE system helps reduce road congestion by up to 30%. LTA developments now serve as a model for other cities around the world.

Sources: official websites of state authorities, the media

Smart Business and Employment ranking

No.	City	Score
1	Singapore	58,6
2	New York	57,7
3	Beijing	57,5
4	Moscow	57,1
5	Shanghai	56,3
6	St. Petersburg	55,2
7	London	53,8
8	Astana	49,7
9	Dubai	48,3
10	Delhi	47,8
11	Riyadh	43,9
	Abu Dhabi	43,9
12	Istanbul	43,0
13	Tashkent	39,8
14	Mumbai	37,4

Global capitals (benchmark cities)

Cities under analysis

Methodology

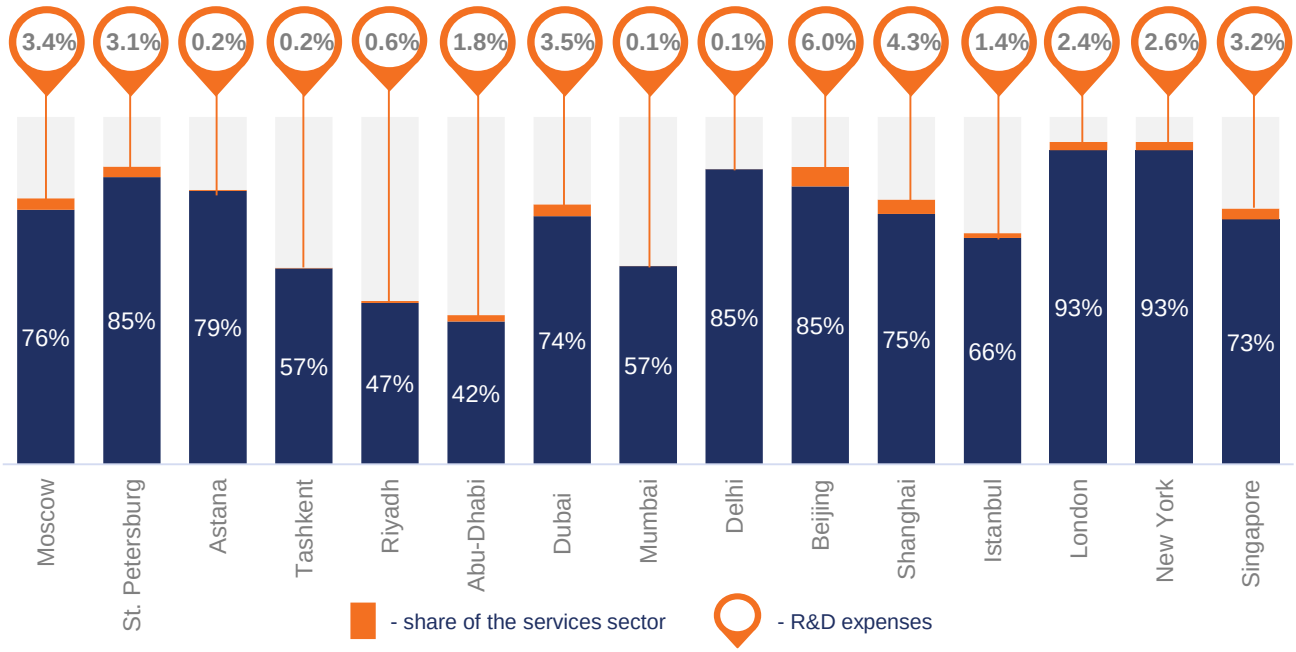
- 10 quantitative and qualitative indicators were collated and presented as a single numerical scale to calculate the Smart Business and Employment rating. For several qualitative criteria instead of a simple "yes" (1 point) and "no" (0 points) scale, a more detailed scale (0–2 points) was used. This allowed for a more accurate assessment of gradations within individual indicators.
- Each of the four groups of indicators was assigned the same weight of 25%. Individual indicators were scored in the groups in accordance with their significance under individual factors.
- **Groups of analyzed indicators:**
  - I. **City economics** including estimations of R&D costs, the share of the services sector in the gross regional product (GRP) of the city, and the number of international conferences
  - II. **E-services for business and employment** including the option to start a business and obtain an electronic construction permit, or be hired to a position via an official electronic job center
  - III. **Innovation in trade** including the development of delivery robots for goods and smart stores
  - IV. **Equality and inclusion** including analyzing gaps in the level of employment between men and women and accessibility for the disabled

Results

- **New York ranked first in the Smart Business and Employment category** due to its high level of digitalization in business and administration interactions, the dominance of the services sector in its economy, and its large number of international conferences. Areas for further development include reducing the employment gap between men and women and transitioning to permanent use of robotic delivery services following successful trials across the city.
- **Beijing ranked second** in this category, leading among BRICS+ and CIS cities thanks to the highest level of R&D expenditure. However, the city's poor accessibility for people with reduced mobility is its weak point preventing it from taking the top place despite high scores in other criteria.
- **Moscow is the leader among CIS cities.** It received high scores across all criteria except for the number of international conferences.
- **Benchmark cities demonstrated similar levels of smart technology adoption** in business and employment. Differences in rankings were primarily due to quantitative criteria. Singapore was the absolute leader in the number of international conferences, doubling the figures of London and New York. London’s weaknesses included the lack of an online business registration system and limited job opportunities through the city’s employment exchange.
- Cities scoring below 50 points showed low levels of digitalization in business and employment services, as well as limited urban accessibility for people with reduced mobility. Improving their positions will require increased investment in R&D and a greater role for the services sector in their economies.

City economics

Share of the services sector and R&D expenses in the city economy



- The services sector is a key driver of urban economic development, reflecting modern economic trends: shifting manufacturing outside metropolitan areas, the growing importance of R&D, increased management complexity, and rising demand for various services among populations in large cities.
- To assess the role of the services sector in urban economies, we used the indicator of the sector's share in the gross regional product (GRP), an aggregate indicator of the economic activity of the region, reflecting the total production of goods and services for end use.
- In most cities, the services sector accounts for more than half of the urban economy, while in seven cities, two-thirds of economic activity is generated by services. The largest contributors to the services sector typically include trade, real estate operations, information and telecommunications, transport, and management services.
- The benchmark cities, London and New York, are leaders in the share of the services sector, with over 90% of economic activity stemming from services.
- The lowest penetration of the services sector is observed in Abu Dhabi and Riyadh, which is attributed to the dominance of industrial sectors in these cities' economies.

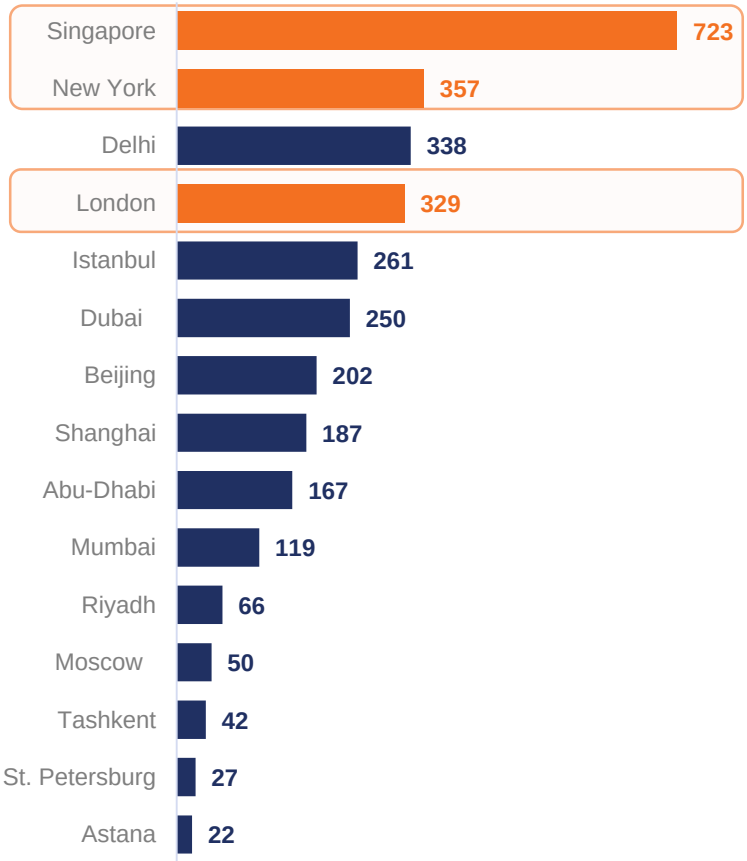
Data on the services sector share are provided for 2023. For Moscow, St. Petersburg, and London, 2022 data were used.

- R&D expenditure reflects the commitment of city and national authorities to advancing both fundamental science and applied innovations. Such investments enhance cities' competitiveness in the modern economy and their appeal to businesses and human capital. Many city administrations aim to increase R&D spending to 5–6% of their GRP.
- In most cities analyzed, R&D is focused on the IT sector, biotechnology, medical technology, advanced materials research, optics, and transportation technologies.
- Beijing stands out, with R&D efforts extending to space exploration, Arctic research, and deep-sea studies. Beijing also has the highest R&D expenditure among the cities analyzed – 6% of GRP.

The services sector includes: wholesale and retail; repair of motor vehicles; transportation and storage; accommodation and food services; information and communications; finance and insurance; real estate operations; professional, scientific, and technical activities; administrative services; public administration, defense and social security; education; healthcare and social work; arts, entertainment and recreation; and other services. Data for Tashkent reflects figures for Uzbekistan. For Moscow, St. Petersburg, Tashkent, London, and Mumbai, 2022 data were used; for New York, 2020 data were used; for all other cities, 2023 data were used.

City economics

Number of international conferences



- Conferences remain one of the primary tools for developing business relationships, including at the international level. The number of international conferences hosted by a city is an indicator of its commitment to fostering global connections and building a favorable reputation in the media and among existing and potential partners.
- Among the cities studied, the highest number of international conferences for knowledge exchange and business networking between February and April 2025 are planned in Delhi, Istanbul, Dubai, and Beijing, according to data from one of the largest aggregator portals for international conferences, allconferencealert.com.
- Benchmark cities outperform others in the sample in terms of the number of conferences hosted. Singapore remains the absolute leader, as in previous rankings, with 723 events scheduled.
- CIS cities host relatively few international conferences. Moscow leads in this category among CIS cities with 50 events to be held.
- IT remains the most prominent subject for international conferences. However, the range of events covers a wide variety of topics, from nanotechnology and microelectronics to agriculture and mineral extraction.

Number of international conferences from February to April 2025, according to allconferencealert.com and worldexpo.pro

The most popular subjects of international conferences

Information technologies

- Artificial intelligence and machine learning
- Big data
- Data transfer technologies
- Cyber security
- Robotics
- Microelectronics
- Data management
- Internet of things

Engineering and modern materials

- Modern Materials
- Construction technologies
- Nanotechnologies

Biology and medicine

- Biotechnology
- Medicine and pharmaceuticals
- Modern agriculture

Business and management

- Transport & logistics
- Fintech
- Social innovation

Energy sector

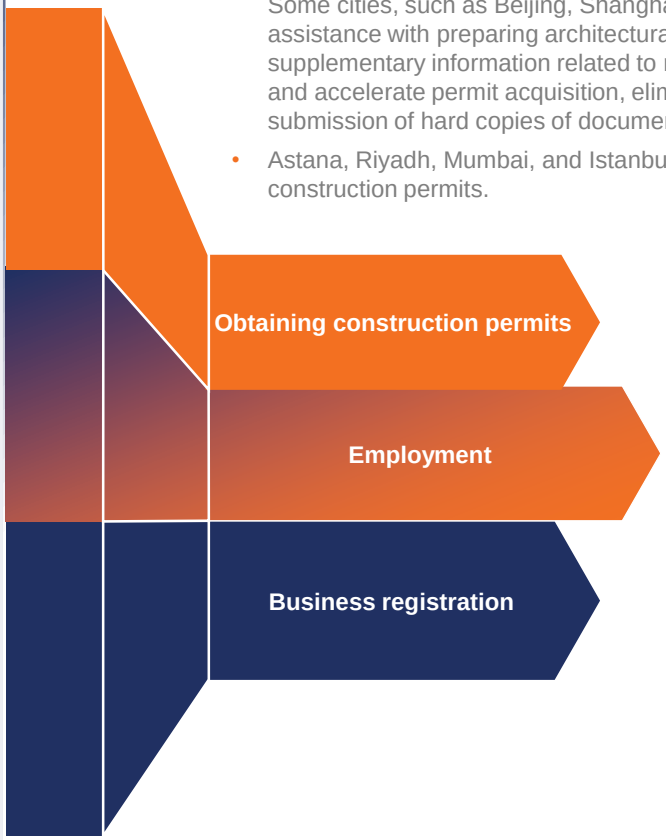
- Renewable energy sources
- Power transmission
- Oil and gas refining

Sources: official statistics databases, EMISS (Unified Interdepartmental Statistical Information System), worldexpo.pro, allconferencealert.com, World Bank, Statista, the media

Digital services for business and employment

Obtaining construction permits through the city's electronic resources

- 11 out of the 15 cities, including 3 benchmark cities, support the process of project documentation approval and enable receiving an electronic construction permit.
- This typically takes the form of detailed step-by-step guidelines for completing the required procedures. Some cities, such as Beijing, Shanghai, Moscow, and St. Petersburg, offer additional services, including assistance with preparing architectural and construction plans, estimated processing timelines, and other supplementary information related to receiving construction permit. These features significantly streamline and accelerate permit acquisition, eliminating the need for in-person visits to various agencies or submission of hard copies of documents.
- Astana, Riyadh, Mumbai, and Istanbul currently lack a dedicated online municipal service for obtaining construction permits.



Employment through the official state electronic job center

- All cities analyzed offer job search services through digital platforms. In nine cities, this service is provided via the city's portal, while in other six – through a national-level service.
- In addition to direct employment, these portals offer supplementary services related to job search and employment, including career counseling, professional aptitude testing, various courses and training programs, and information on social support measures.

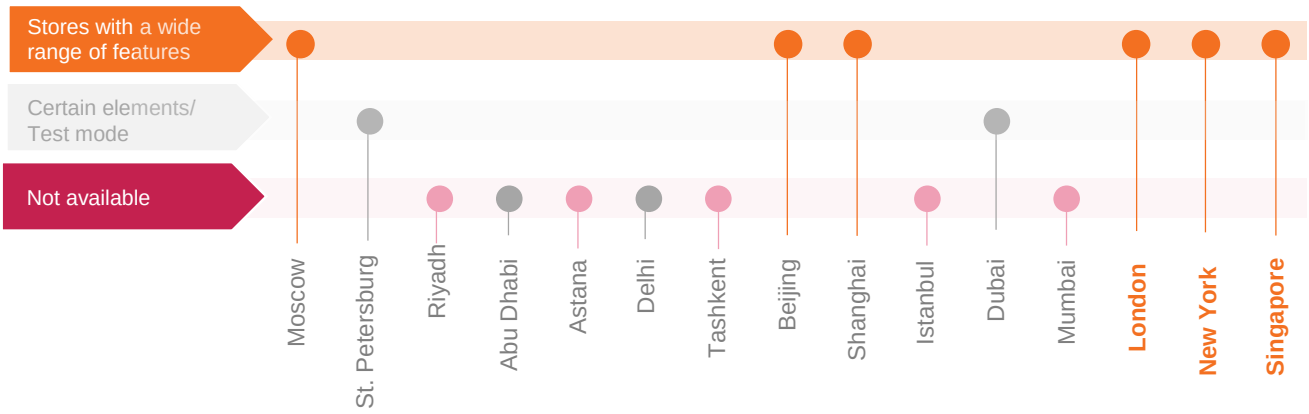
Starting a new business through the city's online resources

- The development level of online business registration services across the analyzed cities is moderate – most services are provided at the national level without city-specific features. Examples include St. Petersburg, Abu Dhabi, Dubai, and Tashkent.
- Comprehensive services are offered in Moscow, Beijing, Shanghai, New York, and Singapore, where municipal portals help streamline approval processes and accelerate business launch. Moscow's portal not only enables business registration but also provides resources for idea generation, project promotion, training, and information on subsidies, loans, and grants. Shanghai offers cloud-based business management tools and an HR platform for staffing solutions.
- Among benchmark cities, Singapore's platform stands out for its user training options, adaptive approach based on business type, and personalized user support. New York's portal focuses on providing end-to-end assistance, including consultations, access to financing, and market analysis.

Sources: The World Bank, official state statistics sources, official websites of state authorities, official state employment and city development portals, SW Tenet assessment

Innovation in trade

Smart stores



- The development of smart stores is most actively promoted in benchmark cities, where the latest technologies are widely implemented. These include stores with extensive functionality (grab-and-go systems, electronic shelf labels, various sensors, AI, etc.). The most popular solution in grocery retail remains the grab-and-go stores, which use cameras to track purchases, AI to analyze customer behavior, and other innovative technologies. This approach significantly simplifies the shopping process, virtually eliminating the need for queues or interaction with checkout counters – a particularly relevant benefit for residents of large cities with busy lifestyles. However, the adoption of these technologies is uneven.
- In cities such as **St. Petersburg and Dubai, only certain elements of the smart store concept are being applied.** For example, retailers in these regions are implementing **electronic shelf labels**, which simplify price changes and eliminate errors associated with manual updates.
- The concept of autonomous retail has been well-received in China, where shoppers are already accustomed to digital payment methods like WeChat Pay. Nevertheless, a full-fledged format involving comprehensive technologies remains largely in the testing stage by major chains. This cautious approach is due to the need to adapt technologies to local specifics, study consumer preferences, and assess market potential for further investment.

Robot-assisted delivery

Among the analyzed cities, robot-assisted delivery is available in one or more districts in the following cities

- Moscow
- St. Petersburg
- Beijing
- Shanghai

Delivery robots run in test mode in most cities, as well as in benchmark cities

- Dubai
- Abu Dhabi
- Astana
- Istanbul
- Riyadh
- Delhi
- London
- New York
- Singapore

Robot-assisted delivery is unavailable in any possible formats in three cities from the sample

- Tashkent
- Mumbai

Sources: specialized trade publications, websites of companies and startups developing smart store and robot-assisted delivery technologies, the media, SW Tenet assessment

Equality and inclusion

Gender gap in employment*

- The narrowest employment gender gap (less than 7 p.p.) is demonstrated by Astana. It is the only city in the sample where the share of employed women exceeds that of men. This is largely due to the predominance of women in the city's demographic structure. Additionally, Kazakhstan is developing the Action Plan of the Government of the Republic of Kazakhstan to Ensure the Promotion of Equal Rights and Opportunities for Men and Women for 2024–2027.
- Most cities fall into the middle group, including benchmark cities, where the employment gap ranges from 8.8 p.p. to 12.2 p.p.
- The largest employment gap is observed in Abu Dhabi, Dubai, and Istanbul, where the share of employed women is 56 p.p., 37.7 p.p., and 35.8 p.p. lower than that of men, respectively. This gap is influenced by cultural traditions in these cities as well as demographic factors, such as a high proportion of young residents, where women are often engaged in childcare or pursuing education.

** - based on data for 2023, ** - data for 2022*

Accessibility of the city environment for people with limited mobility

- Programs aimed at developing accessible urban environments are typically implemented at the national level. At the same time, such programs may include specific targets for individual regions and cities. These initiatives incorporate numerical metrics that indicate the level of a city's infrastructure readiness to accommodate people with reduced mobility. Moscow, St. Petersburg, Astana, and Riyadh use interactive maps to display accessible social facilities, including the types of institutions and their numbers.
- In contrast, Istanbul's program for developing an accessible urban environment focuses primarily on improving transport accessibility. For instance, Istanbul's Sustainable City Mobility Plan focuses on accessible, integrated, and inclusive transport system, including for people with reduced mobility.
- Tashkent and Mumbai lack state-level programs dedicated to developing an inclusive environment for people with reduced mobility. However, measures to improve accessibility in these cities are being implemented through individual pilot projects, municipal decrees, and community initiatives. For example, in Tashkent, every district is expected to have schools that meet inclusive environment standards by 2025–2026.

State program to develop an accessible urban environment

Sources: official statistics databases, the media, SW Tenet assessment

SW TENET

Sustainable Development ranking

No.	City	Score
1	Singapore	55.8
2	London	55.7
3	Moscow	54.4
4	Dubai	54.2
5	St. Petersburg	52.9
6	Abu Dhabi	52.7
7	Shanghai	50.4
8	Beijing	50.2
9	New York	48.9
10	Astana	48.2
11	Riyadh	47.6
12	Istanbul	46.9
13	Tashkent	46.7
14	Mumbai	41.5
15	Delhi	41.3

Global capitals (benchmark cities)

Cities under analysis

Methodology

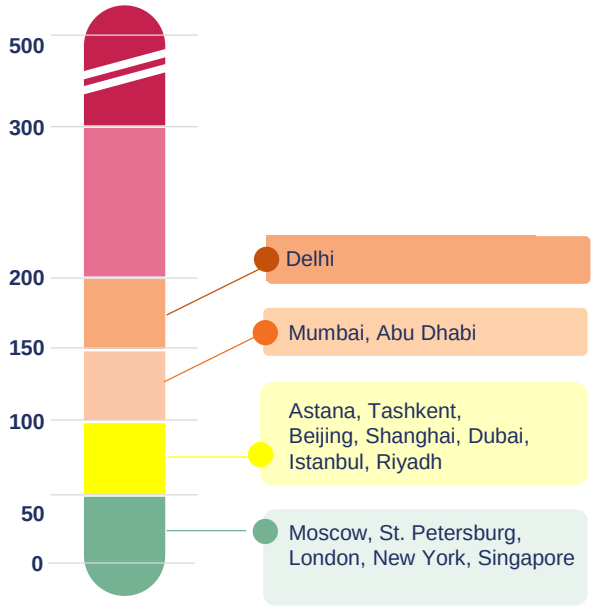
- **16 quantitative and qualitative indicators were collated and presented as a single numerical scale to calculate the Sustainable Development rating.** For several qualitative criteria instead of a simple "yes" (1 point) and "no" (0 points) scale, a more detailed scale (0–4 points) was used. This allowed for a more accurate assessment of gradations within individual indicators.
- **Each of the four groups of indicators was assigned the same weight of 25%.** The individual indicators were assigned the same weight within each group.
- **Groups of analyzed indicators:**
  - I. **air quality**, including automatic atmospheric air monitoring systems, and green areas
  - II. **pollution and waste management**, namely the level of noise and light pollution, residents' satisfaction with the cleanliness of the city, the recycling level of municipal solid waste and the availability of technologies for timely waste removal
  - III. **water quality**, both tap and surface water in rivers and water bodies; water metering
  - IV. **technologies in the electric power industry (**construction of smart buildings, implementation of smart lighting and smart grids, smart sensors)

Results

- **Singapore, London, and Moscow are the leaders in the Sustainable Development ranking.** Singapore's and Moscow's leading positions are largely attributed to high resident satisfaction regarding urban cleanliness. These leading cities also stand out for their extensive adoption of technology across various sectors, including electrical power management, water metering and atmospheric air quality monitoring, as well as a relatively high level of municipal solid waste recycling.
- The lower scores of Chinese cities stem from declining air and water quality, as well as insufficient monitoring of these metrics compared to the leading group. This situation is a result of a historically low attention from municipal administrations to environmental protection and sustainable development. However, some time ago, improving environmental conditions became a priority both at the central and municipal government levels. As a result, active adoption of electric transport, water purification technologies, air emission control systems, and smart building solutions in construction has laid the ground for enhancing sustainable development metrics.
- **The weak performance of Mumbai and Delhi** is due to low environmental scores (air and water quality), reflected in low resident satisfaction with urban cleanliness. The adoption of technologies for efficient energy use and monitoring, as well as waste management, also remains underdeveloped.
- **Singapore and London** demonstrate advanced levels of environmental safety and sustainable resource consumption, ranking among the top cities in the rating. **New York's lower position** is due to relatively low resident satisfaction with urban cleanliness, despite the city's attempts to implement advanced energy management technologies and monitor air and water quality.

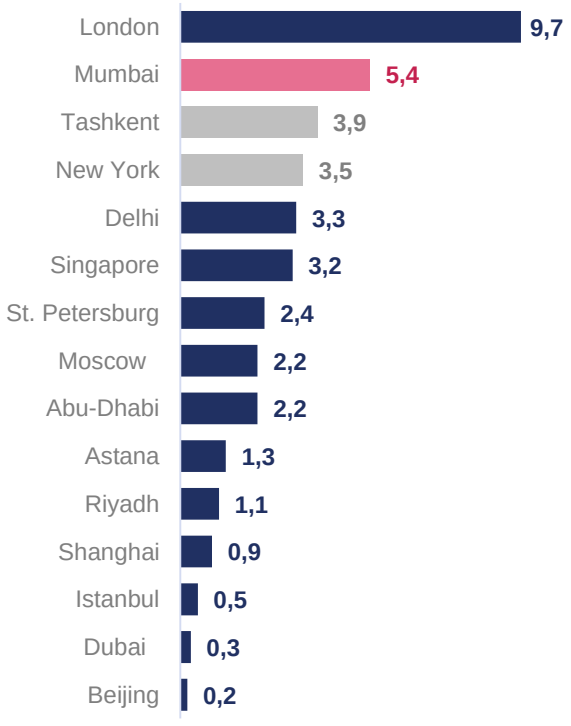
Air quality

Air Quality Index (AQI) in 2024



- The International Air Quality Index (AQI) is used to assess the level of air pollution. To determine air quality, the AQI calculation uses concentration measurements of key pollutants: particulate matter, ground-level ozone, nitrogen dioxide, and sulfur dioxide.
- AQI values range from 0 to 500, where 0 to 50 means good air quality, 51 to 100 is moderate, 101 to 150 is unhealthy for sensitive groups, and 151 or above is unhealthy.
- The AQI data for the cities analyzed was sourced from the international portal aqicn.org for 2024. Using annual data helps smooth out the variations in air quality that occur due to seasonal changes and weather conditions.
- Among the cities analyzed, air quality is split almost evenly between "good" and "moderate". The exceptions are Mumbai and Abu Dhabi, where the air quality is rated as "unhealthy for sensitive groups," and Delhi, which experiences a high level of pollution.
- In the benchmark cities, air quality is rated as "good".

State air pollution monitoring system*



- Environmental monitoring is a key component of the measures implemented by national governments and city administrations to improve environmental quality in the cities analyzed. To monitor ambient air quality, stationary facilities for measuring the concentration of pollutant emissions are used, among other methods.
- Nearly all the cities studied have automated air monitoring systems that provide data in real time.
- In Istanbul, measurements at all stations are taken using fully automated instruments, with the results controlled centrally. Meanwhile, in London, the public monitoring system is also supplemented by private initiatives like Breathe London and Citizen Sense, with its organizers installing accessible air quality sensors for all residents wishing to participate.
- However, Tashkent and New York still primarily use stationary systems that can measure a broader range of indicators but may not be available for automated systems.
- Mumbai is the only city where there is no information available on what kind of monitoring facilities are used for air quality control.

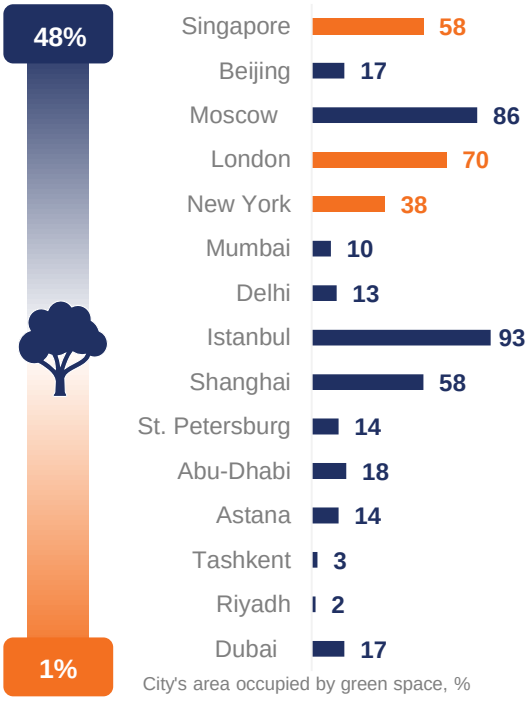
- over 50% of monitoring sites are automated
- less than 50% of monitoring sites are automated
- information on automated monitoring sites is unavailable

Sources: official statistics databases, environmental city portals, the media

** - data as at February 2025, except for the following: Shanghai, Dubai, Istanbul and Singapore – 2023 data, Astana, Beijing – 2024 data, New York – 2022 data*

Urban improvement

Green areas per resident, m2*

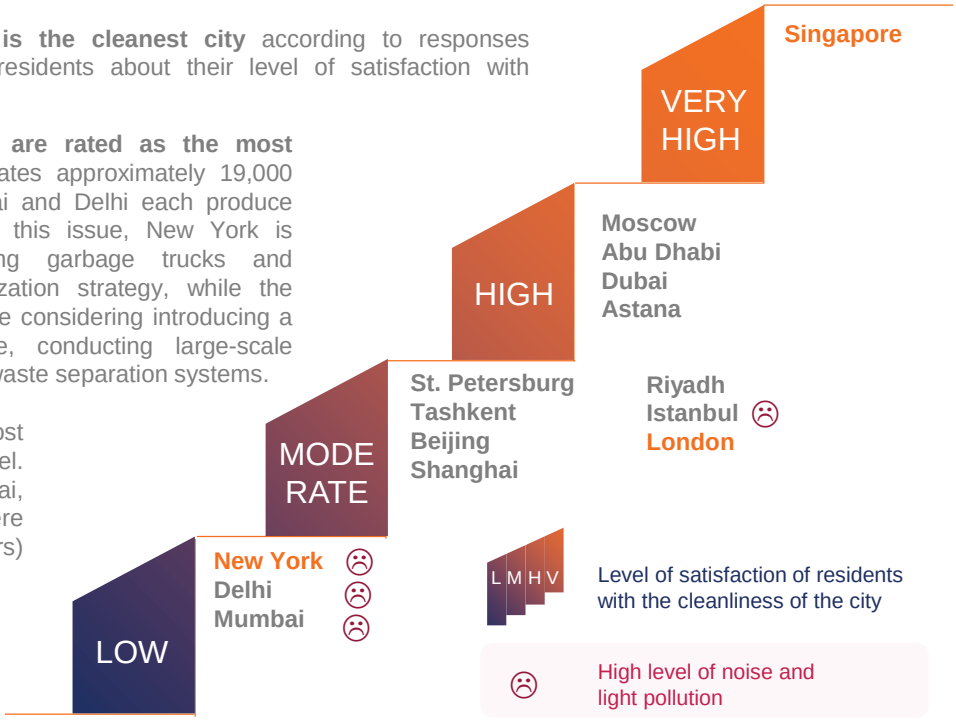


City's area occupied by green space, %

- Urban green areas serve ecological functions and are important for architectural planning. Given their multifunctional significance in ensuring a comfortable urban environment and public health, this indicator is regulated and monitored by city administrations.
- **The "greenest" cities among those analyzed are Istanbul and Moscow,** with 93m^2 and 86m^2 of green space per resident, respectively. These figures include both well-maintained, landscaped public areas and natural forest ecosystems.
- **At the bottom of the list for green areas per resident is Riyadh**, with only about 2m^2 of green zones. To address this, the Green Riyadh project is being implemented under the national Vision 2030 strategy, with the goal of planting 7.5 million trees throughout the city.
- **In terms of the share of a city's area covered by green space, Singapore is the leader**, where vegetation covers 48% of the city's territory. **In 8 out of the 15 cities, the green area ranges from 27% to 48%.**
- The least green cities are Riyadh, Dubai, Tashkent, and Astana, with green areas reaching 1.0%, 1.3%, 2.0%, and 2.4%, respectively. In Tashkent, the low level of green area is linked to tree felling and large-scale construction development, while in Astana, it is due to insufficient attention to landscaping over many years. The administrations of these cities have announced plans to increase green areas and improve the environmental situation.

Satisfaction of residents with the cleanliness of the city

- **Singapore, a benchmark city, is the cleanest city** according to responses published at Numbeo** by city residents about their level of satisfaction with the cleanliness of the city.
- **New York, Delhi, and Mumbai are rated as the most polluted cities.** New York generates approximately 19,000 tons of waste daily, while Mumbai and Delhi each produce roughly 11,000 tons. To tackle this issue, New York is deploying automated side-loading garbage trucks and implementing a waste containerization strategy, while the authorities in Mumbai and Delhi are considering introducing a monthly waste management fee, conducting large-scale cleanup campaigns, and adopting waste separation systems.
- **Light and noise pollution** in most analyzed cities is at an average level. Exceptions include Delhi, Mumbai, Istanbul, and New York, where residents (Numbeo portal users) reported high levels of pollution.



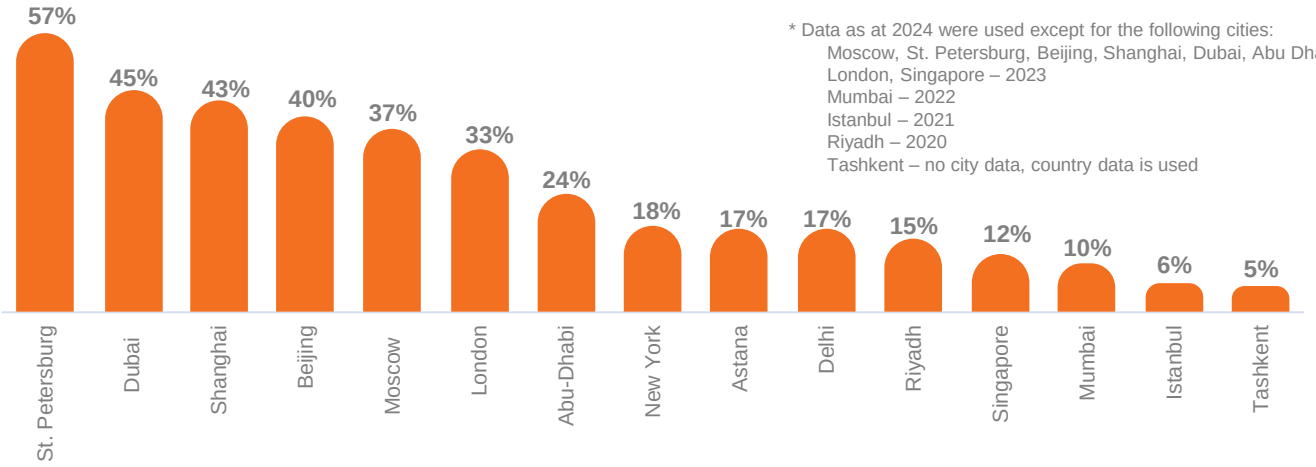
* - data for 2023–2024, Shanghai – 2022 data

*** - Numbeo is an online portal with a global database of quality-of-life indicators in cities around the world, and which collects information mainly based on surveys of portal users living in relevant cities. Depending on the city, the sample of residents surveyed may be limited and/or unrepresentative.*

Sources: official statistics databases, city improvement master plans, Numbeo website, the media

Waste Management

Share of municipal solid waste processed, %*

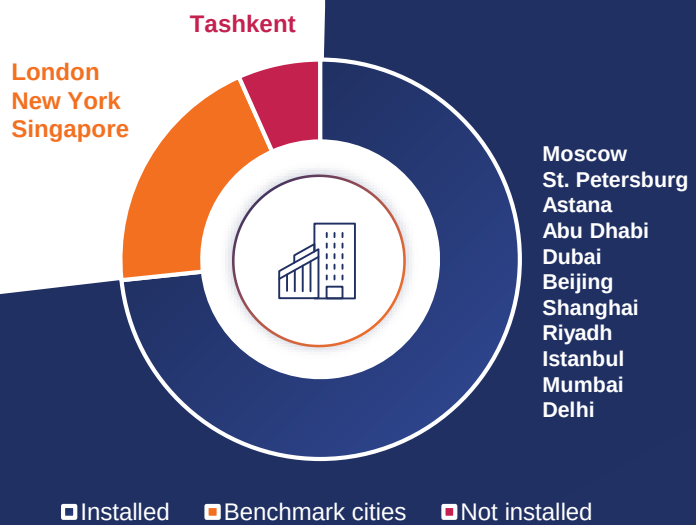


* Data as at 2024 were used except for the following cities:
Moscow, St. Petersburg, Beijing, Shanghai, Dubai, Abu Dhabi, London, Singapore – 2023
Mumbai – 2022
Istanbul – 2021
Riyadh – 2020
Tashkent – no city data, country data is used

Among the cities analyzed, St. Petersburg has achieved the highest municipal solid waste (MSW) recycling rate, at 57%, as a result of transitioning to a new solid waste management system in 2022.

The leader among the benchmark cities is London, where the recycling rate for MSW collected within the city is 33%. It is notable that this figure has remained largely unchanged since 2016 and is the lowest rate nationally (the average MSW recycling rate for the UK is approximately 44%).

Sensors installed in waste bins and/or smart waste containers for the timely removal of waste



- To optimize the process of domestic waste collection, most of the cities studied are implementing smart waste bins equipped with fill-level sensors and/or the ability to compress trash for greater capacity. Today, smart bins are becoming increasingly popular in cities worldwide, transforming conventional waste disposal into a rational and efficient process.
- Most of the analyzed cities have either implemented waste compressing technology or use waste fill-level sensors.
- Shanghai uses IoT solutions for managing waste bins. The bins are equipped with a function that sends overflow alerts directly to a mobile phone. They are also fitted with solar panels to generate electricity for their operation. Such technologies help optimize waste management in the metropolis.
- New York uses the BigBelly system to manage waste collection and disposal. It optimizes the work of personnel and equipment based on which neighborhoods generate waste more quickly and in larger volumes.

Sources: official statistics databases, the media

Water quality and metering

Surface water quality grades*

1	Conditionally clean		
2	Slightly contaminated	**Singapore** Abu Dhabi Dubai Tashkent	
3	Contaminated	**London** St. Petersburg Mumbai	Shanghai Beijing
4	Dirty	**New York** Moscow Astana	Riyadh Istanbul
5	Extremely dirty	Delhi	

* SW Tenet assessment based on the ratio of water quality grades to water pollution indicator according to Numbeo

Tap water quality and metering

Safe to drink

Singapore, St. Petersburg, London, Tashkent, Istanbul, New York, Abu Dhabi, Moscow, Dubai, Riyadh

Unsafe to drink

Beijing, Shanghai, Mumbai, Astana, Delhi

- Surface water quality is classified based on the value of the specific combinatorial pollution index – a conventional composite indicator of water quality. This indicator characterizes the overall sanitary state of the water and the presence of harmful chemical substances. Five water quality grades are identified under the index, with the first grade is conditionally pure water and the fifth is extremely dirty water.
- Among the cities studied, the cleanest surface water in rivers and reservoirs is found in Tashkent, Abu Dhabi, and Dubai. In these cities, the water is rated as slightly polluted and suitable for amenities, drinking, or fishery purposes.
- The lowest surface water quality is in Delhi, where the water can be characterized as extremely polluted.
- Surface water in global capitals is of average quality, ranging from slightly contaminated to dirty.
- Data on drinking water quality was obtained from the Tapsafe online portal, which provides information on the safety of tap water. The portal regularly publishes the results on a quality of tap water survey in most major cities of the world, divided into two categories: safe and unsuitable for drinking
- According to the portal, tap water is deemed safe to drink in most of the cities studied. This rating implies the presence of a well-functioning tap water purification and filtration system.
- Low drinking water quality was noted in five out of the 15 cities.
- The cleanest water among benchmark cities is in Singapore, which employs a comprehensive approach to water quality monitoring. Singapore's National Water Agency conducts over 500,000 tests annually for various physical, organic, inorganic, radiological, and microbiological parameters.
- All cities included in the study use smart water metering systems to improve measurement accuracy, reduce losses, optimize water consumption, and enhance water resource management.

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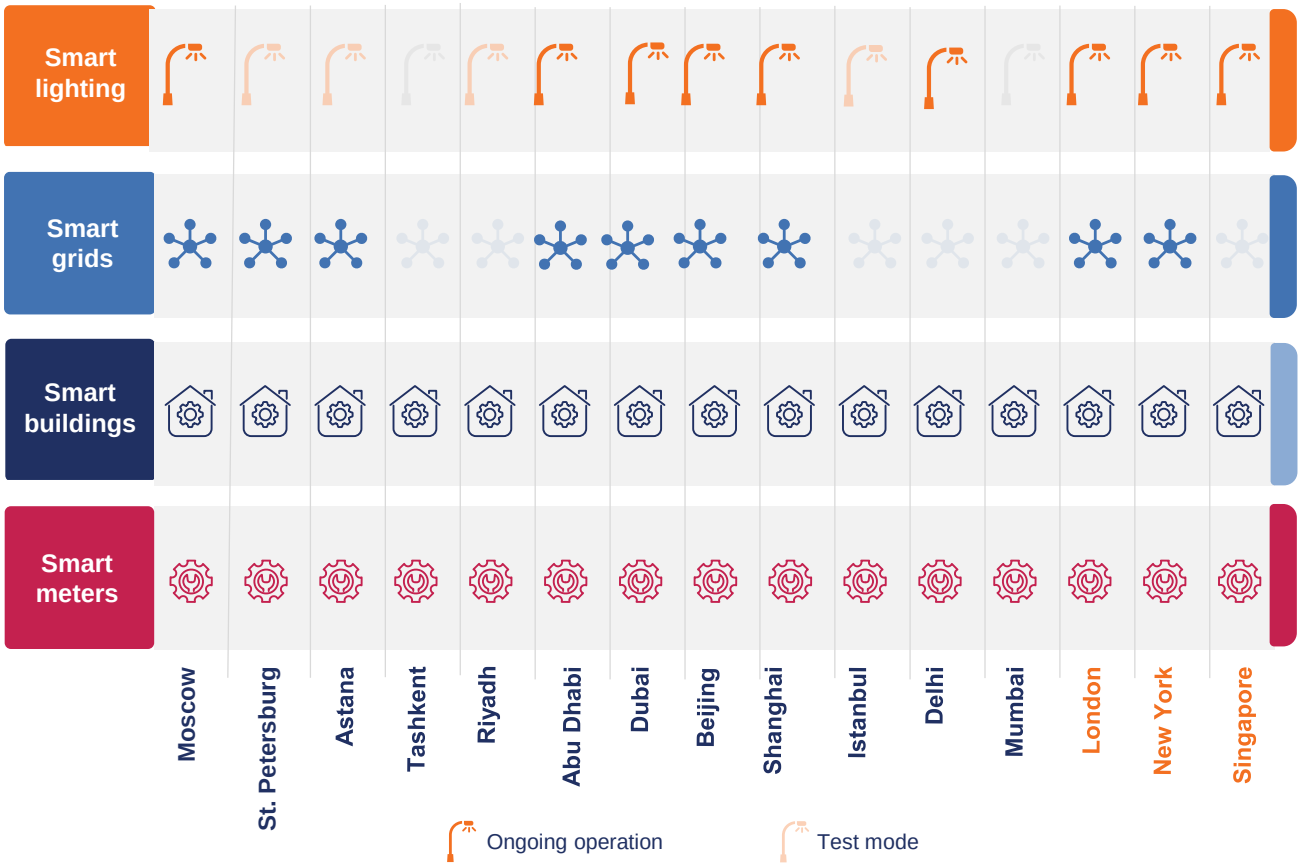
Sources: official environmental newsletters, Tapsafe portal, Numbeo, the media

Technologies in the energy sector

Smart technologies in the energy sector



- **Optimizing consumption of energy resource** is a key sustainability objective for city administrations. The application of advanced technologies in the construction and modernization of urban infrastructure, buildings, and residential properties helps reduce energy consumption and losses, decrease network load, and automate data collection and transmission between consumers and provider.
- **The implementation of smart grids** helps optimize consumption, reduce the number of outages and energy losses, and improve the efficiency of power networks. As city infrastructure modernizes, transitioning to smart technologies has become a current standard. However, among the cities analyzed, these technologies have not been implemented everywhere. Riyadh, Istanbul, Delhi, and Mumbai lag behind other cities in adopting smart grids. Among the benchmark cities, only Singapore is developing this technology in its Punggol Digital District.
- **Smart meters, as a component of smart grids,** have become a widely accepted technology for managing the supply of electricity, heat, and water, as well as monitoring their consumption. Smart meters enable the automatic collection of energy consumption data and its transmission to providers. This technology has been implemented in all the cities analyzed.
- Smart lighting helps reduce electricity consumption by activating lights only when needed or by adjusting their intensity. In most cities, these technologies are either fully operational or in a trial phase. Only Tashkent and Mumbai currently lack smart lighting systems.
- **Smart buildings** are equipped with centralized automated heating, ventilation, air conditioning, lighting, and other systems. Such solutions optimize the operation of a building's engineering systems, thereby reducing the consumption of electricity, water, and heat. The use of advanced engineering solutions in newly constructed buildings has been observed in all the cities analyzed.

Sources: official environmental newsletters, Tapsafe portal, Numbeo, the media

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