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UIS GLOBAL PILOT CITIES OBSERVATION REPORT 2026

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UIS

GLOBAL PILOT CITIES OBSERVATION REPORT 2026

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PREFACE

Today, the world is rapidly entering an urban age. Cities have become the primary spaces where people gather, economies grow, social innovation emerges, and civilizations evolve. In 2024, approximately 56% of the global population lived in cities, a share projected to rise to around 68% by 2050. Although cities occupy only about 2% of the world's land area, they generate more than 80% of global GDP. As urbanization deepens, challenges such as population mobility, resource constraints, climate risks, technological transformation, and uneven development are becoming increasingly intertwined. How to build cities that are more innovative, livable, beautiful, resilient, humanistic, and intelligent has become a shared question for cities worldwide.

It is against this backdrop that the Urban Index of Shenzhen (UIS) was established. Rooted in Shenzhen's own experience and oriented toward global urban governance, UIS seeks to translate urban development values, analytical frameworks, and practical insights into an international public good. It aims to provide cities worldwide with an open reference for understanding their development trajectories, identifying strengths and gaps, defining directions for action, and drawing on transferable practices.

Anchored in the vision of building a modern people-centered city, UIS has developed a six-dimensional agenda framework encompassing Innovation, Livability, Aesthetics, Resilience, Humanism, and Intelligence. It has further constructed a "6+20+50+X" indicator system, comprising 6 dimensions, 20 objectives, 50 core indicators, and an open-ended indicator library designed for continuous expansion, iterative refinement, and dynamic updating. UIS is not simply a city index for ranking purposes, but an open framework for urban diagnosis, comparative learning, and action guidance. Through multidimensional observation, it seeks to reveal the comprehensive capacities and structural characteristics of urban development.

The six-dimensional outcomes released this time form an important part of UIS's phased research and international communication. The six dimensions assess 20 representative global sample cities from the perspectives of innovation capacity, livability, urban aesthetics, resilience governance, humanistic development, and intelligent development. The assessment aims to present the distinctive strengths, structural gaps, and shared issues of different cities in their modernization processes. Through this series of studies, UIS seeks to move beyond single indicators and simple rankings, and to develop an urban observation framework that combines international comparability, diagnostic value, and practical relevance.

At the same time, UIS continues to expand its global cooperation and application system, gradually building an internationally oriented network of experts and professionals. Through urban diagnostics, the selection of outstanding practices, capacity building, scholarship support, and forum-based dialogue, UIS works to connect index research, knowledge translation, and international exchange. Looking ahead, UIS will continue to evolve from a tool for observing cities into an open platform for global urban learning, experience sharing, and collaborative creation.

CHAPTER

CHAPTER 1
UIS AT A GLANCE

1.1 Positioning：Global Public Goods for Urban Governance

1.2 Principle：Nature Friendly, People Centered

1.3 Products：Six-in-one Product System

1.4 Applications：Orient, Direct, and Strategize

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1.1 Positioning:Global Public Goods for Urban Governance



The Urban Index of Shenzhen (UIS) is positioned as Global Public Goods for Urban Governance that China contributes to the world under the framework of the Global Development Initiative.

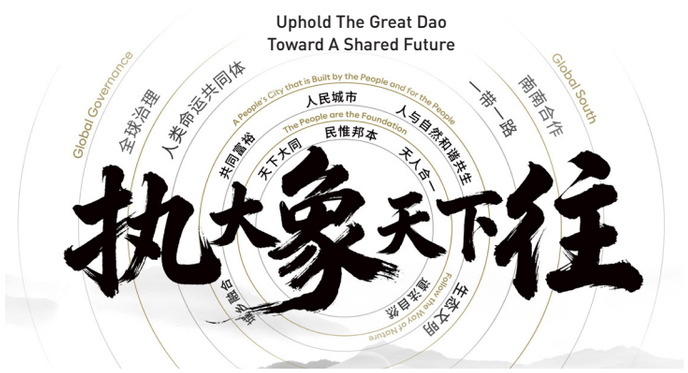
By advancing urban practice within China's path to modernization, it helps enrich the "urban chapter" of global governance and bring more city-based solutions into global policy discussions.

It offers practical references and replicable experiences for cities worldwide—especially those in the Global South—thereby helping bridge the development gap between the Global North and South.

It serves as a platform and tool for shenzhen and other Chinese cities to engage in global urban governance, strengthen international cooperation, and share China's urban experience with the world.

1.2 Principle:Nature Friendly, People Centered

he Urban Index of Shenzhen (UIS) draws on Eastern wisdom and champions a people-centered, nature-friendly vision. It distills ShenZhen's practice into a framework and knowledge base for urban modernization, contributes to global governance dialogue, and offers a new option through the index.



1.3 Products:Six-in-one Product System

The Urban Index of Shenzhen (UIS) goes beyond city ranking, it is a six-in-one public-product system for urban governance.

Reporting Framework	Global city rankings and comprehensive reports covering quantitative assessments, methodologies, and forward-looking perspectives on urban development.
Urban Diagnostic Toolkit	A dual-track model of automated self-assessment and tailored consultancy — pinpointing urban vulnerabilities and delivering actionable improvement strategies
Global Awards and Certification	Includes Global City Awards, Best Practice Awards, and Benchmark Certifications recognizing outstanding urban performance, innovative solutions, and exemplary practices.
Capacity-Building & Training Programmes	Drawing on academic resources and Shenzhen's urban experience to offer training modules, study tours, and fellowship opportunities for international participants
Global Summit & Dialogue Platform	Bringing together cities and experts worldwide to share governance experience and innovative urban solutions
Open Urban Data Platform	An accessible, visualized open-data portal for global researchers, institutions, and universities

1.4 Applications:Orient, Direct, and Strategize

The world is undergoing profound changes unseen in a century, with surging mobility, uncertainty, and complexity. UIS does not offer a static nautical chart; it provides a toolkit for urban governance—like a sextant, a compass, and a dashboard—to help cities fix their bearings, find direction, and implement strategies.

Sextant	Compass	Dashboard
Pinpoints a city's place in global coordinates. Through multi-dimensional comparisons with cities worldwide, UIS enables each city to identify—more clearly and precisely—its position and distinctive features in the global urban landscape.	Clarifies direction in a highly uncertain era—from following to leading. For rapidly urbanizing developing countries in Asia, Africa, and Latin America, UIS provides a referenceable and replicable assessment framework and practical development pathways.	Monitors urban performance, flags risks, and supports strategic decisions. UIS assesses development outcomes, pinpoints strengths and gaps, and updates strategies for building benchmark cities—providing an evidence base for policymaking and resource allocation.

CHAPTER 2

CHAPTER 2
UIS EVALUATION FRAMEWORK

2.1 Indicator System

2.2 Data Sources

2.3 Assessment Methodology

2.4 Target Cities

2.1 Indicator System

DIMENSION	INDICATOR	
INNOVATION	Density	• High-level Papers per Million Inhabitants • Patents per Million Inhabitants
	Abundance	• Urban Innovation Vitality • Attractiveness & Inclusiveness for Migrant Population • Startup Incubation Level
	Intensity	• Total Labor Productivity • R&D Intensity • Business Environment Maturity
	Connectivity	• Technology Transaction Activity • Direct Investment (FDI+OFDI)
LIVABILITY	Settlement	• Housing Support • Basic Service Access • Health & Longevity
	Quality	• Mobility Efficiency • Advanced Service Access • Open Space Quality • Third-place Vitality
	Opportunity	• Demographic Structure • Human Capital Level • Income Level
AESTHETICS	Natural Harmony	• Protected Area to City Territory Ratio • Green-Blue Coverage in Built-up Area • Native Biodiversity in Built-up Area
	Green Progress	• Low-carbon Level • Annual Average Air Quality • Proportion of Safely Treated Domestic Water
	Spatial Resonance	• City Image Favorability • Destination Appeal Intensity • Streetscape Visual Quality

DIMENSION	INDICATOR	
RESILIENCE	Defense	• Building Fortification Level • Municipal Infrastructure Guarantee Level
	Recovery	• Emergency Traffic Support Level • Emergency Response Service Level
	Adaptability	• Natural Shoreline Retention Rate • The Proportion of Permeable Urban Area
	Transition	• Top-Level Design of Resilient City • Disaster Risk Management Level
HUMANISM	Behavior &Literacy	• Public Behavioural Order & Safety • Civic Environmental Behaviour Participation
	Cultural Understanding	• Cultural Heritage Richness • Cultural Space & Facility Sharing • Cultural Participation & Consumption
	Inclusion & Engagement	• Demographic Diversity & Openness • Public Cultural Accessibility & Utilization • Civic Volunteering Rate
INTELLIGENCE	Digital Foundation	• Urban Data Platform Integration • Network Connectivity Level
	Inclusive Public Services	• Public Network Coverage • Digital Payment Convenience
	effective Governance	• Convenience of Online Government Service • Digital Civic Engagement Level

The "6+20+50+X" indicator system translates the vision and objectives of urban development into an evaluation framework that is observable, comparable, and iteratively refinable.

The "6" constitutes the core architecture, establishing six dimensions — innovation, intelligence, livability, aesthetics, resilience, and humanism — as the fundamental orientations for comprehensive urban assessment.

The "20" represents the elaboration of these dimensions, corresponding to second-tier objectives under each of the six dimensions and encompassing the key thematic areas of sustainable urban development.

The "50" serves as the evaluative anchor, disaggregates into specific, quantifiable, and benchmarkable indicators that support cross-city horizontal comparison and disaggregated assessment.

"**X**" functions as an open variable, reserving space for the system to adapt to shifts in the external environment and to undergo continuous updating and iteration, thereby endowing the UIS framework with both present-day operability and forward-looking scalability.

2.2 Data Sources

Data sources are drawn from five principal categories; the specific source corresponding to each indicator is detailed in the Indicator Reference Table in the Appendix.

The first category comprises statistical data from authoritative international institutions, including global urban indicator datasets published by the United Nations (UN SDGs, UNDRR, UNV), the World Bank, the World Health Organization (WHO), the International Monetary Fund (IMF), and the Organization for Economic Co-operation and Development (OECD), as well as specialized data from international ranking and assessment systems such as GaWC, Kearney Global Cities Index, IMD Smart City Index, and ISO 37122. These datasets collectively constitute the baseline for cross-city horizontal comparison.

The second category encompasses remote sensing and geospatial data, including the European Union's Global Human Settlement Layer (GHSL), the UN Environment Programme's World Database on Protected Areas (WDPA), the Global Biodiversity Information Facility (GBIF), Sentinel-2/Landsat satellite imagery, and AI-assisted visual recognition data derived from street-level imagery. These sources are primarily employed for the objective measurement of ecological conditions, urban resilience, and spatial quality.

The third category consists of conventional statistical yearbooks and administrative records, including municipal statistical yearbooks, government gazettes, thematic planning reports, and publicly available departmental data, covering baseline statistics across domains such as demography, economics, infrastructure, cultural facilities, and emergency management. These sources serve as essential references for characterizing the individual profiles of each city.

The fourth category draws on internet-sourced and big data resources, including Points of Interest (POI) data, OpenStreetMap, TripAdvisor user-generated reviews, Wifimap.io public network coverage data, and Ookla/M-Lab broadband speed test data. These are applied to the spatial measurement and behavioural sensing of service accessibility, digital infrastructure, and public space vitality.

The fifth category incorporates specialized assessment and survey data, including the Verisk Maplecroft Urban Environmental Risk Index, the Rockefeller Foundation's 100 Resilient Cities assessments, the UNESCO Framework for Cultural Statistics, the ICMPD City Migration Profiles, and the UN E-Government Survey Development Index. These sources provide thematic support for the humanism, resilience, intelligence and other dimensions.

In terms of data integration, raw data from all five categories are consolidated into a unified urban assessment database and structured across three hierarchical levels — city, dimension, and indicator — forming a foundational data repository covering 20 sample cities, 6 dimensions, and 50 indicators. This integrated repository provides a consistent and standardized basis for subsequent normalization procedures and composite index computation.

2.3 Assessment Methodology

The UIS assessment model is structured around six dimensions of urban evaluation, innovation, livability, aesthetics, resilience, humanism, and intelligence, and implements a technical pipeline of indicator normalization, score transformation, city classification, dimensional relationship identification to enable cross-city horizontal comparison, typological identification, and structural characteristic analysis.

(1) Structured Assessment Across Six Dimensions

The UIS assessment model begins by applying uniform processing procedures to the constituent indicators under each of the six dimensions. Given the presence of dimensional heterogeneity, skewed data distributions, and the influence of extreme values across different indicators, the model employs a two-step procedure to achieve indicator comparability.

1 Robust normalization of raw indicators to ensure cross-dimensional comparability.

For the j-th indicator, the normalized value is computed using the Robust Scaling method:

$$x_{ij}^{norm} = \frac{x_{ij} - median(X_j)}{IQR(X_j)}$$

x_{ij}:denotes the raw value of the i-th city on the j-th indicator.

median(X_j):the median of that indicator across the full sample of cities, and IQR(X_j) is the interquartile range.

By substituting the median and interquartile range for the conventional mean and standard deviation, this method effectively reduces the distorting influence of outliers on assessment outcomes, and is well-suited to the skewed distributions and outlier observations commonly encountered in urban indicator datasets.

2 Transformation of normalized indicator values into a standardized scoring range of 60–100.

Normalized values are mapped to this interval through the following linear transformation:

$$Score_{ij} = 60 + 40 \times \frac{x_{ij}^{norm} - min(x_j^{norm})}{max(x_j^{norm}) - min(x_j^{norm})}$$

where $Score_{ij}$ denotes the final score of the i-th city on the j-th indicator.

For negative indicators — such as pollution emissions, commute time, and disaster risk — a reverse transformation is applied:

$$Score_{ij} = 100 - 40 \times \frac{x_{ij}^{norm} - min(x_j^{norm})}{max(x_j^{norm}) - min(x_j^{norm})}$$

Through this procedure, all indicators are uniformly rescaled to the 60–100 range. A score of 60 represents a relatively low standing among the sample cities, while a score of 100 represents a relatively high standing; intermediate values reflect each city's relative position on the given indicator. Compared to a conventional 0–100 rescaling, the 60–100 interval is better suited to international urban comparison and composite presentation: it preserves inter-city differentiation while preventing the overall assessment results from being subject to excessive volatility caused by disproportionately low scores on individual indicators.

(2) UIS Six-Dimensional Synergy Analysis

Following the computation of scores across the six dimensions for each city, the UIS model proceeds to conduct city typology classification and dimensional relationship identification, with the aim of revealing the development patterns and structural characteristics of different cities.

1 Cluster analysis of cities based on six-dimensional scores.

$$C_i = (D_{i1}, D_{i2}, D_{i3}, D_{i4}, D_{i5}, D_{i6})$$

On this basis, hierarchical clustering is applied to classify cities into developmental typologies. The clustering outcomes are not intended as a simple ranking; rather, they serve to identify distinct structural development types among cities. Through typological classification, it becomes possible to compare the relative strengths and weaknesses of different city groups across the six dimensions, thereby providing replicable and adaptable reference models for cities at earlier stages of development.

2 Relational analysis across the six dimensions.

A sunburst diagram is first employed for visual analysis and morphological characterization. The model then identifies the intrinsic relationships among dimensions at three analytical levels:

Correlation analysis: Pearson or Spearman correlation coefficients are computed to determine whether statistically significant positive or negative correlations exist between pairs of dimensions.

Dimensionality reduction: Principal component analysis (PCA) or factor analysis is applied to identify the primary structural factors underlying cities' composite performance, and to assess whether the six dimensions can be consolidated into a smaller set of common developmental characteristics.

Explanatory modelling: Regression analysis or structural equation modelling (SEM) is employed to further explore the explanatory role of individual dimensions with respect to the overall UIS composite score or other dimensions.

2.4 Target Cities

This report selects 20 globally representative cities for assessment and comparative observation. The sample was constructed with comprehensive consideration of urban morphology, geographic distribution, stage of development, and comparative value, with the aim of capturing the diversity of urban development levels, structural characteristics, and evolutionary trajectories across the globe.

The sample selection follows three overarching principles. First, it prioritizes cities of distinctive morphological types — particularly high-density and megacities — with a focus on urban development performance under conditions of intensive concentration in population, industry, space, and governance. Second, it ensures coverage across different global regions and development gradients, encompassing both mature global cities and cities of the Global South and rapidly developing economies. Third, it emphasizes inter-city comparability and transferability of lessons, selecting representative cities that share common characteristics in terms of urbanization pace, industrial transition, spatial development intensity, and governance complexity, thereby enhancing the explanatory power and reference value of the assessment results.

On the basis of these principles, the 20 sample cities are broadly organized into three categories. The first category comprises mature global cities — London, New York, Paris, and Tokyo — representing international benchmarks of comprehensive urban capability at high levels of development. The second category consists of high-density Asian cities — Singapore, Hong Kong, Beijing, Shanghai, Guangzhou, and Shenzhen — with a focus on examining the internal structural differences in six-dimensional development among cities operating under conditions of high population density, high development intensity, and high governance complexity. The third category encompasses Global South and rapidly developing cities — Jakarta, Manila, Bangkok, Nairobi, and Lima — primarily reflecting the common challenges and practical responses faced by cities undergoing rapid urbanization with respect to foundational carrying capacity, public service provision, quality of life, risk resilience, and development opportunity.

Together, these three categories of sample cities form the comparative foundation of this report. The sample enables benchmarking against the advanced experience of mature global cities, comparative analysis of developmental divergences among high-density Asian cities, and incorporation of the real-world challenges confronting Global South cities — constituting a comprehensive urban assessment sample system that integrates global perspective, typological differentiation, and empirical explanatory power.



No.	Target Cties	Country	No.	Target Cties	Country
1	New York	United States	11	Jakarta	Indonesia
2	London	United Kingdom	12	Bengaluru	India
3	Paris	France	13	Bangkok	Thailand
4	Tokyo	Japan	14	Manila	Philippines
5	Singapore	Singapore	15	São Paulo	Brazil
6	Hong Kong	China	16	Mexico City	Mexico
7	Beijing	China	17	Buenos Aires	Argentina
8	Shanghai	China	18	Lima	Peru
9	Guangzhou	China	19	Cairo	Egypt
10	Shenzhen	China	20	Nairobi	Kenya

CHAPTER 3

CHAPTER 3

ASSESSMENT OF GLOBAL PILOT CITIES

3.1 General Assessment

3.2 Innovation

3.3 Livability

3.4 Aesthetics

3.5 Resilience

3.6 Humanism

3.7 Intelligence

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3.1 General Assessment

(1) Six-Dimensional Performance: A Cross-city Overview

① The six-dimensions framework: a unified system for assessing urban capability.

The six dimensions of innovation, livability, aesthetics, resilience, humanism, and intelligence together form the fundamental coordinate system for assessing comprehensive urban capability. Innovation and intelligence reflect development momentum and governance efficiency; livability, aesthetics, and resilience embody urban quality and carrying capacity; humanism points to social foundations, public culture, and long-term governance accumulation. Cities such as New York, London, Tokyo, and Singapore maintain leading positions across multiple dimensions, demonstrating strong, well-rounded support capacity. Beijing and Shenzhen perform prominently on the innovation and intelligence dimensions, exhibiting a distinctly technology-driven profile. Paris and Hong Kong show a comparatively solid foundation in livability, aesthetics, and humanism.

② Two broad types: balanced performers and single-strength cities.

Viewed horizontally, the variation in a city's rankings across the six dimensions reflects whether its development structure is balanced. The consistently high multi-dimensional rankings of New York, London, Tokyo, and Singapore indicate that their comprehensive capability does not rest on any single dominant strength, but is sustained by broadly distributed, mutually reinforcing strengths. Beijing and Shenzhen demonstrate clear advantages in innovation and intelligence, possessing strong development momentum, yet further effort is needed to extend these technological strengths into the dimensions of livability, resilience, and humanism. Paris and Hong Kong perform well on livability, aesthetics, and humanism, reflecting the long-term accumulation of mature cities in public services, spatial environment, and socio-cultural development. Cities such as Bangkok, Jakarta, and Manila exhibit notable strengths in select dimensions, though cross-dimensional balance remains a work in progress.

③ Dimension-specific rankings: competitive gradients across cities.

Viewed vertically, the patterns of urban differentiation vary considerably across dimensions. The innovation and intelligence dimensions tend to produce wider performance gaps; cities such as New York, London, Tokyo, Singapore, Beijing, and Shenzhen hold clear advantages, reflecting divergent capacities in technological innovation, industrial foundations, digital governance, and smart application. The livability, aesthetics, and resilience dimensions more closely reflect urban quality and carrying capacity; cities such as Paris, Tokyo, Singapore, and Hong Kong maintain relatively stable rankings, indicating mature systems of public services, ecological environment, infrastructure, and risk management. The humanism dimension places greater emphasis on soft power and long-term accumulation; the strong performance of New York and London in this dimension underscores that humanistic capacity is built through sustained, long-term investment rather than short-term effort.

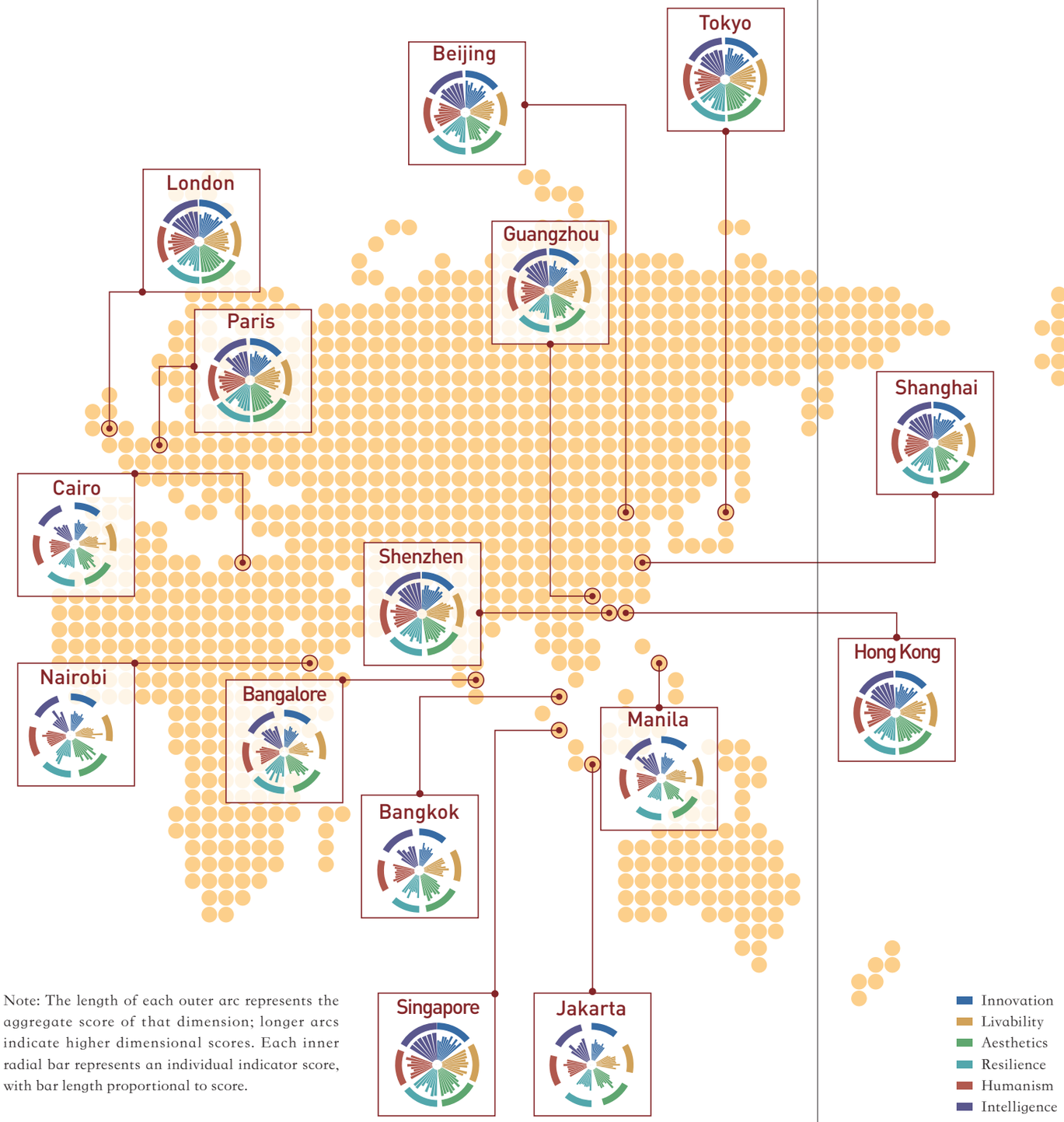
④ Ranking divergence: structural differentiation in urban development paths.

Taken together, the six-dimensional rankings of the 20 pilot cities do not represent a simple linear hierarchy, but instead reveal a plurality of development structures. New York, London, Tokyo, and

Singapore exemplify the multi-dimensionally balanced type, characterized by consistently high performance across all six dimensions. Beijing and Shenzhen represent the technology-leading type, with outstanding performance in innovation and intelligence, yet requiring greater synergy with the livability, resilience, and humanism dimensions. Paris and Hong Kong exhibit a quality-accumulation profile, with well-established foundations in livability, aesthetics, and humanism. Cities such as Bangkok, Jakarta, and Manila are at a structural development stage, with emerging strengths in select dimensions but limited cross-dimensional integration.



(2) Six-Dimensional Synergy: Distinct Patterns Across Cities



Note: The length of each outer arc represents the aggregate score of that dimension; longer arcs indicate higher dimensional scores. Each inner radial bar represents an individual indicator score, with bar length proportional to score.

Six-Dimensional Synergy: Distinct Patterns Across Cities

Sunburst charts are employed to visualize the six-dimensional synergy profiles of the 20 target cities. Through nested concentric arcs and radial bar charts, the hierarchical relationship between dimensions and their constituent indicators is rendered visually accessible, with arc and bar length reflecting dimensional and indicator scores respectively. Differences across cities in color band distribution, outer arc contour, and inner bar variation reveal the structural relationships of mutual reinforcement and interdependence among the six dimensions.

1. Innovation and intelligence in tandem: the technology-driving axis of six-dimensional synergy

Among high-capability cities such as New York, London, Tokyo, Singapore, Beijing, and Shenzhen, innovation and intelligence tend to advance in concert, with pronounced asymmetry between the two being relatively uncommon. This suggests that the true value of innovative capacity lies not solely in the concentration of industrial and research resources, but in whether it can be translated into smart governance, digital infrastructure, and urban service delivery. Innovation supplies the driving force; intelligence embeds it within the city's operational systems — together constituting the technology-driving axis of six-dimensional synergy. Where innovation is prominent but intelligence fails to keep pace, the advantage remains fragmented, falling short of systemic support for overall urban governance capacity.

2. The interweaving of livability, aesthetics, and resilience: consolidating the quality foundation of urban development

Paris, Tokyo, Singapore, and Hong Kong demonstrate well-rounded performance across these three dimensions, with sunburst profiles that are full and balanced — confirming that urban quality emerges from the convergence of living convenience, ecological environment, spatial quality, and risk management capacity, rather than any single dimension in isolation. When these three dimensions mutually reinforce one another, urban development gains greater stability and long-term attractiveness; should any one decline markedly, a structural gap emerges in the quality foundation and the overall profile becomes imbalanced. The performance of Jakarta and Manila in this cluster of dimensions illustrates the constraining effect that resilience deficits can exert on the overall quality foundation.

3. Humanism as long-term accumulation: the indispensable soft connective tissue of six-dimensional synergy

The soft power, public culture, and long-term governance accumulation embodied in the humanism dimension develop over extended periods and manifest gradually; in the sunburst diagram, it is often not the most visually prominent segment. Yet where this dimension is markedly underdeveloped, even strong performance elsewhere is unlikely to produce a complete six-dimensional structure — resulting instead in pronounced hard capability alongside insufficient soft support. The humanism arcs of New York and London are both long and internally consistent, making them among the few cities to have achieved genuine hard-soft synergy. In this sense, humanism functions as the critical soft connective tissue integrating technological advancement, spatial quality, and public governance into an organic whole; its depth often determines how far a city's development can ultimately reach.

4. From single-dimension strength to six-dimensional synergy: the key lies in whether advantages can be translated across dimensions

Bangkok exhibits a relatively prominent aesthetics dimension while progress in other dimensions remains limited; cities in parts of Latin America, Africa, and Southeast Asia similarly display notable strengths in select dimensions alongside uneven overall development. This indicates that these cities are not without strengths — rather, those strengths have yet to diffuse into systemic capability. The essence of six-dimensional synergy lies in whether effective translational relationships can be established across dimensions: innovation into smart governance; intelligence into resilience and operational efficiency; livability and aesthetics into urban attractiveness; and humanism integrating technology, space, and governance into a coherent development logic. The closer a city's sunburst diagram approaches a full circle, the closer it tends to be to this mature state of systemic capability.

3.2 Innovation

3.2.1 Understanding Innovation

The conceptual evolution of urban innovation did not originate from "networks" and "ecosystems." Rather, across successive stages of industrialisation, knowledge intensification, and globalisation, cities have responded to distinct innovation imperatives-progressing incrementally from "the agglomeration of factors" towards "the coupling of relationships". Each paradigm shift has not simply negated the preceding stage, but has continuously expanded and deepened the connotation of innovation in response to new urban contradictions.

During the early-to-mid phase of industrialisation, innovation was understood as "the agglomeration of factors." Joseph Schumpeter established innovation as the endogenous driver of economic growth through his concept of "creative destruction"; Alfred Marshall further observed that the geographical proximity of specialised talent, equipment, and knowledge generates external economies through an "industrial atmosphere." The central question at this stage was whether agglomeration could be achieved — whether a city could concentrate, at a given location, a sufficient quantity and prestige of research institutions, leading enterprises, and high-end talent to form a recognisable "knowledge-density highland." Cities relied on standalone science parks, industrial zones, and high-technology development areas as their principal vehicles; innovation was conceived as "output within functional zones" — spatially enclosed, specialised, and outward-radiating.

In the latter half of the twentieth century, as the global economy entered a phase of industrial reorganisation and the rise of the service sector, the mere accumulation of factors could no longer fully explain disparities in innovation performance. Michael Porter's industrial cluster theory and Jane Jacobs' urban diversity theory pointed, from different directions, to the same insight: what fundamentally drives innovation is not the mere aggregation of homogeneous factors, but the differences, mixing, and interaction among diverse actors, industries, and populations. Richard Florida's "creative class" theory further emphasised that an inclusive, diverse, and open urban culture constitutes the fundamental condition for attracting innovative talent and triggering new combinations. The core question of innovation thus advanced from "can it agglomerate?" to "is it vibrant?" — whether a city can accommodate diverse actors, external talent, and emerging industries to form a broad and dynamic innovation base.

At the close of the twentieth century, the critical inflection point of innovation shifted once again. Christopher Freeman's theory of national and regional innovation systems, and Henry Etzkowitz's "Triple Helix" model of university-industry-government interaction, successively revealed that innovation is the joint product of factor inputs, organisational efficiency, and institutional environments; identical R&D expenditures and talent pools yield significantly different output



Figure 1 Innovation in the UIS Framework

efficiencies under different institutional arrangements. The Organisation for Economic Co-operation and Development (OECD) systematised this understanding in its *Oslo Manual*, proposing that innovation is not merely a function of outputs, but a product of the synergy between input quality, process efficiency, and institutional environment. The urban-level inquiry thus deepened from "is it vibrant?" to "is it powerful?" — whether a city can efficiently convert R&D investment, human capital, and institutional supply into productivity gains, enterprise growth, and industrial competitiveness.

Entering the twenty-first century, global innovation has moved into an open and networked phase. Henry Chesbrough's open innovation theory, Manuel Castells' network society theory, and the GaWC have collectively demonstrated that, under conditions of high-frequency cross-border flows of knowledge, capital, talent, and data, innovation increasingly occurs at network nodes spanning cities, institutions, and disciplines. The Brookings Institution's 2014 concept of "innovation districts" revealed at the spatial level that high-density, walkable, mixed-use urban neighbourhoods can couple long-distance global network linkages with high-frequency local exchange, enabling tacit knowledge to spill over naturally within everyday living environments. The critical question of urban innovation has thus advanced once more to "is it connected?" — whether a city can occupy a topological position of nodal value within the global innovation network.

Tracing this intellectual trajectory, the evolutionary pathway of the innovation city progresses from "factor agglomeration," through "abundance and inclusiveness" and "conversion efficiency," ultimately arriving at "network coupling" in a layered, cumulative progression. Based on this framework, the present study defines the "innovation city" as: a complex ecosystem capable of enabling the continuous generation, flow, coordination, and conversion of innovation factors; and characterises it through a four-dimensional framework of "Innovation Density – Innovation Abundance – Innovation Intensity – Innovation Connectivity," each dimension addressing one of the four essential questions of innovation.

Innovation Density: **Measured by the stock density of high-level knowledge and technological outputs, this dimension assesses the scale of high-end agglomeration in knowledge production and technological output, constituting the foundational layer of the urban innovation system. It answers the question of "can it agglomerate?"**

This determines whether a city can concentrate a sufficient critical mass and excellence of research institutions, leading enterprises, and high-end talent at a given location to form a recognisable "knowledge-density highland," providing an inexhaustible wellspring of hard-core driving force for innovation.

Innovation Abundance: **Measured by the degree of vitality among diverse actors, talent inflows, and entrepreneurial incubation, this dimension shapes a vibrant, inclusive, and diverse innovation base — the key to stimulating the emergence of innovation and systemic iteration. It answers the question of "is it vibrant?"**

This determines whether a city can accommodate diverse external talent and emerging industries, enabling different populations and sectors to interact and collide at high frequency in everyday spaces, thereby continuously generating new combinations and allowing innovation to emerge organically.

Innovation Intensity: **Measured by the capacity to convert innovation into economic efficiency, factor inputs, and institutional effectiveness, this dimension supports the high-performance operation of "people, capital, and institutions" — the core embodiment of a city's global innovation competitiveness. It answers the question of "is it powerful?"**

This determines whether a city can efficiently convert high-intensity R&D investment and human capital, supported by a mature and facilitative business environment, into productivity gains and industrial value — achieving deep transmission from "factor input" to "substantive output."

Innovation Connectivity: **Measured by a city's nodal capacity and depth of bidirectional flows within the global innovation network, this dimension extends the channels for cross-regional allocation of knowledge, capital, and technology — the hallmark of a city's advancement toward becoming a top-tier global innovation node. It answers the question of "is it connected?"**

This determines whether a city can occupy a topological position of strategic value within the global innovation landscape, enabling its internal innovation ecosystem and the global network to form a bidirectional empowerment loop.

The four dimensions are mutually reinforcing and dynamically coupled: Density determines whether a city can agglomerate; Abundance determines whether a city can accommodate diversity; Intensity determines whether a city can generate value; and Connectivity determines whether a city can form networks. Together they point toward a self-evolving "innovation rainforest."

Table 1 Indicator System of Innovative Cities

Objectives	Indicators	Definition
Innovation Density	High-level Papers per Million Inhabitants	Measures the overall scale and spatial concentration of high-quality knowledge production within the region. The *Nature Index* Share value — reflecting a city's contribution to publications in 145 designated high-impact journals — serves as the core metric.
	Patents per Million Inhabitants	Measures the overall volume of technology development and intellectual property creation within the region. The indicator is computed based on granted invention patents and Patent Cooperation Treaty (PCT) patent data, expressed as the number of patents per million inhabitants across cities.
Innovation Abundance	Urban Innovation Vitality	Captures the frequency and spatial distribution of human nighttime activities as a proxy for innovation-related production, consumption, and public service activity — interpreted as the "nighttime density of economic activity" rather than direct innovation output. High-precision nighttime light remote sensing data, combined with built-up area boundaries, are used to quantify the intensity and dynamic changes of innovation-driven economic activity within cities.
	Attractiveness & Inclusiveness for Migrant Population	Measures a city's capacity to attract and integrate external talent. For mainland China, the indicator is primarily calculated as the proportion of non-registered (non-hukou) permanent residents in the total resident population; for other countries and regions, it is derived from a composite of net population growth and the share of immigrant population.
	Startup Incubation Level	Derived from a composite of the number of incubation platforms and unicorn enterprises. Calculated by weighting the number of certified technology business incubators and maker spaces against the number of unicorn and potential unicorn enterprises.
Innovation Intensity	Total Labor Productivity	Measures the output efficiency per unit of labor input, calculated as regional GDP divided by the average number of employed persons in the region.
	R&D Intensity	Measures the level of resource allocation to R&D activities and its structural share of total economic output. Calculated as gross domestic expenditure on R&D (GERD) divided by city GDP.
	Business Environment Maturity	Evaluates the convenience, fairness, and regulatory quality of the regional market environment. Drawing on the methodology of the World Bank's Business Ready (B-READY) report or equivalent frameworks, the indicator aggregates scores across dimensions including starting a business, obtaining construction permits, and access to credit.
Innovation Connectivity	Technology Exchange Activity	Measures the vibrancy of technology commercialization and knowledge flows within the regional economy. Calculated as a composite of the annual value of registered technology contracts divided by GDP and the number of internationally recognized academic events hosted by the city.
	Direct Investment (FDI+OFDI)	Measures the region's two-way participation in global innovation resource allocation. Typically computed as the combined annual value of foreign direct investment (FDI) inflows and outward direct investment (OFDI) outflows.

3.2.2 Overall Assessment

Based on a comprehensive assessment using the four-dimensional framework of "Innovation Density – Innovation Abundance – Innovation Intensity – Innovation Connectivity" and 10 indicators, the composite scores of the 20 sample cities range from 62.43 to 90.31 — a spread of nearly 28 points — indicating that innovation resources exhibit a high degree of agglomeration at the city level. This finding is broadly consistent with the global innovation landscape revealed by the World Intellectual Property Organization (WIPO): significant capability thresholds exist between apex nodes and foundational tiers, and competition among innovation cities is no longer about leadership in any single indicator, but rather the systemic integration of knowledge origination, ecosystem vitality, conversion efficiency, and global connectivity.

(1) Ranking Tiers

Ranked by composite score from highest to lowest, the 20 sample cities can be classified into four tiers (see Table 2), exhibiting a hierarchical structure characterised by "Global Innovation Highlands – Steady-State Nodes – Structural Transition – Systemic Cultivation."

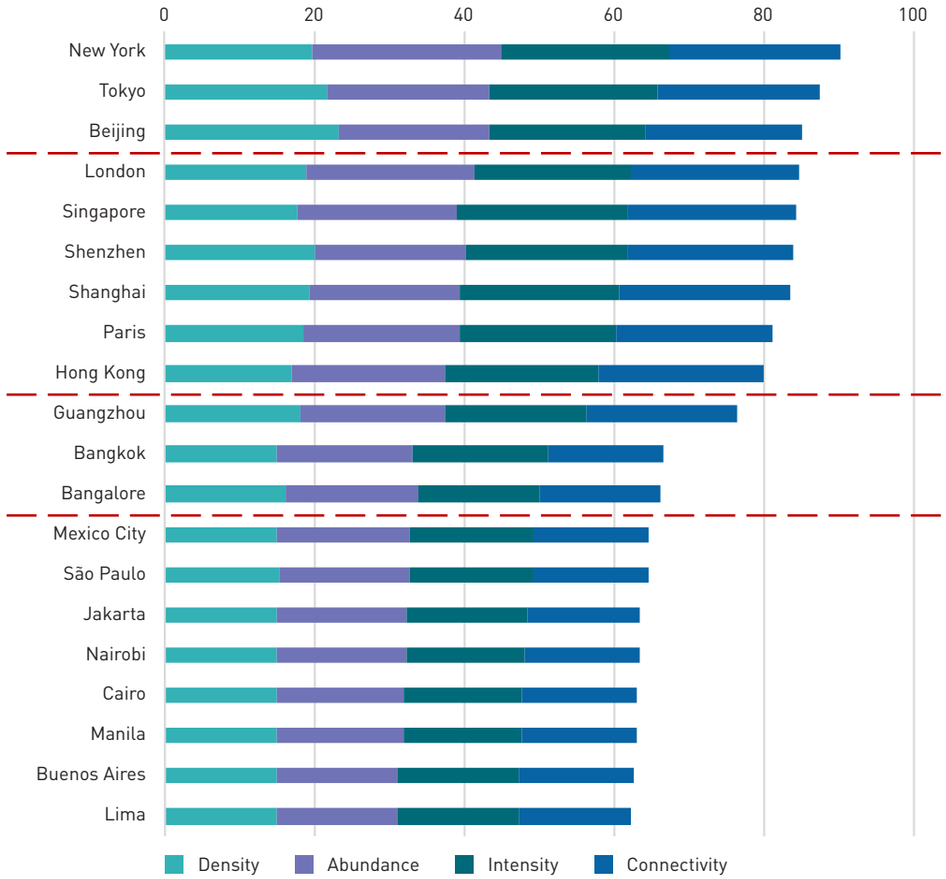


Figure 2 Tier Performance

Tier 1

Score>85: Comprising New York, Tokyo, and Beijing

The defining characteristic is leadership across all four dimensions, constituting apex innovation systems capable of simultaneously organising knowledge production, ecosystem cultivation, conversion efficiency, and global networking — serving as core nodes that govern global technology transfer and knowledge origination. New York ranks first in both Abundance and Connectivity, exhibiting a finance-and-talent-hub-driven "omnidirectional node" profile. Tokyo achieves scores above 86 in all four dimensions, displaying the highest degree of balance in the sample — a reflection of the deep coupling of government, industry, and academia under the Gijutsu Rikkoku ('technology-based nation') tradition. Beijing ranks first in Density across the entire sample, reflecting the high-density accumulated advantage in fundamental research under the concentrated deployment of national strategic science and technology capabilities. Together, these three cities represent the most mature form of innovation development, capable of deeply coupling knowledge creation, ecosystem cultivation, and factor networks into a self-reinforcing steady-state closed loop.

Tier 2

80<Score≤85: Comprising London, Singapore, Shenzhen, Shanghai, Paris, and Hong Kong

six cities that are overall robust and possess notable global competitiveness in one or two dimensions. London, Singapore, and Hong Kong exhibit a "high Abundance – high Connectivity" structure, leveraging their positions as global financial hubs with high-intensity cross-border capital flows to construct "compact yet refined" globally connected nodes. Singapore further achieves the highest scores in Total Labor Productivity and Business Environment Maturity, topping Innovation Intensity. Shenzhen records the highest R&D Intensity in the entire sample, with its "enterprise-led" R&D paradigm reflected in high-intensity conversion capacity. Shanghai leads mainland cities in Technology Exchange Activity, having accomplished its transition to a "Science and Technology Innovation Centre." Paris maintains regional influence through its European institutional framework and startup incubation ecosystem. Shenzhen ranks first among non-capital innovation cities in mainland China, with a marginal gap to London and Singapore, having substantively entered the first echelon of global innovation cities and possessing strong potential to advance into Tier 1

Tier 3

65<Score≤80: Comprising Guangzhou, Bangkok, and Bangalore

three cities in a transitional phase of rapid innovation factor agglomeration and structural transformation. Guangzhou, leveraging its manufacturing base and Greater Bay Area synergies, has achieved relatively high levels in Technology Exchange Activity, yet Startup Incubation Level and Total Labor Productivity retain room for improvement — reflecting that the conversion capacity for the transition from "manufacturing powerhouse" to "innovation powerhouse" requires further enhancement. Bangalore, capitalising on its engineering talent dividend and language advantage, demonstrates vitality in Attractiveness & Inclusiveness for Migrant Population and technology outsourcing. Bangkok serves as an active innovation node among emerging Southeast Asian economies. It should be noted that Tier 3 exhibits an internally asymmetric structure of "tight at the top and loose at the bottom": Guangzhou approaches the Tier 2 threshold, while Bangkok and Bangalore remain at the initial stage of ascending to higher tiers. All three cities retain further room for improvement in the systematisation of knowledge origination and control over global networks.

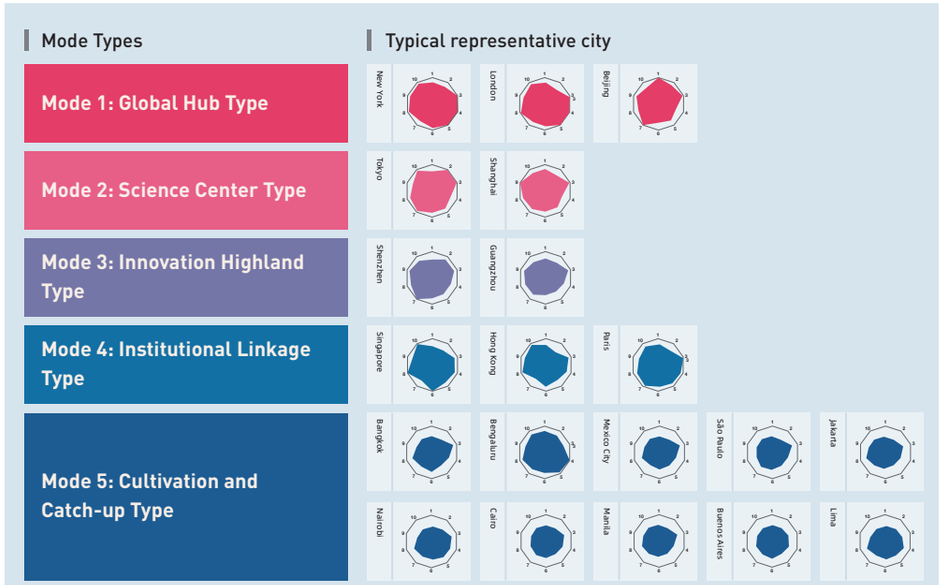
Tier 4

Score≤65: Comprising Mexico City, São Paulo, Jakarta, Nairobi, Cairo, Manila, Buenos Aires, and Lima

eight cities that are predominantly core cities of developing countries in the Global South undergoing rapid urbanisation, with scores concentrated in the 62–65 baseline band. The defining characteristic is that all four dimensions are at the foundational capacity-building stage, with infrastructure support, talent attraction, and capital vitality retaining room for improvement. These cities exhibit localised vitality in Abundance — Urban Innovation Vitality scores for Mexico City and São Paulo both exceed 82 — while High-level Papers per Million Inhabitants, R&D Intensity, and Direct Investment (FDI+OFDI) remain on an upward trajectory; the closed loop of knowledge output, technology conversion, and capital circulation is still in formation. This tier is at a critical window for converting factor dividends into innovation dividends.

(2) Performance Profile

While tier classification reflects differences in capability level, pattern classification reveals structural pathways. Examining the internal structure of the four dimensions and ten indicators across cities, the 20 cities do not arrange themselves along a single linear ladder but rather exhibit differentiated modes of innovation organisation. This study identifies five typical patterns to distinguish the sources of advantage and optimisation pathways for different cities.



1 High-level Papers per Million Inhabitants
2 Patents per Million Inhabitants
3 Urban Innovation Vitality
4 Attractiveness & Inclusiveness for Migrant Population
5 Startup Incubation Level
6 Total Labor Productivity
7 R&D Intensity
8 Business Environment Maturity
9 Technology Exchange Activity
10 Direct Investment (FDI+OFDI)

Figure 3 Typology of Innovation Patterns

Table 2 Pattern Classification and Characteristics

Type	Cities	characteristic
Global Hub	New York, London, Beijing	The overarching characteristic is simultaneous leadership across all four dimensions, forming a self-reinforcing steady-state closed loop. These cities serve as core nodes through a synergistic structure of "fundamental research – industrial conversion – capital allocation – global networking." New York, leveraging Wall Street, constitutes a global capital allocation centre; simultaneously, the post-industrial entrepreneurial ecosystems of Silicon Alley and the Brooklyn Navy Yard are flourishing. The two mutually reinforce each other, together forming a "knowledge–talent–capital" triple hub. London integrates multinational headquarters, research institutions, and historic urban fabric into a "knowledge–capital–culture" hub through the King's Cross Knowledge Quarter. Beijing, through the coordinated 'Three Science Cities and One Zone' framework — Zhongguancun Science City, Huairou Science City, Future Science City, and the Beijing Economic-Technological Development Area — coupled with accelerated international science and technology exchanges, achieves simultaneous leadership in Density and a high position in Connectivity. The essence of this pattern lies in a city's topological position within the global innovation network.
Science Centre	Tokyo, Shanghai	The overarching characteristic is a foundation of national-level research systems and comprehensive research universities, with Innovation Density as a robust leading dimension supported by mature Intensity and Connectivity — constructing a "dual-wheel" output capacity in high-level papers and patents. Tokyo, through the synergy of the Greater Shinagawa R&D Axis and Tsukuba Science City, generates intensive application-patent output driven by corporate headquarters R&D clusters. Shanghai, through Zhangjiang Science City's integration of national laboratories, multinational R&D centres, and domestic innovation enterprises, leads mainland cities in Technology Exchange Activity. The key lesson lies in sustained, stable public investment and the spatial organisation of government-industry-academia-research coupling.
Innovation Highland	Shenzhen, Guangzhou	The overarching characteristic is above-average Intensity (particularly R&D Intensity) and moderate-to-high Abundance, with Density and Connectivity in a consolidation phase. These cities, with enterprises serving as the principal innovation agents and industrial value chains providing traction, efficiently convert high-intensity R&D investment into patents and products. Shenzhen's gross R&D expenditure as a share of GDP has ranked first among mainland Chinese cities for many consecutive years, with enterprise R&D investment accounting for over 90%. Huaqiangbei, within approximately 1.45 square kilometres, achieves a 24-hour closed loop spanning "chips – components – finished products – industrial design." Guangming Science City and the Xili Lake International Science and Education City are systematically consolidating the depth of fundamental research. Guangzhou maintains steady performance in Urban Innovation Vitality and Technology Exchange Activity, though the R&D expenditure scale of its leading domestic enterprises requires further strengthening. The core logic of this pattern is that "the industrial chain is the community" — R&D investment can only be efficiently converted when embedded within a high-density industrial ecosystem.
Institutional Connectivity	Singapore, Hong Kong, Paris	The overarching characteristic is leadership in Intensity (Business Environment Maturity) and Connectivity (Direct Investment (FDI+OFDI)), while Density is objectively constrained by the scale of the domestic market. These cities amplify the global circulation efficiency of limited factors through institutional dividends and rule-of-law frameworks: Singapore's one-north achieves the ultimate intensification of factors through a tripartite arrangement of "Economic Development Board – JTC Corporation – National Research Foundation." Hong Kong's Central–Admiralty corridor provides a "one-stop" interface for global capital entering and exiting the Greater Bay Area through its common-law system. Paris concentrates European entrepreneurial resources through single mega-scale campuses such as Station F. This pattern demonstrates that innovation capacity does not necessarily depend on scale, but can achieve disproportionate impact through institutional precision.
Cultivation and Catch-up	Bangkok, Bangalore, Mexico City, São Paulo, Jakarta, Nairobi, Cairo, Manila, Buenos Aires, Lima	The overarching characteristic is that all four dimensions are at a foundational cultivation level, with the ecosystem progressively forming a systemic closed loop — yet internally exhibiting differentiated pockets of vitality. In Bangalore's Koramangala district, a low-cost, walkable neighbourhood of less than 10 square kilometres has incubated dozens of unicorns including Flipkart, Swiggy, Ola, and Razorpay, demonstrating a 'grassroots entrepreneurial rainforest' pathway toward Abundance. Bangkok and Mexico City lead locally in Urban Innovation Vitality and Attractiveness & Inclusiveness for Migrant Population, while Startup Incubation Level and cross-border capital flows remain in cultivation. For this tier, the key lies in prioritising fundamental research investment, international institutional alignment, and the supply of affordable innovation spaces as breakthrough priorities — expanding from localised steady states toward a full-dimensional network.

3.2.3 Assessment by Objective

(1) Innovation Density

The Innovation Density dimension measures a city's capacity for high-end agglomeration in knowledge production and technological output, with a core focus on whether a city can form a recognizable "knowledge-density highland" within the global innovation landscape. This dimension is assessed comprehensively through two indicators — High-level Papers per Million Inhabitants and Patents per Million Inhabitants — quantifying a city's absolute positional advantage at the apex of the global innovation value chain from both the fundamental research and applied technology ends.

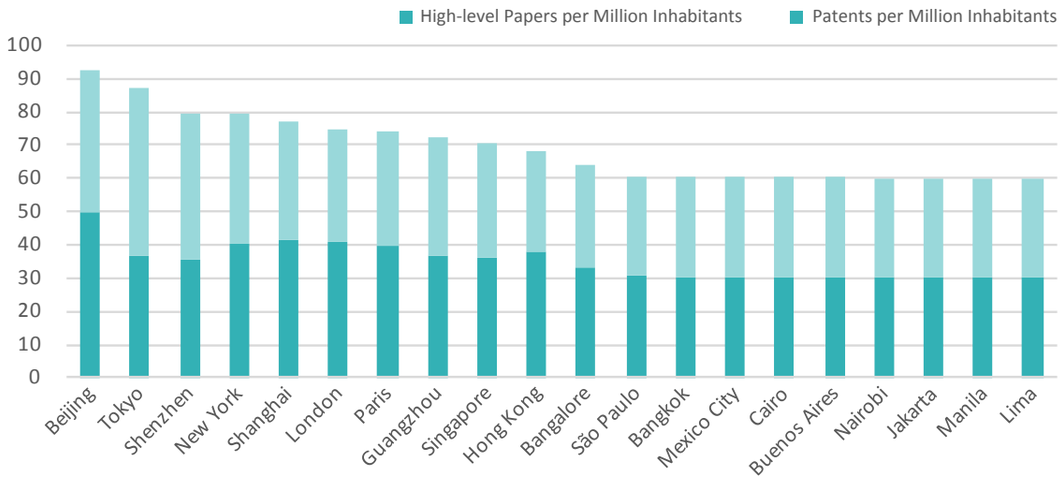


Figure 4 Innovation Density Scores by City

The Innovation Density dimension exhibits a pronounced "steep apex, flat base" pyramidal structure. Beijing occupies the top position, embodying the deep fundamental research endowment of a city serving as the nation's core strategic science and technology platform — the university cluster, national laboratory system, and disciplinary depth of the Chinese Academy of Sciences system have, over the past decade-plus, continuously underpinned Beijing's global leadership in the *Nature Index* city rankings. Tokyo follows closely, reflecting Japan's "technology-based nation" tradition of enterprise-led, application-oriented R&D, as well as its refined university–enterprise collaborative innovation network and well-established intellectual property management system. Shenzhen ranks immediately behind Tokyo and Beijing, with PCT international patent applications maintaining first place among Chinese cities for many consecutive years — a direct reflection, at the indicator level, of the "enterprise-led, market-oriented, deep industry–academia–research collaboration" Shenzhen innovation paradigm; however, high-level paper output retains room for improvement, reflecting that a city excelling in applied R&D remains in a phase of systematic reinforcement of its depth in fundamental research.

Cities in the leading cohort — Beijing, Tokyo, New York, and Shanghai — simultaneously maintain high performance in both papers and patents. Their common characteristic is the formation of a steady-state innovation ecosystem in which "apex research institutions – leading enterprises – venture capital" are deeply interlocked: New York, through the bidirectional linkage between Wall Street capital and industrial R&D, has established powerful knowledge–technology coupled output capacity in frontier fields such as biomedicine and artificial intelligence; Shanghai, through Zhangjiang Science City's deep integration of its manufacturing base with fundamental research, maintains balanced leadership in both papers and patents. London and Paris, while prominent in paper output, exhibit relatively moderate patent output — reflecting the structural characteristic of European cities where university and public research systems predominate while enterprise R&D is more evenly distributed. Singapore and Hong Kong represent typical "offshore" innovation nodes — both achieve considerable high-level paper output, while patent output scale is objectively constrained by the size of their domestic industrial base. Manila, Lima, Nairobi, and other cities have scores concentrated around the 60-point benchmark level, reflecting that they remain at a foundational stage at the apex of the global innovation value chain, with R&D investment, higher education systems, and enterprise innovation actors in a continuing period of cultivation.

The core implication of Innovation Density is that high-level knowledge output and high-quality technological output are the irreplaceable "hard currency" for a city to ascend to the apex of the global innovation pyramid — neither is dispensable. The shared experience of leading cities is the sustained maintenance of high-intensity, stable public investment in fundamental research, coupled with the construction of a complete innovation chain that converts knowledge into patents and patents into products.

| Case 1 |Tokyo's Greater Shinagawa Area — A "Supply-Chain R&D Network" Interweaving Headquarters Economy and Future Living Laboratory

Tokyo achieves the highest Patents per Million Inhabitants score in the entire sample. Its spatial foundation lies not only in the traditional headquarters axis of Otemachi and Nihonbashi, but more critically in the recently launched "Greater Shinagawa Area." Within this core district of fewer than 10 square kilometres, over a hundred multinational corporate headquarters and R&D centres are concentrated, forming a "golden triangle of industry–academia–research" within walking distance of the University of Tokyo's Research Center for Advanced Science and Technology (RCAST) and the National Institute of Advanced Industrial Science and Technology (AIST).



The Greater Shinagawa Area aims to transform into a globally advanced demonstration zone for "Lifestyle Transformation." Leveraging its unique "Designated Research and Development Corporation" system and a thoroughly open, boundary-free urban district, innovation density here has been elevated to an unprecedented level: corporate researchers, university scholars, and startup teams achieve high-frequency cross-disciplinary collaboration in shared laboratories, the Link Scholars' Hub (LISH), and vibrant cultural open spaces.

Here, "the supply chain is the R&D network" has evolved into "the R&D network is the urban organism." Tokyo's paradigm demonstrates that high-level patents are by no means isolated laboratory products, but rather the inevitable emergence of deep interlocking and mutual co-creation among industrial chains, headquarters clusters, and frontier urban public scenes within a high-density Transit-Oriented Development (TOD) network.

| Case 2 | Shenzhen's Guangming Science City and Xili Lake International Science and Education City — "Dual-Engine" Reinforcement of Fundamental Research Depth



Shenzhen's PCT international patent applications have maintained first place among Chinese cities for many consecutive years, yet high-level paper output remains a structural gap. Facing the practical task of "leading at the application end, reinforcing at the foundational end," Shenzhen has deployed Guangming Science City and Xili Lake International Science and Education City as twin engines to systematically consolidate fundamental research depth and reconstruct the foundation of Innovation Density. Within a planning area of 99 square kilometres, Guangming Science City concentrates multiple major science facilities — including synthetic biology research, brain analysis and brain simulation, and materials genome — forming a synergistic matrix of "facilities + laboratories + universities" together with multiple research universities and key laboratories. Xili Lake International Science and Education City, anchored by the Southern University of Science and Technology and Tsinghua Shenzhen International Graduate School, constructs within approximately 70 square kilometres a full-chain platform spanning from fundamental research to industrial commercialization. The coordinated operation of these two science cities demonstrates that ascending to the apex of the global innovation pyramid requires breaking free from a singular industrial technology pathway and depends on sustained, high-intensity, stable public investment to build the "hard foundation" of fundamental research. This spatial configuration is propelling Shenzhen to gradually transition from a "patent-intensive city" relying solely on enterprise R&D toward a new paradigm of "dual-engine" advancement in both papers and patents, enriching the structural depth for high-level knowledge output.

(2) Innovation Abundance

The Innovation Abundance dimension measures the vibrancy, abundance, and capacity for sustainable renewal of a city's innovation ecosystem. Its core focus is not the "peak height" of innovation, but whether the "base" upon which innovation occurs is sufficiently broad and dynamic. This dimension is assessed comprehensively through three indicators: Urban Innovation Vitality, Attractiveness & Inclusiveness for Migrant Population, and Startup Incubation Level. This indicator combination inherits the classical proposition advanced by et al. in *The City as Innovation Machine*: "the foundation of innovation lies in the high-density mixture of population, activity, and space."

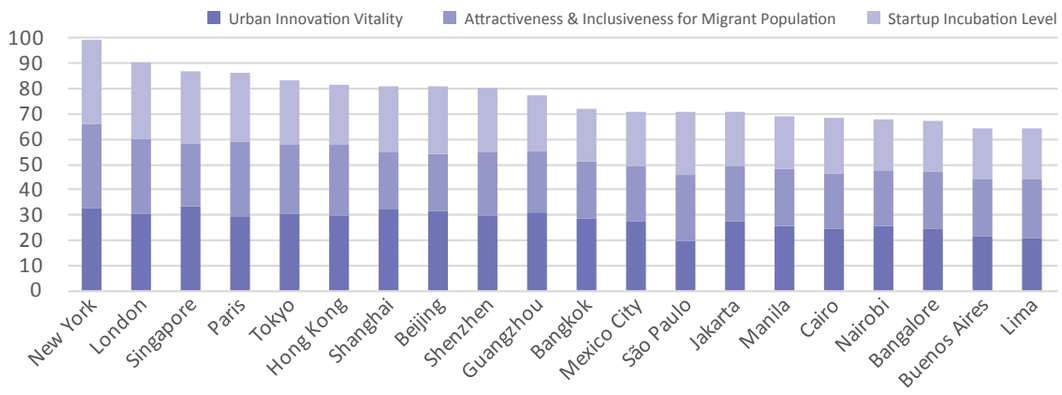


Figure 5 Innovation Abundance Scores by City

If Innovation Density emphasizes "how strong is the output," Innovation Abundance focuses on whether a city internally possesses sufficiently rich innovation actors, talent sources, entrepreneurial scenes, and new economic activities. The score distribution of this dimension forms a stark contrast with the Density dimension — the gap among top cities narrows significantly, with the top ten cities all scoring above 77. New York leads globally, with all three indicators approaching or reaching full marks; as the world's foremost centre for immigration and net talent inflow, the leading concentration of unicorn enterprises, and a global metropolis with an exceptionally vibrant nighttime economy, it presents a profile of outstanding comprehensive advantages. London, Tokyo, and Singapore rank among the leaders; Tokyo achieves the highest Urban Innovation Vitality, reflecting the extreme density of nighttime economy and industrial activity in a mega-metropolitan region, yet its Attractiveness & Inclusiveness for Migrant Population retains room for improvement — reflecting a structural tension between high economic density and population internationalization that requires further reconciliation. Singapore demonstrates the typical "small but exquisite" open-city form through its pronounced advantages in Attractiveness & Inclusiveness for Migrant Population and unicorn incubation capacity.

The four mainland Chinese cities in the assessment (Shanghai, Beijing, Shenzhen, Guangzhou) form a compact "sub-apex cluster," with Urban Innovation Vitality scores all above 89 — reflecting that Chinese megacities have reached the global forefront in terms of economic activity intensity within built-up areas. The internal structure across three indicators merits attention: Shenzhen leads Beijing and Shanghai in Attractiveness & Inclusiveness for Migrant Population, constituting the mainland city with the highest population mobility as an innovation node — a consequence of both Shenzhen's institutional tradition of openness encapsulated in the ethos "once you arrive, you are a Shenzhen person," and the sustained gravitational pull created by its youthful demographic structure and industrial opportunity provision. At the same time, it should be noted that the four cities of Beijing, Shanghai, Shenzhen, and Guangzhou retain approximately 10 points of advancement space compared to New York, London, and Singapore in the Attractiveness & Inclusiveness for Migrant Population indicator — signalling considerable room for improvement in attracting internationally high-end talent and establishing transnational talent circulation mechanisms. In terms of Startup Incubation Level, Beijing and Shanghai slightly outperform Shenzhen, indicating that comprehensive science and innovation centres maintain a modest edge in unicorn cultivation density; Guangzhou is still in an acceleration phase on the incubation dimension, and moving from "abundant" to "frontier" still requires systematically consolidating the frontier technology startup cultivation system.

In the middle band, Bangkok, Mexico City, and Bangalore constitute another Abundance mode: Bangalore's Attractiveness & Inclusiveness for Migrant Population is comparable to that of first-tier cities, reflecting the strong gravitational pull of "India's Silicon Valley" on domestic and international technology talent. Bangkok and Mexico City more prominently demonstrate relative leadership in nighttime economy vitality and population mobility openness, while Startup Incubation Level retains significant room for improvement. Buenos Aires and Lima score within the baseline band of the sample, reflecting innovation ecosystems still at an early stage.

The core mechanism revealed by Innovation Abundance is: innovation is not merely the output of knowledge and technology, but an emergent phenomenon rooted in urban space, continuously catalyzed by diverse populations and high-density activities. For innovation cities such as Shenzhen at the ascension stage, the key for the next phase lies in further enhancing attractiveness to top international talent — through more advanced international talent management systems, internationalized education and healthcare services, cross-border professional qualification mutual recognition, and other systematic provisions — while upgrading incubators, accelerators, and industrial parks toward an ecological model to elevate global unicorn incubation capacity to new heights.

| Case 3 | New York's Brooklyn Tech Triangle and Silicon Alley — The "Innovation Machine" of Post-Industrial Mixed-Use Neighbourhood Regeneration



The underlying logic of New York's global leadership in Innovation Abundance lies in the post-industrial neighbourhood cluster formed by Manhattan's "Silicon Alley" and the Brooklyn Navy Yard. Within approximately 2 square kilometres of former office buildings from the Flatiron District, Silicon Alley concentrates over ten thousand technology startups, accelerators, and venture capital firms — embedding entrepreneurial activity deeply within the urban fabric through the adaptive reuse of ground-floor historic buildings and co-working spaces. The Brooklyn Navy Yard, as a critical anchor of the Brooklyn Tech Triangle, has transformed a century-old shipyard into an approximately 1.2-square-kilometre "advanced manufacturing and innovation ecosystem community," retaining its industrial land-use designation while introducing 3D printing, robotics, medical devices, and green technology, supplemented by incubators and skills training centres. The core insight is that Innovation Abundance does not derive from the mechanical accumulation of factors, but from the high-density spatial mixture of "old spaces + new economy + diverse populations." This mixed, flexible, and inclusive spatial supply eliminates barriers to entry, allows tacit knowledge to spill over naturally within daily walking radius, and ensures the continuous occurrence of the emergent process whereby innovation moves from idea to prototype and from prototype to market.

| Case 4 | Bangalore's Koramangala — A Global South Catch-Up Pathway Through Low-Cost Walkable Neighborhoods



Within fewer than 10 square kilometres encompassing Koramangala and adjacent neighbourhoods in Bangalore, dozens of unicorn enterprises have been incubated — including Flipkart, Swiggy, Ola, and Razorpay — earning the area recognition as "India's startup core district." As a quintessential Global South developing-country catch-up pathway, its Innovation Abundance does not depend on capital-intensive mega-scale high-specification parks, but rather on affordable housing, co-working spaces, and café-style "third spaces," combined with the high-frequency circulation of young talent enabled by proximity to top universities. Weekend hackathons, founder community events, and angel investor meetups occur spontaneously and at high frequency at the neighbourhood scale, forming a "live–work–socialize" highly mixed grassroots entrepreneurial ecosystem. This experience suggests to emerging cities: the key to Innovation Abundance is not enclosed industrial parks with high capital investment, but low-threshold, affordable, walkable mixed-use neighbourhoods. By providing spatial assets with low experimentation costs, enabling diverse talent, grassroots capital, and entrepreneurial ideas to collide naturally within daily radius, cities can equally incubate innovation ecosystems of remarkable vitality.

(3) Innovation Intensity

The Innovation Intensity dimension measures a city's deep capacity to convert innovation factors into economic output and institutional effectiveness, with a core focus on the transmission efficiency and structural quality among "inputs – institutions – outputs." This dimension is assessed comprehensively through three indicators: Total Labor Productivity, R&D Intensity, and Business Environment Maturity. These three indicators correspond respectively to the input and efficiency states of three categories of critical innovation factors — "people, capital, and institutions" — embodying the emphasis of the OECD in The *Oslo Manual* that "innovation is not merely a function of outputs, but a product of the synergy among input quality, process efficiency, and the institutional environment."

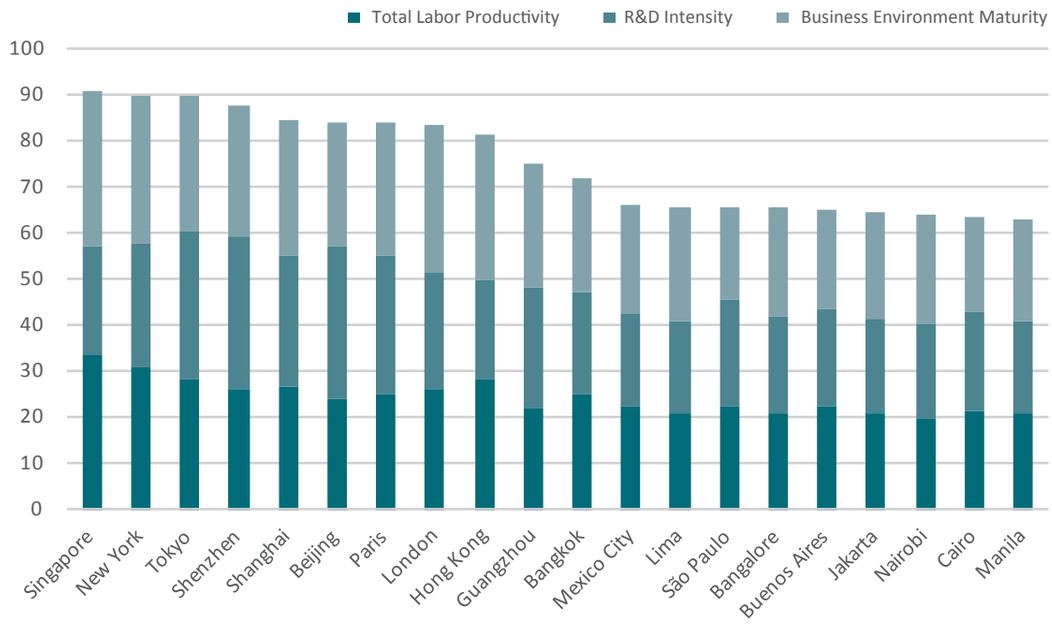


Figure 6 Innovation Intensity Scores by City

Compared with "Density–Abundance," Innovation Intensity places greater emphasis on the input density and operational efficiency per unit of economic system. This dimension exhibits the most pronounced "tiered stratification" pattern. The first tier (Singapore, New York, Tokyo, Shenzhen) — four cities with closely clustered scores yet distinct pathways: Singapore achieves the highest sample values in both Total Labor Productivity and Business Environment Maturity (approaching the upper bound after standardization), exemplifying how a city-state, through ultimate institutional design, converts limited factors into the world's highest economic efficiency — from "one-stop government services" to the world's shortest time to start a business, demonstrating the multiplier effect of institutional dividends on Innovation Intensity. New York ranks second with a balanced combination of Total Labor Productivity and Business Environment Maturity, reflecting its long-term accumulation as a global hub for finance, professional services, and high-end commerce. Tokyo's high score in R&D Intensity highlights the resource-input tradition of the "technology-based nation."

Shenzhen ranks fourth, with R&D Intensity at the top of the entire sample — directly reflecting Shenzhen's long-standing high-intensity R&D transmission mechanism with enterprises as the principal actors. Gross R&D

expenditure as a share of GDP has ranked first among mainland Chinese cities for many consecutive years, with enterprise R&D investment accounting for over 90%. The R&D expenditure scale of leading enterprises — Huawei, Tencent, BYD, DJI, among others — ranks among the world's foremost; private technology enterprises serve as both the primary funders and primary executors. This "enterprise-led" R&D structure forms a distinct contrast with Singapore's "institution-led" model and Tokyo's "supply-chain-led" model, constituting Shenzhen's unique innovation-driven pathway. Shenzhen's Business Environment Maturity leads domestically, yet maintains a certain gradient relative to Singapore, New York, and London — implying continued space for deepening in areas such as intellectual property protection intensity, facilitation of cross-border factor flows, and alignment with high-standard international rules.

Following thereafter, Shanghai, Beijing, Paris, London, Hong Kong, and other cities each possess distinct characteristics, collectively revealing an important mechanism — Innovation Intensity is not about extreme leadership in any single indicator, but about whether the three factors can form a balanced structure of mutual complementarity and mutual reinforcement. Guangzhou retains a certain gradient relative to the above cities, with the advancement of Total Labor Productivity as the next-phase priority; Tier 4 cities have systematic space for sustained intensification of R&D Intensity and institutional environment development.

The core implication of Innovation Intensity is: high-quality innovation output necessarily rests upon high-intensity R&D investment, high-efficiency factor combination, and a high-maturity institutional environment. For Shenzhen, leadership in R&D Intensity across the full sample has become the most distinctive "Shenzhen characteristic." The next phase should build upon this foundation by continuing to optimize the internationalization of the business environment; further stimulating structural advancement in Total Labor Productivity through market-oriented factor allocation reforms; and, through "pioneering and bold" institutional opening-up aligned with high-standard international economic and trade rules, converting the "hard input" advantage in R&D into the "soft power" of innovation efficiency.

| Case 5 | Singapore's one-north — "Institution as Productivity" Through Ultimate Factor Intensification



Situated on approximately 200 hectares in southwestern Singapore and operated holistically by JTC Corporation, one-north represents a paradigmatic example of "institutional dividends" converting into "Innovation Intensity." The park is organized into thematic precincts — biomedical sciences, ICT/media, among others — compressing national research institutions, multinational corporate R&D centres, startup accelerators, residential apartments, and lifestyle amenities within walkable ecosystem. Its core experience lies in the fact that, under objective constraints of limited geographic hinterland and factor scale, the tripartite administrative design of "Economic Development Board – JTC Corporation – National Research Foundation" provides "one-stop" policy, land, and funding support that transcends bureaucratic silos. Leveraging the world's shortest time to start a business, the most comprehensive intellectual property protection, and the most open talent visa regime, one-north converts every square metre of land and every unit of investment into the highest-efficiency innovation output through ultimate institutional arrangements. This demonstrates that high-quality Innovation Intensity is critically dependent on operational efficiency — when Total Labor Productivity and Business Environment Maturity reach their apex simultaneously, the institution itself becomes the most important factor of production.

(4) Innovation Connectivity

The Innovation Connectivity dimension measures a city's nodal capacity and hub status within the global innovation network, with a core focus not on a city's internal innovation stock, but on the connection density and depth of bidirectional flows between a city and external innovation systems. This dimension is assessed comprehensively through two indicators: Technology Exchange Activity and Direct Investment (FDI+OFDI).

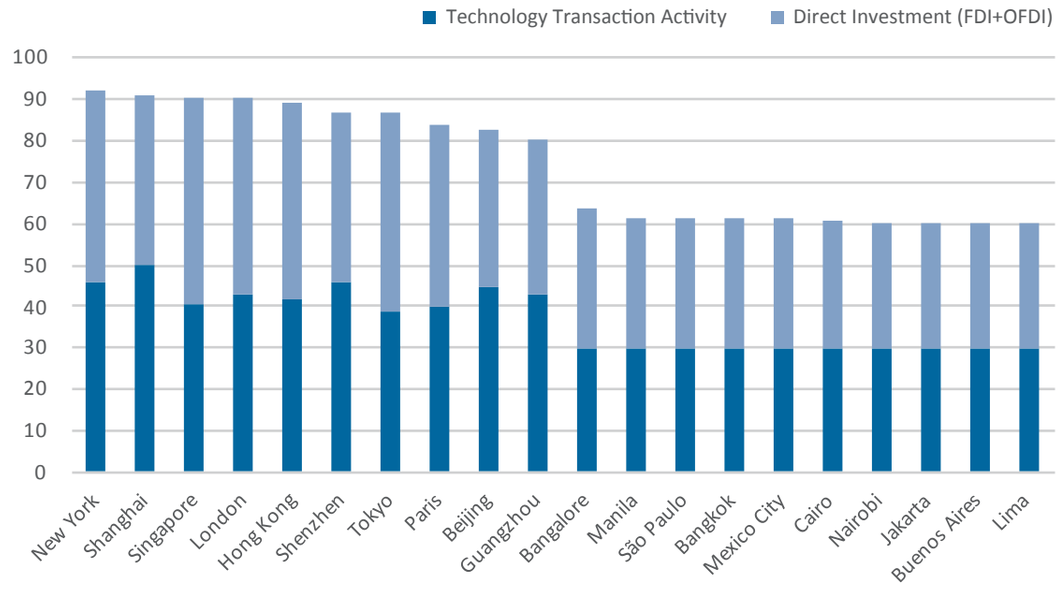


Figure 7 Innovation Connectivity Scores by City

The Innovation Connectivity dimension exhibits the most pronounced tiered differentiation among all four dimensions — the top ten cities score between 80 and 92, while from the 11th-ranked Bangalore to the 20th-ranked Lima, scores are concentrated around the 60-point baseline band, with scarcely any transitional cities in between. This hierarchical pattern of "global node cities – regional centre cities" profoundly reveals the network-based nature of Innovation Connectivity — only when a city simultaneously possesses high-density channels in all four directions of knowledge inflow, knowledge outflow, capital inflow, and capital outflow can it ascend to the core-node position within the global innovation network.

New York holds a firm first-place position, fully embodying its status as the core hub for bidirectional flows of global financial capital and industrial capital, and reflecting Wall Street's powerful traction on innovation investment as a capital allocation centre. Shanghai's outstanding performance reflects the significant enhancement of technology market vitality under the China (Shanghai) Pilot Free Trade Zone and the advancement of International Science and Technology Innovation Centre development, as well as the sustained promotion of global knowledge flows through international platforms such as the China International Import Expo and the World Artificial Intelligence Conference. Singapore and London rank virtually tied for third: Singapore achieves a full score in Direct Investment (FDI+OFDI), perpetuating its traditional advantage as Southeast Asia's financial and headquarters economy centre; London maintains its position as Europe's core financial and technology hub through a balanced combination of Technology Exchange Activity and Direct Investment (FDI+OFDI). Hong Kong sustains its traditional advantage as an international financial centre through a high score in Direct Investment (FDI+OFDI).

Shenzhen ranks 6th in the sample, with Technology Exchange Activity second only to Shanghai among mainland cities — reflecting the enormous volume of Shenzhen's technology contract transactions. Shenzhen–Hong Kong science and technology cooperation and collaborative innovation within the Guangdong–Hong Kong–Macao Greater Bay Area have formed a distinctive cross-border network in technology factor flows. Direct Investment (FDI+OFDI) is currently in an intensification phase; compared with established international financial nodes such as New York, London, Singapore, and Hong Kong, room for advancement remains. Shenzhen's attributes as an international financial hub require further strengthening, with headquarters economy internationalization, offshore finance functions, and cross-border RMB business serving as priority directions for subsequent expansion. In the second echelon, Bangalore leads, with its Direct Investment (FDI+OFDI) reflecting India's international connectivity as a global software outsourcing and technology capital recipient. Cities such as Manila, São Paulo, Bangkok, and Mexico City remain at an early cultivation stage in terms of deep embedding within the global innovation network.

The core implication of Innovation Connectivity is: in today's era of deepening globalization, a city's innovation capacity depends not only on its own factor accumulation, but equally on its topological position within the global innovation network. Comparative research between the Guangdong–Hong Kong–Macao Greater Bay Area and the San Francisco Bay Area has already demonstrated that bay-area-level cross-border collaboration is often the critical pathway for advancing a city's Innovation Connectivity. For Shenzhen, deep Shenzhen–Hong Kong collaboration, facilitation of cross-border factor flows within the Greater Bay Area, agglomeration of international science and technology headquarters, and construction of a "Shenzhen–Global" innovation cooperation network constitute the priority directions for enhancing Innovation Connectivity in the next phase. Simultaneously, building upon the comparative advantage already established in Technology Exchange Activity, the focus should shift to expanding cross-border capital flow facilitation — advancing Shenzhen's upgrade from a "technology hub" to a "technology + capital dual hub," thereby genuinely ascending to the ranks of apex nodes within the global innovation network.

| Case 6 | Hong Kong's Central–Admiralty — The "Greater Bay Area Interface" of Cross-Border Capital and Rule of Law



The Central–Admiralty core district, spanning approximately 1.5 square kilometres from the HSBC Main Building to Pacific Place, constitutes the spatial origin point of Hong Kong's role as an international financial centre and the Greater Bay Area's "cross-border capital – rule-of-law hub" — perfectly mapping Hong Kong's high positional advantage in cross-border capital flows. Concentrated here are the Hong Kong Exchanges and Clearing Limited (HKEX), the Asia-Pacific headquarters of over a hundred global financial institutions, the International Arbitration Centre, and top-tier international law firms — providing global capital with "one-stop" fund routing, cross-border M&A structuring, intellectual property, and international arbitration services for entering and exiting mainland China. Hong Kong's practice profoundly reveals that a city's connectivity rank within the global innovation network ultimately depends on whether it can provide irreplaceable cross-border financial infrastructure and heterogeneous institutional interfaces. Through offering new listing rules for biotech and high-growth innovative enterprises, and "patient capital" support from transnational venture capital, it efficiently connects global innovation resources; simultaneously, leveraging its mature common-law system and international arbitration services, it fortifies the rule-of-law safeguard for the "1-to-N" commercialization of science and technology achievements in the Greater Bay Area and the global expansion of mainland enterprises. Central–Admiralty deeply aligns the traditional "finance + rule of law" advantages with the industrial depth of the Greater Bay Area, becoming not only a hub for cross-border capital agglomeration, but also a bridgehead leading regional collaborative innovation and institutional convergence.

3.2.4 Insights and Recommendations

The comparative analysis of 20 global cities demonstrates that competition among innovative cities is no longer a contest of singular resources, but rather a systemic coupling of Density, Abundance, Intensity, and Connectivity. Latecomer cities must be particularly vigilant against the structural mismatch of "resource-rich yet weakly connected with low conversion efficiency."

First, consolidate Innovation Density through sustained long-term investment. High-level Papers per Million Inhabitants and Patents per Million Inhabitants constitute the irreplaceable "hard currency" for ascending to the apex of global innovation, rooted in stable public investment and a complete conversion chain from "paper → patent → product." Policy emphasis should be placed on constructing a full-lifecycle pathway encompassing "basic research—technology transaction—pilot verification—intellectual property services," leveraging public investment to reduce connection costs and trial-and-error costs, rather than substituting for market-driven technology route selection.

Second, enhance Innovation Abundance through openness and inclusiveness. Innovation is an emergent process arising from the sustained collision of diverse populations, high-density activities, and entrepreneurial scenarios: only when talent is willing to enter, stay, and collaborate can innovation transition from sporadic occurrence to everyday reality. Policy emphasis should shift from "whom to attract" to "whether they can stay, and whether they can experiment at low cost." Mixed-use land, affordable spaces, and fine-grained block structures with dense road networks should underpin the coupling of "research–industry–city," preserving flexible spaces for experimentation, prototyping, and pilot production, while configuring talent housing and "third places" to construct a "15-minute innovation living circle." Vigilance is required against high rents and excessive urban renewal that displace young talent and producer services.

Third, drive Innovation Intensity through institutional efficiency. High investment can only be converted into high output when embedded within highly efficient organizational structures and high-quality institutional environments. Singapore amplifies limited resources through institutional efficiency; Shenzhen has forged a distinctive path through enterprise-led R&D—both pointing toward a governance logic where "reducing friction" outperforms "granting incentives." Priority actions include advancing data sharing, intellectual property circulation, technology contract registration, cross-jurisdictional social security mutual recognition, and the opening of experimental application scenarios, thereby converting R&D "hard investment" into efficiency "soft power." It is recommended that functional zones—rather than administrative districts—serve as the organizational units for innovation, advancing cross-regional joint governance.

Fourth, achieve innovation leapfrogging through global connectivity. Technology Exchange Activity and Direct Investment (FDI+OFDI) are increasingly differentiating global node cities from regional centre cities. Leading cities simultaneously accommodate knowledge flows, capital flows, talent flows, and regulatory flows, forming a dual capability that integrates the localized coupling of "R&D—conversion—manufacturing" with deep embedding in global networks. Latecomer cities must transcend the singular role of "technology exporter" and, through deepening cross-border synergy and facilitating factor mobility, accelerate their ascent toward composite hubs of "technology + capital + rules," embedding themselves within the core node tier of the global innovation network.

Fifth, guide innovation governance through evaluative diagnostics. The value of the four-dimensional indicator framework extends beyond ranking—it lies in the precise diagnosis of governance shortcomings: where Density is weak, reinforce basic research platforms and industrialization pathways; where Abundance is weak, enhance spatial openness and talent inclusiveness; where Intensity is weak, optimize factor allocation and intellectual property protection; where Connectivity is weak, strengthen cross-border infrastructure and institutional interfaces. The four dimensions are progressively interlocked: Density provides the foundation for Abundance; Abundance infuses vitality into Intensity; Intensity accumulates momentum for Connectivity; and Connectivity, in turn, feeds back into Density by channeling global resources. Only by dynamically identifying shortcomings and tracking improvements through this framework can evaluation be transformed into an iterative instrument for urban innovation governance.

The competition among innovative cities is, in the final analysis, a competition of systemic capabilities. Only when the four-dimensional driving forces of "Concentrate, Accommodate, Convert, and Connect" are mutually coupled can a self-repairing, continuously evolving "innovation rainforest" be catalyzed. The key lies not in momentary resource accumulation, but in establishing the governance capacity to continuously integrate knowledge, talent, institutions, and networks into innovation momentum—making innovation the endogenous logic of urban growth.

3.3 Livability

3.3.1 Livability

(1) Understanding Livability

Livability has evolved with the changing course of urban development. It is not a fixed standard, but a concept that has been continually redefined as cities move through different stages of economic, social, and technological change. In this sense, the pursuit of livability reflects an ongoing effort to place people at the center of urban development. From the early focus on survival, sanitation, and order, cities gradually moved toward efficiency, convenience, and comfort, and later toward vitality, diversity, environmental quality, equity, resilience, and long-term adaptability. Today, livability is no longer a static description of the living environment. It is a key lens for assessing a city's overall quality, development performance, and ability to support people over time. At its core, livability asks whether a city can respond to human needs, enhance well-being, and remain stable and adaptive amid uncertainty.

Existing international livability assessments, such as the EIU Global Liveability Index and Mercer Quality of Living Ranking, tend to measure a city's capacity to provide healthcare, education, infrastructure, safety, and other essential services. In essence, they ask what a city has. In recent years, other assessments have begun to pay more attention to whether residents can access and use public resources. However, they still largely focus on static outcomes and comparisons across individual indicators. Building on this, UIS places greater emphasis on a broader understanding of livability. It looks not only at whether urban services are sufficient and accessible, but also at whether a city can support people's long-term development and maintain a dynamic balance throughout the process of urban growth.

This understanding is closely rooted in Shenzhen's own development experience. As a high-density, fast-growing, and highly mobile city, Shenzhen has gone through a compressed process of modernization over just more than

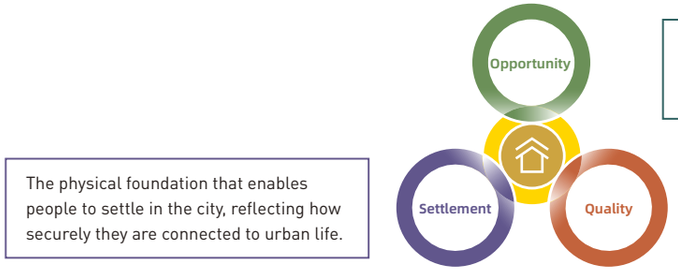


Figure 1 Framework for Livable Cities

four decades, with population growth, industrial upgrading, spatial expansion, and improvements in quality of life unfolding almost simultaneously. The city has had to create conditions for large numbers of newcomers to enter, settle, and build a stable life. At the same time, it has had to continuously improve everyday living conditions and provide space for people's long-term development. It is through this process of balancing multiple goals at once that Shenzhen has developed a livability framework centered on "Settlement, Quality, and Opportunity".

Building on this framework, UIS further develops a livability assessment system composed of three development objectives and ten indicators. The system looks not only at the performance of individual indicators, but also at the structural relationships and overall coordination among them. It aims to provide a more comprehensive picture of how cities perform on settlement, quality, and opportunity.

Settlement is about creating the basic conditions for people to establish themselves in the city. It forms the foundation for urban inclusion and long-term stability, allowing individuals to enter the city, stay, and develop a sense of belonging.

It reflects whether a city can accommodate different groups in an inclusive and stable way, provide basic security, build confidence for the future, and lay a solid foundation for continued living and development.

Quality focuses on everyday experience. It shapes a high-quality, warm, and tangible urban living environment, and represents the most direct expression of livability.

It ensures that the benefits of urban development are translated into daily life that residents can access, enjoy, and participate in. By embedding convenience, comfort, and vitality into the fabric of everyday life, the city becomes not only a place to stay, but a place worth living in.

Opportunity is driven by the possibilities for personal development. It supports the growth of individual capabilities and the realization of personal value, making it essential for a city's long-term vitality and future readiness.

It reflects whether a city can continue to provide diverse pathways and upward mobility, enabling people not only to settle, but also to grow, expand their potential over time, and contribute lasting momentum to the city's evolution.

Overall, Shenzhen's development reflects the coordinated advancement of settlement, quality, and opportunity: a city must enable people to stay, support them in living well, and create room for their continued development. It translates Shenzhen's process of pursuing multiple goals and maintaining dynamic balance into a measurable indicator system, helping to assess the overall level of urban livability.

Table 1 Indicator System of Livable Cities

Objectives	Indicators	Definition
Settlement	Housing support	Measured by a composite housing security index, including the rent burden ratio — the ratio of median urban rent to median household disposable income — and the supply rate of affordable housing, measured by the share of newly added policy-supported housing in total new housing supply.
	Basic service access	Measured by the coverage of basic public services. It reflects the share of urban areas where residents can conveniently access community services, healthcare, education, and other essential public facilities within a 15-minute living circle.
	Health and longevity	Measured by life expectancy, indicating the average number of years residents are expected to live under current social conditions. It reflects the overall level of healthcare, living environment, quality of life, and social development.
Quality	Mobility efficiency	Measured by the average one-way commuting time. It reflects the convenience of daily travel and the planning, construction, and operational efficiency of urban transport infrastructure.
	Advanced service access	Measured by the coverage of enhanced public services. It reflects the share of urban areas where residents can conveniently access commercial, cultural, sports, entertainment, and other quality-of-life facilities within a 15-minute living circle.
	Open space quality	Measured by a combination of per capita open space, accessibility to parks, green spaces, squares, and other open spaces, as well as Numbeo's Green and Open Spaces Quality Index. It reflects the comfort and quality of the living environment.
	Third-place vitality	Measured by the density of third-place facilities, including cafés, teahouses, bars, bookstores, community activity centers, and other spaces that support social interaction and leisure, per square kilometer.
Opportunity	Demographic structure	Measured by the median age of the resident population. A moderate and stable median age indicates a healthier and more dynamic population structure.
	Human capital level	Measured by the share of the population with higher education, reflecting the city's human capital and potential for innovation-driven development.
	Income level	Measured by per capita disposable income and price levels, reflecting the income residents can allocate after accounting for the cost of living.

3.3.2 Overall Assessment

Overall, the livability performance of the 20 sample cities presents a tiered pattern, shaped by each city's development stage, regional context, and overall urban capacity. Tokyo and Singapore, as mature global cities, show relatively balanced and stable performance across multiple objectives. New York, Paris, Hong Kong, Beijing, Shanghai, Guangzhou, and Shenzhen remain at a relatively high level overall, but display notable structural differences. By contrast, Global South cities such as Jakarta, Manila, and Nairobi continue to face pressure in strengthening basic urban capacities across several objectives.

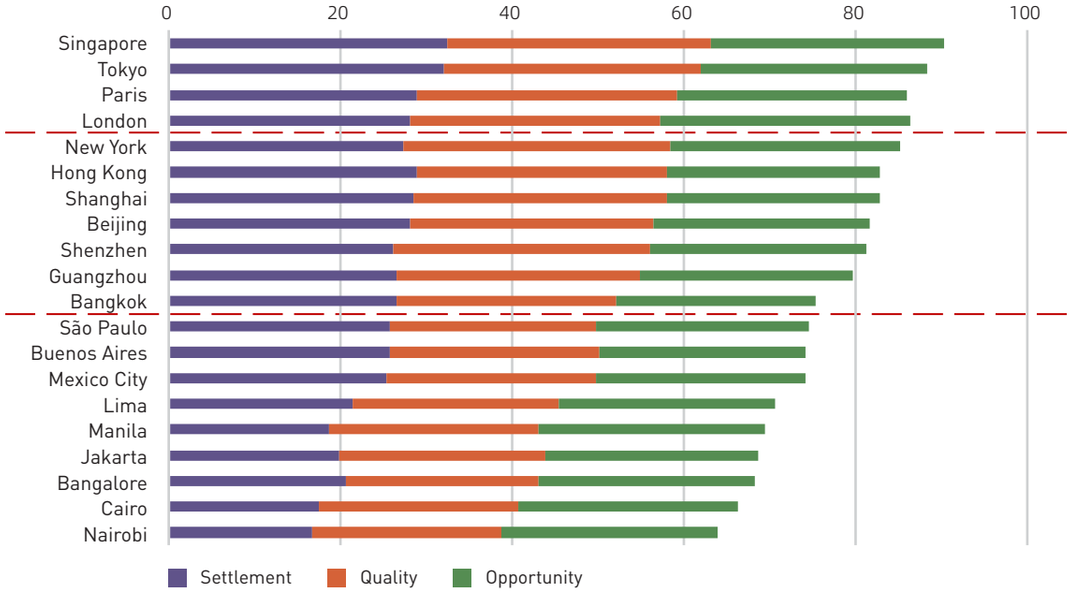


Figure 2 Tier Performance

(1) Ranking Tiers

Tier 1

score>88: Singapore and Tokyo

Singapore and Tokyo represent the highest level of livability among the sample cities. They perform strongly across the assessment framework, making them the most balanced and stable group in this assessment. Their shared strength lies in mature institutions, well-developed public service systems, and strong governance capacity, which together support stable settlement, high-quality daily life, and sustained personal development.

Tier 2

80<score≤88: Paris, London, New York, Hong Kong, Shanghai, Beijing, Shenzhen, and Guangzhou

Cities in this tier also demonstrate a high level of livability and form the main body of the assessment. They have solid overall foundations, supported by relatively complete public service systems, high-quality living environments, and a strong supply of development opportunities. Compared with Tier 1, however, their performance is less even, with variations in housing affordability, population structure, service balance, and cost of living. Their overall livability is strong, but not yet as stable or balanced as the leading cities.

Tier 3

70<score≤80: Bangkok, Buenos Aires, Mexico City, São Paulo, and Lima

Cities in this tier show a moderate level of livability. They have built certain foundations or distinctive strengths in specific areas, but their overall performance remains less stable than that of higher-tier cities. Many of them have strong urban vitality, demographic support, or regional service functions, while still facing constraints in basic urban capacity, service accessibility, environmental quality, and development opportunities. Their livability profile is therefore marked by localized strengths alongside broader structural limitations.

Tier 4

core<70: Bangalore, Jakarta, Manila, Nairobi, and Cairo

Cities in this tier have relatively lower overall livability scores and face varying pressures across the framework. Many are still in a phase of rapid urbanization, population growth, and expanding development momentum, while basic infrastructure, public services, housing security, commuting efficiency, and everyday living conditions remain under strain. At the same time, these cities often have strong demographic vitality and considerable development potential, pointing to significant room for future improvement.

(2) Performance Profile

Unlike the previous comparison based on overall scores and tiers, the ten-indicator radar charts provide a closer look at the internal structure of livability across different cities. Overall, the 20 sample cities can be broadly grouped into five structural patterns:

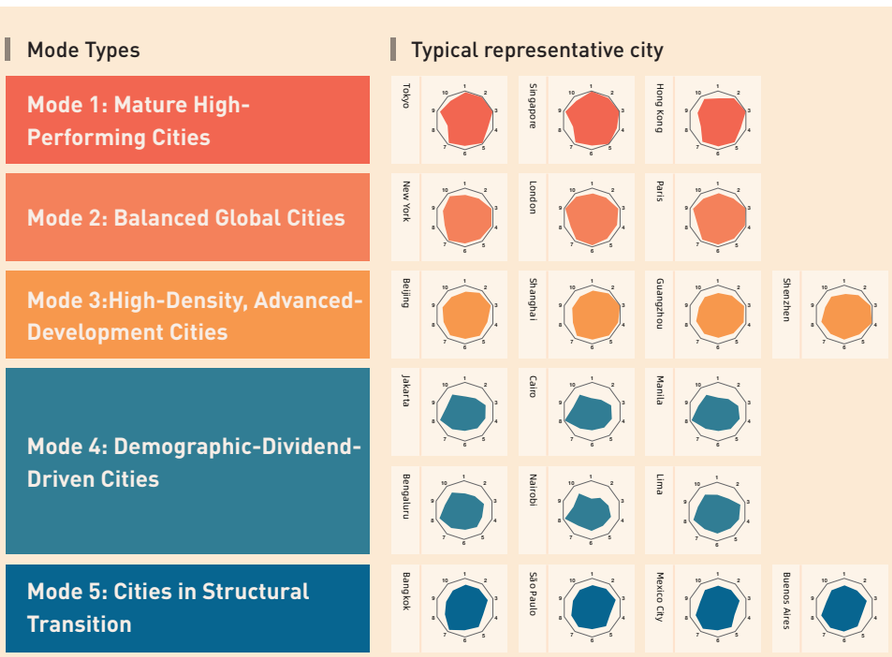


Figure 3 Typology of Livability Patterns

Table 2 Pattern Classification and Characteristics

Type	Cities	characteristic
Mature High-Performing Cities	Tokyo, Singapore, Hong Kong	Character: These cities show broadly expanded radar charts, indicating a high overall level of livability. However, demographic structure is generally weaker, reflecting aging-related pressures in mature urban systems. Tokyo and Singapore have more complete support structures, with demographic change as the main constraint. Hong Kong also maintains strong quality of life, but faces pressure in housing security and long-term settlement.
Balanced Global Cities	New York, London, Paris	Character: These cities show relatively complete and evenly expanded radar charts, with no obvious weak points. Their livability is supported not by a single outstanding indicator, but by a balanced relationship among settlement, quality of life, and development opportunities. This reflects the strong overall capacity of mature global cities.
High-Density, Advanced-Development Cities	Beijing, Shanghai, Guangzhou, Shenzhen	Character: These cities perform strongly in quality-of-life indicators, while settlement-related indicators are more constrained. This suggests solid foundations in transport, services, and daily urban life, but continued pressure in housing security, residential stability, and long-term stay. Beijing stands out in talent, Shanghai is more balanced, Shenzhen in demographic structure and efficiency, and Guangzhou in overall steadiness.
Demographic-Dividend-Driven Cities	Jakarta, Cairo, Manila, Bangalore, Nairobi, Lima	Character: These cities show strong performance in demographic structure and growth potential, but weaker foundations in settlement and quality of life. Their livability is still largely supported by population momentum, while basic capacity, public services, and living conditions need further strengthening. Bangalore shows a stronger talent base, while the others are more defined by population vitality.
Cities in Structural Transition	Bangkok, São Paulo, Mexico City, Buenos Aires	Character: These cities show a moderate spread across several indicators rather than a single strong peak. They have developed some everyday vitality and service capacity, especially in third places, urban atmosphere, and regional functions. However, their overall livability structure is still moving from localized strengths toward a more complete and coordinated system.

(3) Key Findings

Through the overall assessment and structural analysis of the 20 sample cities, several key patterns in global livability development can be identified:

First, livability is not simply the result of excelling in individual indicators. What matters is the balance between the conditions that allow people to settle, the quality of everyday life, and the opportunities for long-term development. The assessment shows that even cities with strong economic capacity may have uneven livability profiles if housing stability or long-term urban capacity remains under pressure. At the same time, cities that do not lead in every indicator can still perform more steadily when their basic support systems, daily living conditions, and development opportunities are better aligned. Livability, therefore, should be understood less as a collection of individual strengths, and more as the result of a well-balanced urban system.

Second, in high-development cities, the focus of livability is shifting from expanding urban capacity to improving structural balance, with settlement becoming a key source of differentiation. High-performing cities have generally built strong foundations in quality of life. The differences between them are now increasingly shaped by housing security, residential stability, and the ability to support long-term stay for different groups. This suggests that, once cities reach a more advanced stage of development, livability depends not only on better services or more opportunities, but also on stronger long-term settlement support. The key is to move from strengths in selected areas toward a more balanced urban system.

Third, for rapidly urbanizing cities, improving livability depends not only on sustaining growth momentum, but on translating growth into better settlement conditions and everyday life. Cities such as Bangalore, Jakarta, Manila, Nairobi, and Cairo continue to show strong vitality through population concentration, industrial development, and urban expansion. However, infrastructure, public services, and housing systems have not kept pace, making it difficult for settlement and quality of life to form an effective relationship with growth. For these cities, livability is not simply about pursuing faster growth. It is about turning the outcomes of growth into more inclusive basic support, more tangible improvements in daily life, and more sustainable development opportunities, gradually forming a more stable livability structure.

Fourth, similar opportunity scores do not necessarily mean similar quality of growth. Developed and developing cities draw on very different sources of growth. The assessment shows that cities such as Singapore, London, New York, and Tokyo draw more on human capital, mature industries, and stable development systems. By contrast, Bangalore, Manila, Nairobi, Jakarta, and Cairo benefit more from younger population structures, demographic vitality, and growth potential. For many rapidly urbanizing cities, the next step is to turn demographic vitality into stronger talent accumulation, broader development opportunities, and more sustainable growth capacity, creating a more stable foundation for long-term urban development.

3.3.3 Assessment by Objective

(1) Settlement

The settlement assesses a city's basic capacity to accommodate people and support long-term stability. It forms the foundation of livability and is essential to a city's ability to function steadily over time. Focusing on housing support, basic service access, and health and longevity, this dimension examines whether different groups can enter the city, stay, and gradually build a stable life. At its core, settlement asks whether a city can provide an inclusive, reliable, and sustainable support system that gives people a basic sense of security and confidence in the future.



Figure 4 Settlement Scores by City

Among sample cities, settlement is shaped by two different types of support. Housing support most clearly reflects differences in institutional arrangements and governance approaches, and is a key factor that differentiates cities. By contrast, basic service access and health and longevity are more closely linked to the overall level of urban development, reflecting a city's development stage and its broader capacity to provide basic support.

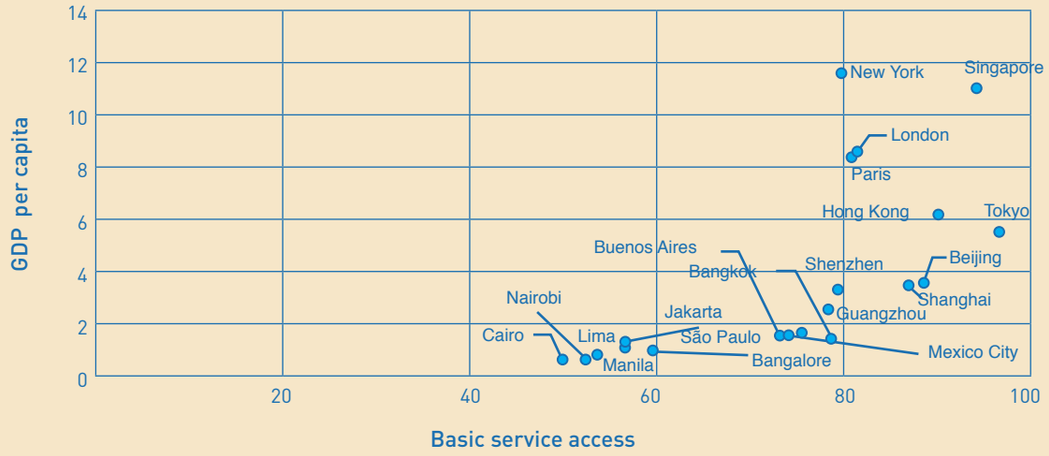


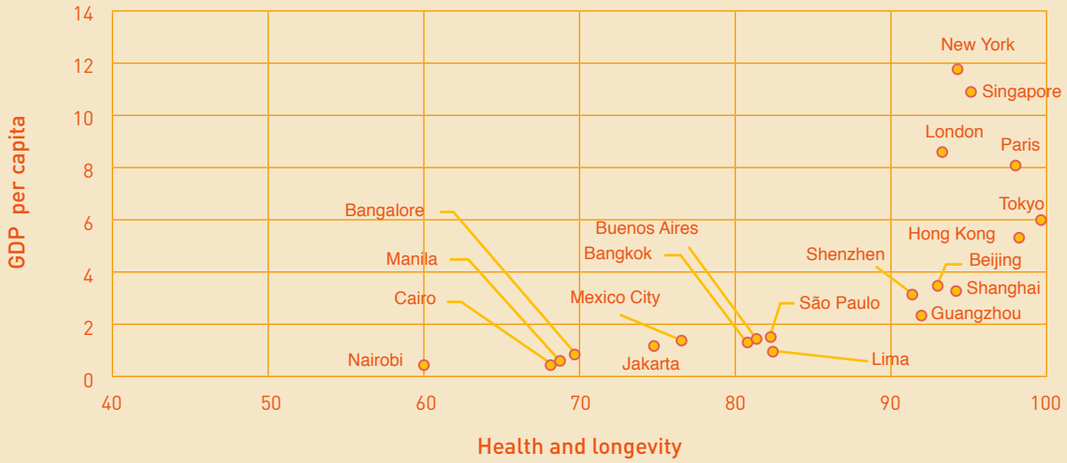
Even among cities at similar levels of development, residential stability can vary significantly depending on public housing provision, rental market systems, land institutions, and housing regulation mechanisms.

Case 1 | Singapore — Public Housing as a Foundation for Stable Settlement

Singapore represents the most typical institutionalized model. Through long-term and large-scale public housing development, it has provided strong support for long-term residential stability for the majority of residents, making housing not only a place to live, but also an important foundation for social stability.Tokyo represents a different model. Rather than relying on a high share of public housing, it maintains a relatively stable residential system under high-density conditions through continuous housing supply, a mature rental market, and a metropolitan housing structure supported by rail transit.Hong Kong and New York both face housing-related constraints. Hong Kong's public housing system helps maintain residential stability for certain groups, but housing disparities remain prominent under its dual-track structure. New York, by contrast, faces sustained affordability pressures within a highly market-oriented housing system.Beijing, Shanghai, Guangzhou, and Shenzhen are still in a process of adjustment, with affordable housing, rental housing, and more diverse housing options developing in parallel. Among them, Shanghai and Beijing show a relatively more balanced profile. Guangzhou benefits from comparatively lower housing cost pressure and therefore provides more stable support. Shenzhen, however, continues to face significant constraints on long-term residential stability amid high housing prices and high population mobility.







By contrast, cities such as Jakarta, Manila, Nairobi, and Cairo face a different housing reality. Under rapid urbanization, continued population inflows, and limited formal housing supply, urban informal settlements have become a entry point for many low-income groups and newcomers to the city.

These settlements are less the result of deliberate policy design than a response to constraints in public finance, land governance, and implementation capacity. Without formal recognition and sustained public investment, they often lack adequate infrastructure, public services, and environmental improvement. As a result, residents face weaker living conditions, lower security, and limited residential stability.

When informal settlements expand in an unmanaged way, they can further intensify spatial sprawl, service shortages, and environmental pressure. In this context, entering the city does not necessarily lead to stable settlement.

Case 2 | Shenzhen Shuiwei Ningmeng Apartments Provide Budget Housing for Newcomers

Shenzhen's urban villages have long served as a source of low-cost housing and a buffer for population inflows, providing an important entry point for many newcomers to the city. Around 60% of Shenzhen's population lives in urban villages. The Shuiwei Ningmeng Talent Apartments project adopts an incremental renewal approach that combines comprehensive renovation with apartment operation, helping transform existing rental spaces into a more stable, manageable, and livable form of housing. Jointly advanced by the government, enterprises, and the village collective, the project retains the original urban fabric and everyday atmosphere of handshake buildings and arcade streets, while introducing elevators, corridors, community service facilities, and modern commerce. In this way, fragmented and informal rental spaces are gradually reshaped into youth-friendly housing units with basic living support.



Shenzhen's urban villages also serve as low-cost housing and buffers for population inflows, but their development has followed a different path. Rather than remaining outside the formal urban system, many have been gradually incorporated into governance and renewal efforts. Through safety improvements, infrastructure upgrades, and better environmental management, these areas are being transformed from basic low-cost shelters into transitional housing with stronger everyday support.

(2) Quality

The quality objective focuses on residents' everyday experience and overall performance of living quality. It shows whether the outcomes of urban development can be felt, accessed, and used in daily life, making it the most tangible part of the livability framework. Through mobility efficiency, advanced service access, open space quality, and third-place vitality, this objective assesses whether a city can provide a convenient, comfortable, well-organized, and vibrant living environment. It looks beyond the number of facilities or the physical condition of spaces, and focuses on how transport, services, and everyday urban settings work together to make daily life more accessible, enjoyable, and attractive.

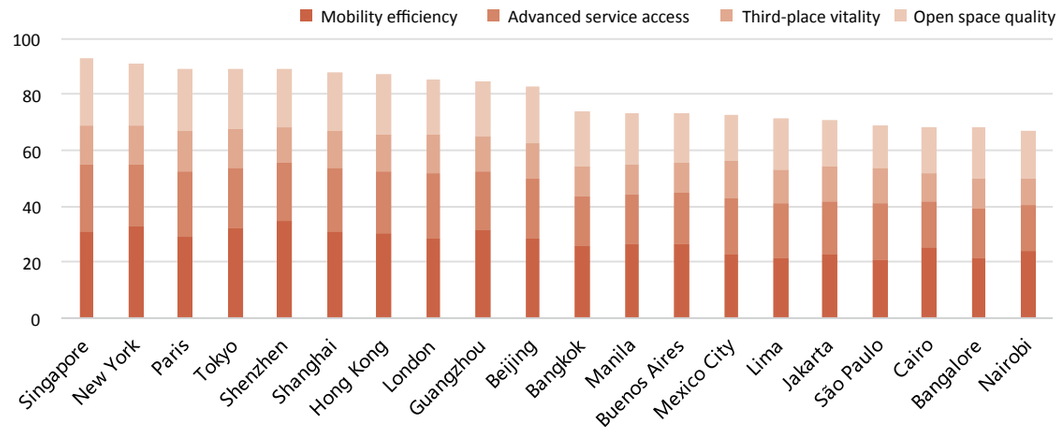
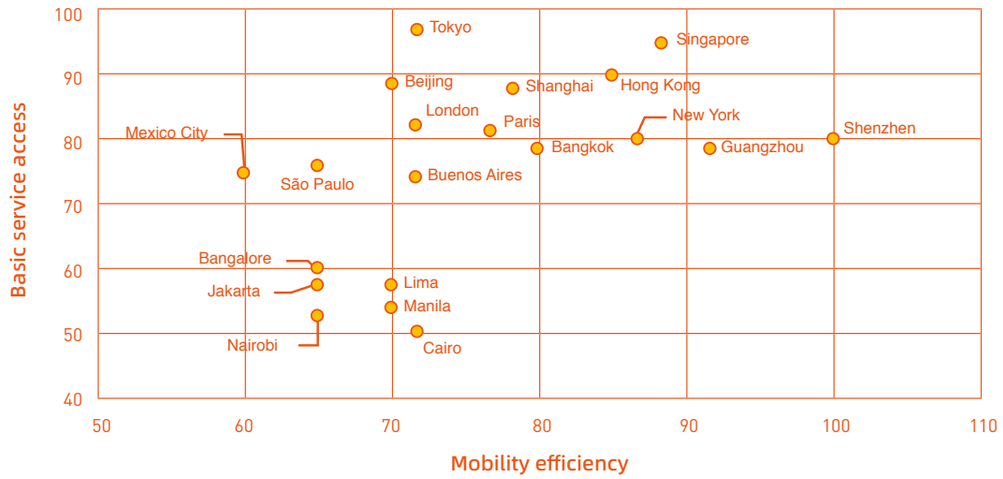
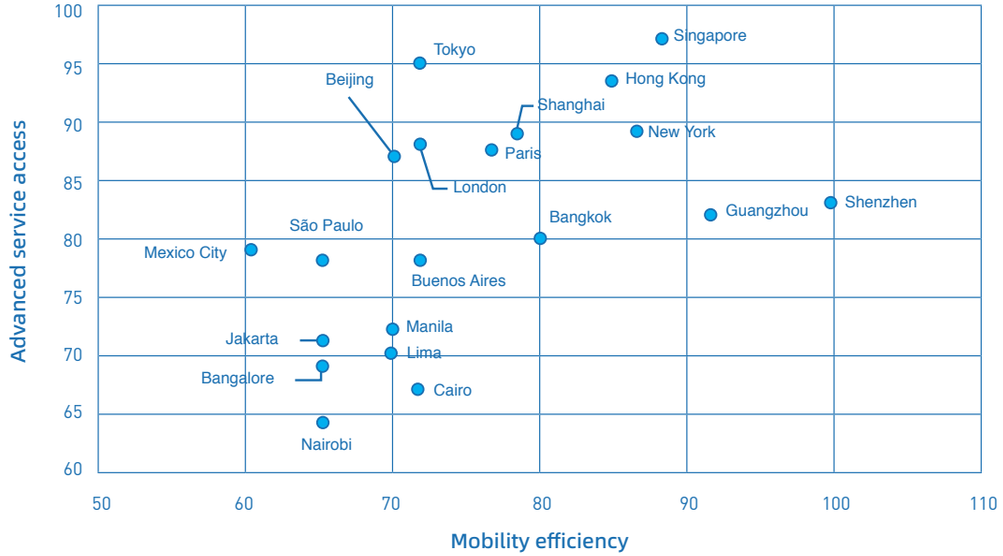


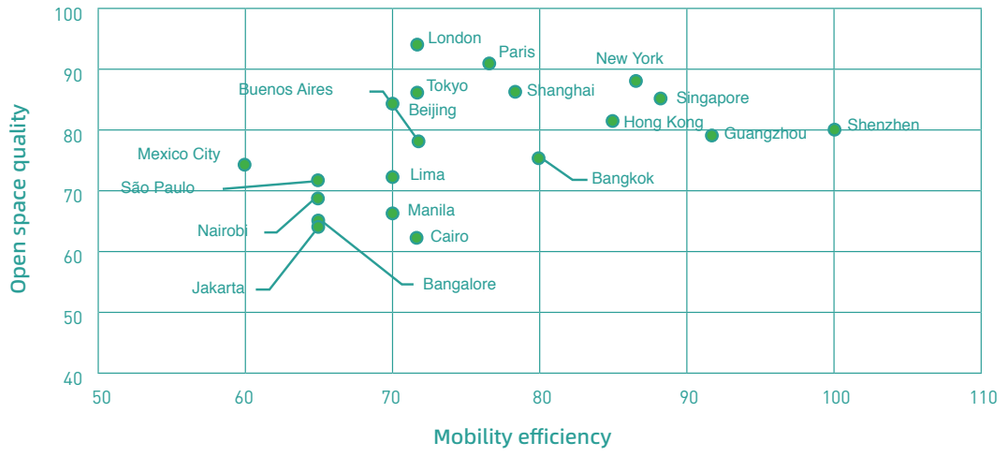
Figure 5 Quality Scores by City

Mobility efficiency plays a bridging role in the indicator system. On one hand, it is closely linked to settlement issues, especially the relationship between housing location, housing cost, and access to jobs. On the other, it directly shapes the efficiency of everyday urban life and is an important measure of living quality. For high-density cities, the ability to connect housing, employment, and services with lower time costs is critical. It determines whether a city can turn basic residential accommodation into a genuinely better daily living experience.

Examining the relationship between mobility efficiency, basic and advanced service access, and open space quality, a clear positive correlation can be observed. Cities with higher mobility efficiency tend to show stronger accessibility to services and open spaces. In the scatter plots, the sample cities broadly fall into two clusters. One consists mainly of cities in the first and second tiers, concentrated in the high-mobility and high-accessibility range. The other consists mainly of cities in the third and fourth tiers, clustered in the lower-mobility and lower-accessibility range. This suggests that mobility efficiency and access to living resources are not separate capabilities. Together, they reflect whether a city can effectively organize housing, employment, and high-quality daily amenities into a compact, frequent, and accessible everyday life system.







| Case 3 | Shenzhen Improving Efficiency through Planning and Transit

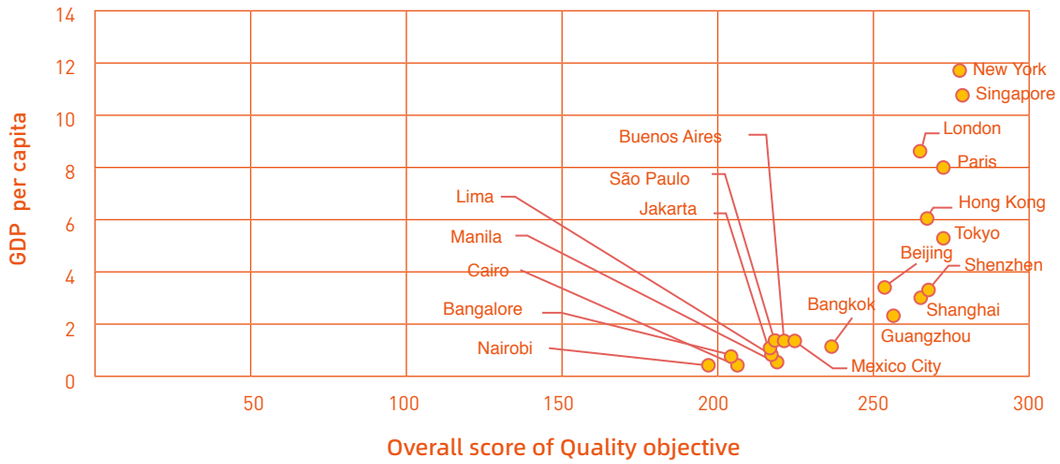


Shenzhen's strength in the quality objective is closely linked to its mobility efficiency within a polycentric urban structure. As multiple employment and service nodes continue to grow — including Futian, Nanshan, Qianhai, Bao'an Central District, Longgang, and Guangming — the city does not rely on a single core to accommodate all urban functions. Instead, its polycentric structure helps distribute jobs, services, and daily activities, while the rail network strengthens efficient connections between different districts. According to public information from the Shenzhen government, by 2024 the city's urban rail network had reached over 560 kilometers, with nearly 400 stations. This expanding network strengthens connections among major urban centers and improves access between housing, jobs, and daily services. By linking its polycentric structure with rail-based mobility, Shenzhen is turning high-density urban form into a more efficient everyday living experience, making mobility efficiency an important foundation of quality of life.

Shenzhen stands out in this comparison, suggesting that it has developed strong advantages in everyday efficiency under high-density conditions. Hong Kong and Singapore also fall within the high-performing range, supported by highly integrated transport and service networks. New York shows a strong ability to organize services and daily amenities, while Shanghai and Guangzhou have also built a solid foundation for efficient urban living. By contrast, Beijing, Tokyo, and London remain in the higher-performing group overall, but their mobility efficiency is not among the strongest. This suggests that their strengths in the quality objective rely more on service networks, spatial quality, and the broader living environment, rather than on shorter travel times alone.

Among the third- and fourth-tier cities, Bangkok stands out and is already approaching the range of the first- and second-tier cities. This suggests that Bangkok has built a strong foundation in service accessibility and everyday urban vitality, making it one of the most distinctive mid-tier cities in the quality objective.

By contrast, Mexico City, São Paulo, Jakarta, and Cairo remain in the lower range overall. This indicates that, where spatial expansion continues and infrastructure and service networks are still being improved, residents often need to spend more time accessing daily services. In this sense, the combination of mobility efficiency and advanced service access reflects how well a city connects housing, employment, and services into an efficient everyday life network.



| Case 4 | New York Bryant Park as A Model for Public Space Management



A key feature of New York's public space governance is its mature public-private management model, supported by mechanisms such as Business Improvement Districts (BIDs). By involving surrounding property owners, local businesses, and professional operators, the city has been able to improve public spaces and strengthen street vitality over time. Bryant Park is one of the most representative examples of this approach. Bryant Park Corporation, a not-for-profit private management company, was founded in 1980 to restore and operate the park. In 1988, a 15-year agreement entrusted BPC with management and improvement responsibilities. Today, Bryant Park attracts more than 12 million visitors each year, making it one of New York's — and the world's — busiest public spaces. Its success lies not only in landscape design, but also in sustained programming and operation. Lawns, movable chairs, food and beverage services, reading areas, performances, winter ice skating, and free public events are integrated into one place, transforming the park from a simple urban green space into a multifunctional setting for leisure, social interaction, and public life.

Based on the sample results, high-income cities such as London, Tokyo, Paris, Singapore, Hong Kong, and New York are generally positioned in the higher range of the quality objective. This suggests that cities at more advanced stages of development are often better able to translate development outcomes into tangible improvements in everyday life. Although their specific pathways differ, these cities have developed relatively mature support systems across mobility efficiency, service access, open space quality, and third-place vitality. Paris is a notable example of the stable strengths seen in mature European cities, particularly in public space, service networks, and the organization of everyday urban life.

Beijing, Shanghai, Guangzhou, and Shenzhen are particularly noteworthy. Their performance in the quality objective is already approaching that of leading global cities, suggesting that mobility efficiency, service provision, and everyday urban environments have reached a relatively high level under high-density conditions.

At the same time, their GDP per capita and household income levels have not yet fully reached those of mature global cities at the same level of quality performance. This points to a pattern in which quality of life has advanced ahead of income levels. In other words, their strengths in the quality objective are not simply the result of economic development, but are also supported by strong spatial organization, transport systems, and service provision under high-density conditions. Bangkok is another notable case. Although its overall development level is lower than that of first- and second-tier cities, its quality score is already close to the higher range. This suggests that some mid-tier cities can create strong urban appeal through third-place vitality, everyday urban atmosphere, and service settings, even before reaching the same economic level as mature global cities. By contrast, Jakarta, Cairo, and Nairobi remain in the lower range overall, indicating that improvements in the quality objective are often more constrained where the economic base, infrastructure, and service systems still need further development.

(3) Opportunity

The opportunity objective measures a city's ability to provide development opportunities and upward mobility for individuals. It concerns whether residents can build their capabilities and improve themselves within the city, while also supporting urban vitality and future development. Through demographic structure, human capital level, and income level, this objective assesses a city's capacity to generate development opportunities, support different forms of personal growth, and translate economic and social resources into broader possibilities for individual advancement. It focuses on whether a city can form a stable, open, and sustainable growth structure, enabling individuals not only to settle and live, but also to continue growing over time.

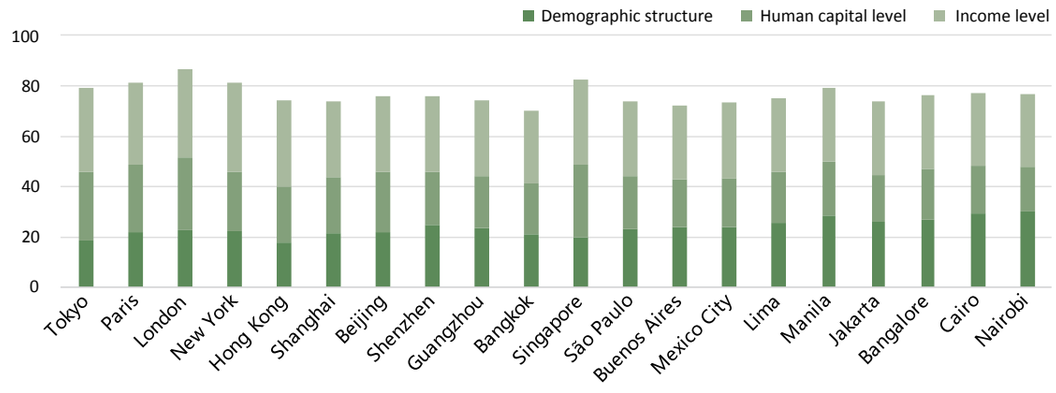
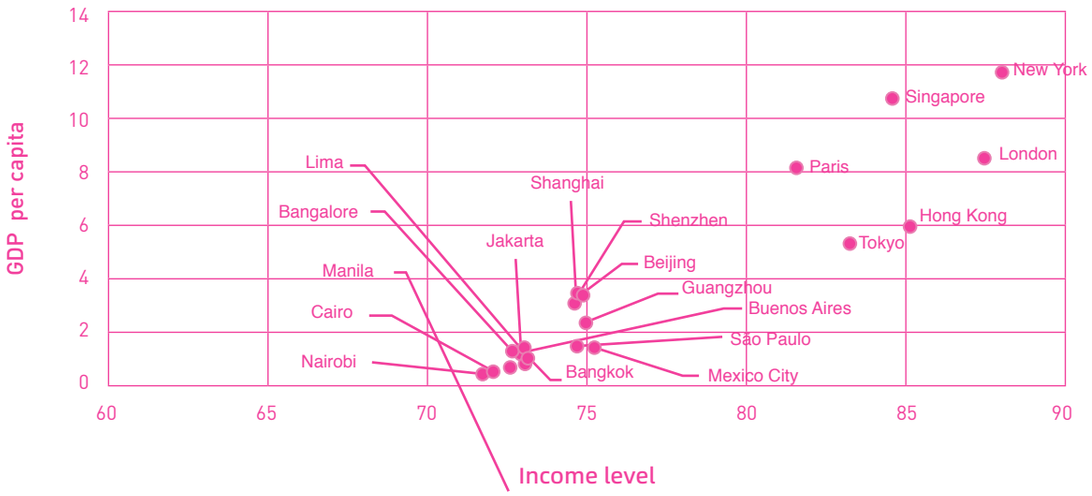


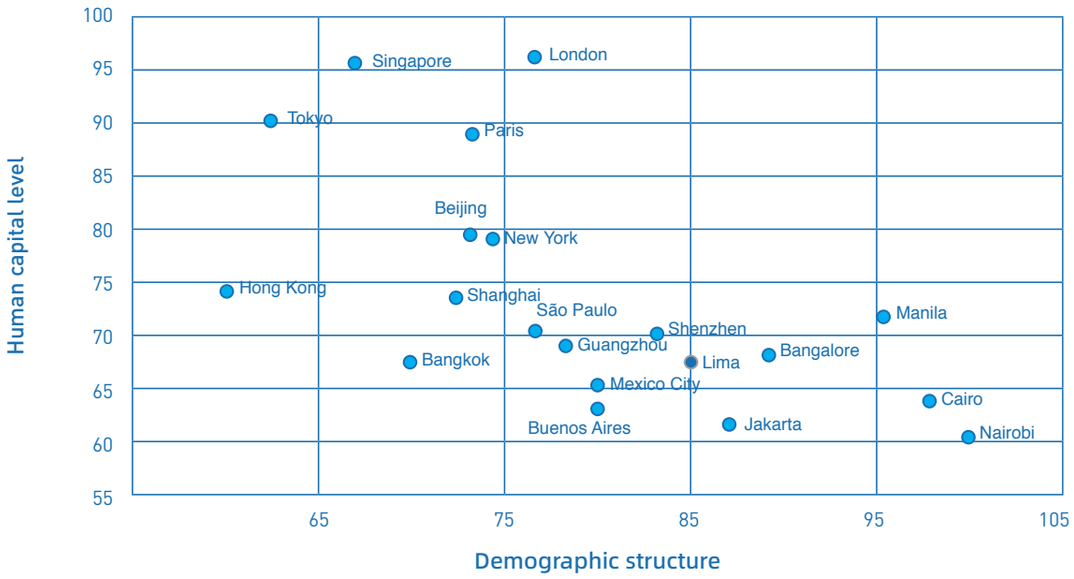
Figure 6 Opportunity Scores by City

Overall, the most notable feature of the opportunity objective is that cities achieve high scores in different ways, while no city shows a fully balanced profile. Mature cities such as London, Singapore, Paris, New York, and Tokyo maintain strong performance mainly through high human capital level and income level. Although they are less advantaged in demographic structure, they still show relatively high-quality growth capacity. By contrast, some third- and fourth-tier cities, such as Manila, Cairo, Nairobi, and Bangalore, rank relatively high mainly because of their strong demographic structure, which reflects demographic dividends and development potential. This does not mean, however, that their growth support systems are already mature or stable. Meanwhile, some cities that perform well in settlement and quality may rank lower in opportunity because of more stable demographic structures or insufficient coordination within their support systems. This shows that the opportunity objective reveals not only current growth conditions, but also a city's future development momentum and capacity for sustained growth.



Examining the relationship between income level and GDP per capita, a generally positive correlation can be observed. Mature cities with higher incomes and stronger economic output are mostly positioned in the upper-right range, suggesting that a higher level of economic development usually provides stronger support for residents' income and consumption capacity.Notably, however, Beijing, Shanghai, Guangzhou, and Shenzhen do not fall into a higher range that fully matches their overall urban economic strength. Instead, they are positioned closer to some third- and fourth-tier cities in the lower-left range. This suggests that a city's overall economic strength does not automatically translate into higher affluence at the resident level, and that there may still be a gap between economic growth and the everyday returns experienced by individuals.

This pattern is closely related to disposable income, cost of living, housing burden, and overall consumption pressure. In other words, GDP per capita mainly reflects a city's overall output capacity, while income level focuses more directly on whether development outcomes are translated into residents' disposable resources and everyday living conditions. For Beijing, Shanghai, Guangzhou, and Shenzhen, the issue is not insufficient economic capacity. Rather, under conditions of high cost, high density, and intense competition, residents' everyday benefits have not yet reached the level seen in mature high-income cities. Within the opportunity objective, income level is therefore used as a more direct measure of whether urban development outcomes are being converted into better daily life and stronger conditions for long-term personal development.



Looking at the relationship between demographic structure and human capital level, the sample cities show a clear pattern of differentiation. Nairobi, Manila, Cairo, Bangalore, Lima, and Jakarta are mainly positioned in the lower-right range, indicating a shared profile of relatively young populations and strong growth potential, but comparatively lower human capital levels. This suggests that their opportunity advantage is driven more by demographic dividends and labor supply, and has not yet been fully translated into stronger human capital support.

| Case 5 | King's Cross in London Attracting Enterprise and Talent Agglomeration through Regeneration



King's Cross is one of London's most representative urban regeneration and knowledge-economy districts in recent years. Built on the renewal of former industrial and railway lands, the district brings together offices, research institutions, education, housing, retail, and public spaces, creating an urban setting that continues to attract businesses, talent, and innovation activity. The area is now home to institutions and companies such as Google, Meta, Universal Music, the Francis Crick Institute, and Central Saint Martins, forming a spatial structure where knowledge production, creative industries, and high-end services are closely connected.

| Case 6 | Bangalore — Electronic City as a Technology Cluster for Demographic and Talent Dividends



Electronic City is one of Bangalore's most representative technology clusters and an important spatial platform for the development of internet-related and technology industries. Established by KEONICS in 1978, the area has, over time, attracted information technology, software services, R&D support, and multinational corporate functions, with companies such as Infosys, Wipro, TCS, Tech Mahindra, and Biocon located there. Through this concentration of technology industries, Electronic City has created a large number of employment opportunities and attracted young technical workers and engineering talent to the city, strengthening Bangalore's advantages in demographic structure and human capital level.

In contrast, Tokyo, Paris, Singapore, and London are mostly positioned in the upper-left range, reflecting a different pathway. Although they show weaker demographic vitality, they have generally high human capital levels. This suggests that mature cities rely more on education, knowledge accumulation, and high-quality human capital than on the expansion of a young population. For these cities, the main constraint is not a lack of talent, but the long-term impact of aging, a shrinking working-age population, and more stable demographic structures.

Within the higher human capital range, cities also show further differences. Hong Kong has a strong talent base, but weaker demographic vitality and more visible aging-related pressures. Beijing, Shanghai, Guangzhou, Shenzhen, and New York are closer to the upper-middle range, showing a relatively balanced relationship between demographic vitality and human capital. Among them, Beijing and Shanghai have more stable talent foundations, Shenzhen and Guangzhou show stronger demographic vitality, and New York has a more mature overall support system. São Paulo is a relatively balanced mid-tier case: neither indicator is among the highest, but there is no obvious weakness between demographic vitality and human capital, suggesting a more balanced growth structure.

Overall, this comparison points to two different sources of urban growth capacity. Some cities rely more on young populations and growth potential, while others draw more on education, knowledge accumulation, and human capital. A stronger opportunity profile does not come from one outstanding indicator alone. It depends on whether demographic vitality can be translated into a stronger talent base, or whether cities facing aging pressures can sustain growth through high-quality human capital.

3.3.4 Insights and Recommendations

Based on a systematic assessment of the 20 sample cities, this report identifies four relevant observations on livability. Overall, livability is neither the result of a single standout advantage nor a static measure of quality of life. Rather, it reflects a city's comprehensive capacity to provide sustained support, enable dynamic transitions, and foster mutual reinforcement across three interrelated layers: Settlement, Quality, and Opportunity.

First, the foundation of a livable city lies in its capacity to support long-term settlement. Across the sample cities, livability is shaped less by isolated environmental improvements or individual facility upgrades than by whether a city can enable diverse groups to enter, stay, and gradually establish themselves. Housing support is the most differentiating factor, while basic services and essential well-being provide the necessary foundation. In this sense, livability begins not with high-end lifestyle offerings, but with a basic urban support system that allows people to live securely, remain in the city, and build stable everyday lives.

Second, improving livability depends on a city's ability to translate development outcomes into high-quality everyday life. The comparison of the Quality objective shows that cities differ in how well they organize commuting efficiency, service accessibility, and third places into an everyday system that is efficient, comfortable, and inviting. Mobility efficiency connects where people live with where opportunities are located, while services and everyday urban settings determine whether residents can truly experience the quality of the city. In essence, the Quality objective reflects a city's capacity to turn development strength into accessible, reliable, and human-centered daily well-being.

Third, building a livable city depends on the coordinated balance of Settlement, Quality, and Opportunity across different stages of development. This assessment offers a cross-sectional view of the 20 sample cities, showing that no city can reach the leading group through strength in only one area. Settlement, Quality, and Opportunity need to form a mutually reinforcing structure. Cities with similar overall scores may rely on very different strengths: some on stronger basic support, some on better everyday quality, and others on greater growth potential. Yet livability becomes more stable only when these three aspects are well aligned. Shenzhen's experience further suggests that livability is not a fixed outcome at one point in time, but a continuous process of adjustment as cities respond to changing challenges and move toward a better balance among Settlement, Quality, and Opportunity.

Fourth, the direction of livable city building should be inclusive improvement for the majority. Livability should not be a lifestyle model for a small group of high-income residents, but a measure of whether broader populations can gain a basic sense of security, everyday convenience, and opportunities for advancement. The comparison suggests that high density does not necessarily undermine livability; what matters is whether urban governance is forward-looking, refined, and inclusive. Rather than focusing only on selected core areas, demonstration projects, or high-quality districts, cities need to ensure that affordable housing, commuting efficiency, basic services, open spaces, community environments, and entry-level opportunities for young people are accessible to most residents. Only when livability improvements move from isolated showcases to citywide access, and from benefits for a few to shared gains for many, can livability become a lasting and widely shared urban capacity.

3.4 Aesthetics

3.4.1 Understanding Aesthetics

The human perception of urban aesthetics is, in essence, the projection of a form of civilization onto physical space. Its evolution has undergone a paradigm shift from the "aesthetics of making" to the "aesthetics of symbiosis". In the era of industrial civilization, urban aesthetics followed a logic of "conquering nature": nature was treated as the opposite of urban development, while cities pursued grand artificial order, regular geometric patterns, and monumental architectural forms. Natural elements were reduced to decorative bonsai and ornaments. The "aesthetics" of that period was one-dimensional: a declaration of human power rather than a dialogue with living systems, which directly contributed to resource depletion, worsening pollution, and systemic ecosystem degradation. With the global spread of ecological crises and the rise of sustainable development, urban aesthetics entered a second phase of "integrating nature". Urban planners began introducing greenways, parks, and waterfront spaces into the urban fabric, seeking to repair the wounds of industrialization through landscape interventions. Yet this integration remained strongly anthropocentric: nature was "invited" into the city, and its value was judged largely by whether it could raise property values or improve residents' well-being, while the integrity and intrinsic agency of ecosystems were not yet fully respected.

In the 21st century, "coexistence and co-prosperity" has become the new paradigm of urban aesthetics. In the East, this paradigm is embodied in the philosophical traditions of the "unity of heaven and humanity" and "following the laws of nature", emphasizing the intrinsic unity and vital continuity between humanity and nature. In the West, it is reflected in the theoretical lineages of "Genius Loci" and "Sustainable Aesthetics", which focus on the experiential value of space, ecological ethics, and intergenerational responsibility. Under this paradigm, the city is no longer an external object isolated from natural systems, but an organic component of them. A beautiful city is no longer an object of visual consumption, but a living community in which humans and nature coexist in harmony. This shift in aesthetic paradigm requires an integrated evaluation framework that fuses scientific rationality and humanistic experience into a unified measure of value.

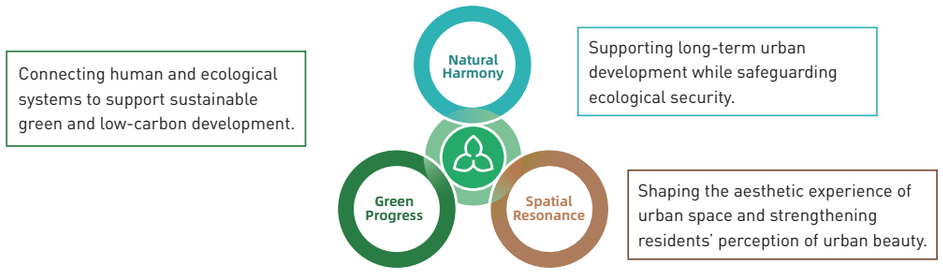


Figure 1 Aesthetics in the UIS Framework

Modern urban science provides a solid theoretical foundation for the "aesthetics of symbiosis". The theory of Coupled Human and Natural Systems (CHANS) reveals cities as complex adaptive systems: human society and natural systems are not opposing poles, but co-evolving systems that continuously exchange flows of energy, materials, and information. As open systems far from equilibrium, cities must constantly absorb low-entropy energy and information from the outside and maintain its own stability and order through negative entropy flow. This means that the "aesthetics" of a city cannot be judged solely from a morphological perspective; it must incorporate the scientific dimensions of systems theory and ecology. A beautiful city must first be an ecologically healthy, stable, and resilient system.

The urban sustainability framework jointly advanced by UN-Habitat and UNEP further translates this scientific understanding into the language of global governance. Within this framework, the definition of a beautiful city must go beyond aesthetics alone and incorporate multi-dimensional considerations of ecological security, environmental governance, and spatial quality. Urban aesthetics is not merely an object of sensory pleasure; it is also a comprehensive expression of ecosystem services. It is not only the accumulation of history and culture, but also a real-time measure of the coupling quality between contemporary human systems and natural systems. Accordingly, a scientific evaluation framework must answer three questions at the same time: Does the city have a complete and healthy ecological foundation? Is the city's metabolism compatible with the carrying capacity of the natural system? Does urban space evoke deep cultural identity and aesthetic resonance among residents?

While scientific thought provides the rational framework for a beautiful city, humanistic experience gives it its spirit and texture. Human perception of space is never purely geometric; it is a cultural construction shaped by emotion, memory, and meaning. A beautiful city must enable residents not merely to live in a place, but to dwell in it. It should be perceptible, memorable, and capable of fostering belonging. Therefore, the evaluation framework for beautiful cities must place humanistic experience in an essential position, assessing not only the physical quality of space but also the emotional resonance, cultural identity, and sense of spiritual belonging that space evokes.

Building on the dual foundation of scientific thought and humanistic experience, this report constructs a three-dimensional evaluation framework: "Natural Harmony – Green Progress – Spatial Resonance". The three dimensions follow a systems logic of "foundation-layer constraint – regulatory-layer optimization – feedback-layer reinforcement", together forming a complete picture of a beautiful city.

Natural Harmony: With natural ecology as its foundation, this dimension secures the basis of urban aesthetics and the bottom line of ecological security.

It is the prerequisite for all forms of urban aesthetics. It determines whether a city has the confidence and foundation for long-term development, enables humans and nature to coexist in harmony, and provides urban aesthetics with its most authentic grounding.

Green Progress: Through behavioral regulation, this dimension reduces the pressure that human activities place on nature and builds a bridge between human systems and ecosystems.

It safeguards the long-term continuity of urban aesthetics, prevents development from overdrawing natural capital, and makes "green" the enduring keynote of urban development.

Spatial Resonance: With culture and aesthetics serving as value feedback, this dimension sustains the harmony and stability of the urban spatial system.

It enables urban aesthetics to be genuinely perceived by residents, widely recognized by society, and continuously accumulated as the city's distinctive spiritual imprint and humanistic character.

Table 1 Indicator System for Aesthetics Assessment

Objectives	Indicators	Definition
Natural Harmony	Protected Area to City Territory Ratio	Proportion of protected areas (e.g., nature reserves) in the city's administrative area, measuring the city's ecological conservation efforts and the guarantee level of its ecological security bottom line.
	Green-Blue Coverage in Built-up Area	Proportion of various green spaces and water bodies in the built-up area, reflecting the foundation level of ecological space and the permeability of the natural environment in urban built-up areas.
	Native Biodiversity in Built-up Area	Proportion of native bird species present in the built-up area to the total number of native bird species in the region, reflecting the ecosystem health and biodiversity conservation effectiveness of urban built-up areas.
Green Progress	Low-carbon Level	Annual per capita carbon dioxide emissions of the city, measuring the city's per capita carbon emission intensity and overall low-carbon development level.
	Annual Average Air Quality	Annual average concentration of PM2.5 particulate matter in ambient air, reflecting the city's ambient air quality and air pollution control effectiveness.
	The Proportion of Safely Treated Domestic Wastewater Flows	Proportion of domestic wastewater safely treated by municipal sewage treatment systems, reflecting the city's water environment quality and water pollution control level.
Spatial Resonance	City Image Favorability	Public recognition of the city's popular attractions, reflecting comprehensive public evaluation of its overall image and spatial imagery.
	Destination Appeal Intensity	Visit intensity of the city by international and domestic tourists, measuring the city's attraction strength as a major global travel destination.
	Streetscape Visual Quality	Aesthetic quality of landscapes and interfaces at the urban street level, measuring the visual aesthetics and public perception quality of the city's street public spaces.

3.4.2 Overall Assessment

Based on the evaluation results, the comprehensive scores of the 20 sample cities show significant tiered differentiation. According to their overall performance, they can be divided into three tiers, clearly presenting the global patterns of aesthetics-oriented urban development.

(1) Ranking Tiers

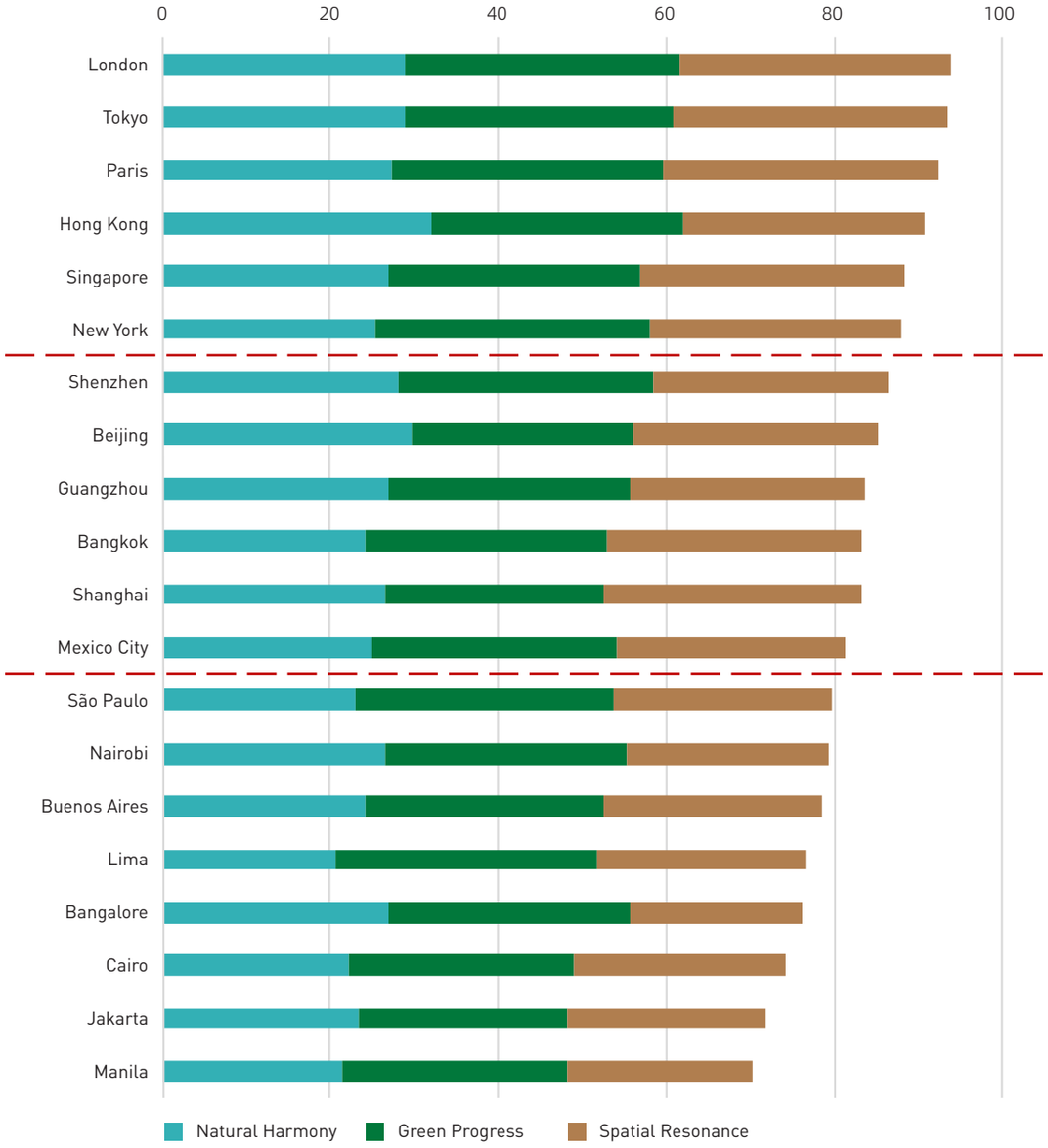


Figure 2 Tier Performance

Using 87 and 80 as thresholds, the total scores of the 20 cities are divided from high to low into three tiers. Tier 1 consists mainly of developed metropolises in Europe, North America, and East Asia, reflecting a high degree of synergy between economic development and ecological quality. Tier 2 is composed largely of rapidly rising Asian cities that are transitioning from scale expansion to quality improvement. Tier 3 is concentrated mainly in developing cities in South America, Africa, and Southeast Asia, which face multiple challenges in ecological protection, environmental governance, and spatial quality enhancement. Overall, the level of urban aesthetic quality is strongly and positively correlated with economic development, investment in ecological governance, and accumulated historical-spatial assets. However, cities differ in their strengths and weaknesses across the three dimensions, reflecting distinct development pathways and areas for improvement.

Tier 1

score ≥ 87: London, Tokyo, Paris, Hong Kong, Singapore, and New York

All are developed metropolises with global influence, characterized by multi-dimensional balance and outstanding performance in selected dimensions. London, Tokyo, and Paris rank in the top three. London and Paris perform exceptionally well in Green Progress and Spatial Resonance, demonstrating the accumulated strengths of mature cities in environmental governance and spatial aesthetics. Tokyo, with scores above 86 in all three dimensions, represents a model of balanced development. Hong Kong ranks fourth on the strength of the highest Natural Harmony score among the 20 cities, reflecting the structural tension between nature conservation and spatial experience in high-density metropolises. Singapore and New York are respectively distinguished by spatial quality and green, low-carbon performance; New York ranks first in Green Progress but is relatively weaker in Natural Harmony. Overall, Tier 1 cities have largely moved beyond the "pollute first, treat later" stage and have established a virtuous cycle in which ecological protection, low-carbon transition, and spatial quality reinforce one another, offering benchmarks for beautiful city development worldwide.

Tier 2

80 ≤ score < 87: Shenzhen, Beijing, Bangkok, Guangzhou, Shanghai, and Mexico City

These cities are at a critical stage of rapid development and deep transformation, characterized by pronounced strengths alongside clear constraints. Shenzhen ranks high in Green Progress within this tier, reflecting positive achievements in low-carbon transition, but its Spatial Resonance remains comparatively weak, indicating room for improvement in public space aesthetics. Beijing leads this tier in Natural Harmony, reflecting active efforts in ecological space protection in a megacity context. Guangzhou performs relatively evenly across the three dimensions, with a slight advantage in Green Progress, although its overall highlights are less distinctive. Shanghai stands out in Spatial Resonance but performs more moderately in Natural Harmony and Green Progress. Bangkok scores relatively high in Spatial Resonance, indicating broad recognition of its urban aesthetic quality among domestic and international visitors, but it is weaker in Natural Harmony and faces significant pressure in protecting its ecological base. Mexico City, the only non-Asian city in this tier, shows relatively balanced but not outstanding performance across all three dimensions. Overall, Tier 2 cities already have the basic conditions to move toward Tier 1; the key lies in addressing shortcomings in green and low-carbon transition or spatial quality, and in shifting urban development from quantitative growth to qualitative upgrading.

Tier 3

score < 80: São Paulo, Nairobi, Buenos Aires, Lima, Bangalore, Cairo, Jakarta, and Manila

These are developing cities in South America, Africa, and Asia that generally face multiple challenges: a weak ecological base, pressure on environmental governance, and insufficient spatial quality. São Paulo and Lima perform well in Green Progress, reflecting governance achievements in specific environmental fields, but their Natural Harmony scores are low, indicating insufficient systematic and binding protection of ecological space. Bangalore, as an emerging technology city, performs moderately in Natural Harmony but ranks lowest in Spatial Resonance, reflecting the pronounced erosion of street space and public aesthetics under rapid urbanization. Nairobi, Buenos Aires, Cairo, Jakarta, and Manila score in the middle-to-lower range across all three dimensions, reflecting the resource constraints and governance dilemmas faced by late-developing metropolises during catch-up development. Cities in this tier urgently need to strengthen ecological bottom-line control, secure investment in green infrastructure, and improve the aesthetic quality of public spaces, while exploring distinctive pathways to advancing urban aesthetics that fit their development stage and resource endowments.

(2) Performance Profile

Based on the performance of each city across the three dimensions and nine indicators, the 20 cities can be grouped into four typical patterns: Mature Benchmark, Density Breakthrough, Structural Transition, and Constrained Shortfall. Each pattern corresponds to a distinct pathway for advancing urban aesthetics.

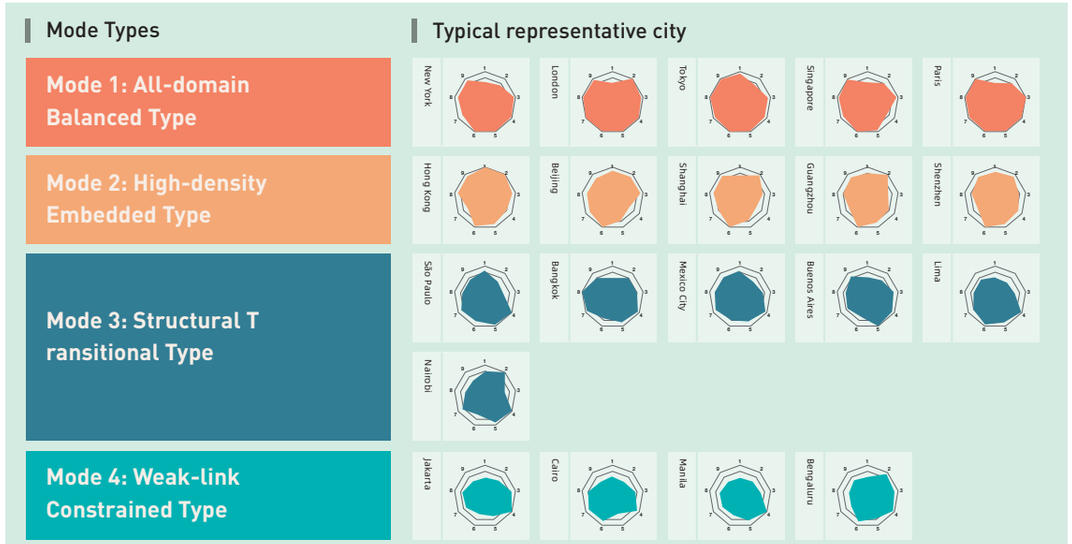


Figure 3 Typology of Aesthetics Patterns

Table 2 Pattern Classification and Characteristics

Type	Cities	characteristic
Mature Benchmark	New York, London, Tokyo, Singapore, Paris	Cities in this pattern present a mature configuration of balanced performance across all three dimensions, with no evident shortfalls. They lead comprehensively in built-up-area ecological quality, coordinated environmental governance, public-space aesthetics, and international appeal, while their main limitation lies in the natural constraint that high levels of urbanization place on the share of protected areas within the jurisdiction. After long processes of deindustrialization and re-urbanization, these cities have established cross-sectoral and full-cycle environmental governance mechanisms, bringing biodiversity conservation, air-quality management, and public-space aesthetics into an integrated urban renewal framework. They do not rely on a single-dimensional breakthrough. Rather, through the long-term coupling of industrial systems, governance mechanisms, and cultural capital, they have formed a positive cycle of "environmental quality – cultural appeal – global flows". Beautiful city development is thus the product of institutional maturity and accumulated civilization, not something that can be achieved by short-term investment. This pattern shows that once a city has moved beyond the stage of "damage first, repair later", ecology, environment, and space can enter a mutually reinforcing cycle, with aesthetics becoming an underlying logic of urban operations rather than an add-on objective.

Type	Cities	characteristic
Density Breakthrough	Hong Kong, Beijing, Shanghai, Guangzhou, Shenzhen	This pattern comprises major high-density cities in East Asia. Its core strength lies in the high-degree interweaving of ecological space and the built environment through strong public investment: Natural Harmony performs particularly well, and environmental infrastructure has advanced significantly. Its main weaknesses are that low-carbon performance remains constrained by the legacy of heavy industry and energy-structure lock-in, while international communication of the city image has not yet kept pace. In response to ecological overdraft under compressed urbanization, these cities have mobilized administrative capacity to advance park-city, sponge-city, and ecological restoration initiatives, achieving rapid improvements in the ecological base and dense penetration of blue-green networks into built-up areas. However, the operating demands of megacities and the inertia of industrial structures mean that emissions optimization lags behind spatial improvement, forming a typical pathway in which spatial integration moves faster than emissions decoupling. High-density late-developing metropolises can restore their ecological foundations quickly by concentrating resources, but deep transformation of energy and industrial structures requires a longer cycle and more systematic market–government coordination. Beautiful city development therefore needs to progress from "having ecological space", to "operating in a low-carbon manner", and then to "generating cultural value".
Structural Transition	São Paulo, Bangkok, Mexico City, Buenos Aires, Lima, Nairobi	These cities are not lagging behind in every respect; rather, they show a stage-specific profile in which certain local strengths are visible but system-wide coordination remains insufficient. They often have highlights in low-carbon levels, air quality, tourism appeal, or city image, yet these strengths have not been fully converted into stable, balanced, and sustainable competitiveness in beautiful city development. In some cases, low-carbon performance essentially derives from lighter industrial structures or an insufficient degree of industrialization; it is a form of "passive low-carbon" performance rather than the result of active green-transition governance. Once such cities enter a phase of accelerated heavy industrialization or motorization, emissions intensity may rebound quickly. Ecological-space encroachment and weak planning control during rapid urbanization expose a structural contradiction between governance capacity and the speed of urban expansion. The key task for this pattern is therefore not simply to preserve existing highlights, but to turn local advantages into systematic capacity: stabilizing the natural base through ecological bottom-line control, closing governance gaps through environmental infrastructure, and improving everyday perception through street and public-space renewal, so that beautiful city development can move toward true three-dimensional synergy.
Constrained Shortfall	Jakarta, Cairo, Manila, Bangalore	The main feature of this pattern is that the basic platform for beautiful city development remains unstable. Ecological-space control, environmental infrastructure, street-level public space, and city-image building are all subject to systemic constraints. Most of these cities are in a phase of rapid population concentration and spatial expansion, while fiscal capacity, technical reserves, and institutional development have not kept pace. Their fundamental challenge is that beautiful city development should not begin with image projects, landmark construction, or isolated pilot demonstrations. It should return to the operating bottom lines of the city: prioritizing environmental infrastructure, strictly curbing disorderly sprawl, ensuring the basic supply of public space, improving street safety and accessibility, and establishing rigid boundaries between ecological protection and urban expansion. Only after ecological security, environmental quality, and public-space bottom lines are secured can city-image enhancement, cultural branding, and international appeal have a sustainable foundation.

3.4.3 Assessment by Objective

To more accurately understand the core mechanisms of beautiful city development, it is necessary to examine the micro-level dynamics of the three dimensions—Natural Harmony, Green Progress, and Spatial Resonance—and analyze the policy tools and technological frontiers behind them.

(1) Natural Harmony

The Natural Harmony dimension measures the harmonious relationship between cities and natural ecosystems. It is not only the green foundation of urban aesthetics, but also a resilience guarantee for long-term urban sustainability. Through three indicators—the level of ecological-space protection, the share of blue-green space within built-up areas, and native biodiversity in built-up areas—it comprehensively assesses a city's ability to respect and sustain its natural base. Across the sample cities, performance in this dimension diverges markedly, showing that natural endowment itself does not automatically translate into an aesthetic advantage. The decisive factor is whether a city can turn natural resources into a stable ecological-security pattern through planning control, protection institutions, and ecological restoration.

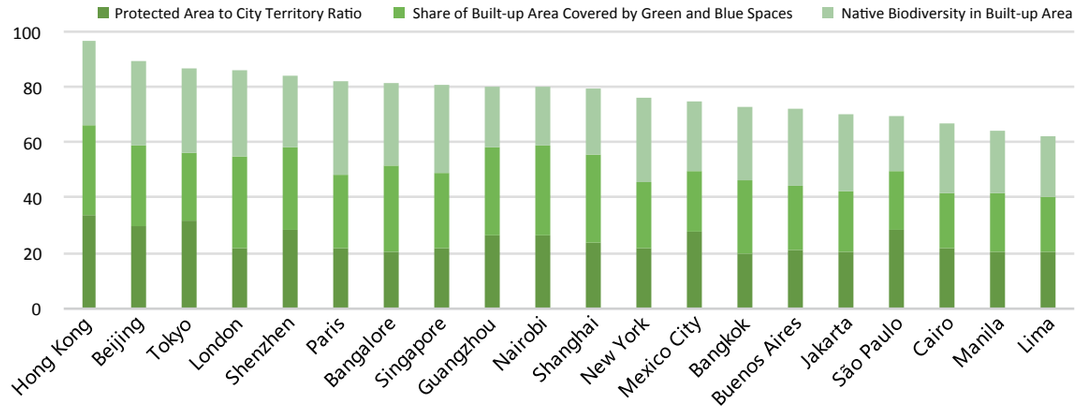


Figure 4 Natural Harmony Scores by City

Overall, high-scoring cities can be broadly divided into two groups. The first includes high-density cities such as Hong Kong, Beijing, and Shenzhen, which combine relatively large-scale ecological space with strong rigid control capacity. Through ecological control lines, country parks, ecological protection redlines, or large-scale ecological corridor systems, they have retained a relatively complete ecological base amid rapid urbanization. The second includes highly built-up cities such as Tokyo and Singapore, which enhance ecosystem carrying capacity in highly artificial environments through fine-grained greening, micro-habitats, waterfront restoration, and ecological network stitching. Shenzhen's "Mountains–Sea–City Integration" plan links the city's mountains, coastline, and urban park clusters through ecological corridors, building a citywide ecological network framework of "one ridge, one belt, and twenty corridors". It upgrades isolated blue-green patches into connected ecological infrastructure, providing continuous movement corridors for native species while bringing surrounding nature within residents' everyday reach.

Middle- and low-scoring cities reveal two types of issues. In some cities, regional natural hinterlands are relatively rich, but the absence of rigid urban-expansion boundaries allows built-up areas to continuously encroach on ecological space, making it difficult for peripheral nature to become stable urban ecosystem services. In others,

green space and water bodies do not sufficiently penetrate built-up areas; ecological patches are fragmented, and biodiversity conservation remains largely confined to protected areas rather than embedded in urban construction and daily governance. The performance of Lima, Cairo, and Manila shows that mountains, water resources, or natural hinterlands do not automatically produce a high level of Natural Harmony. Once spatial control and ecological restoration mechanisms are lacking, the ecological base can be weakened rapidly during urbanization.

Superior natural endowment alone is not sufficient for a beautiful city. Without effective governance, the ecological base can easily be consumed by urban expansion. Refined institutional design and rigorous implementation, however, can upgrade nature conservation from passive retention to active resilience building. The leading cities in this dimension have all established clear and firm boundaries between development and protection through three instruments: legal regulation, spatial planning, and fine-scale engineering.

| Case 1 | Hong Kong – Statutory Citywide Protection Mechanism Integrating Ecological Conservation and Value Creation

Through the Country Parks Ordinance, Hong Kong has built a robust legal protection system, placing about 44,842 hectares—around 40% of its land area—under statutory protection and forming a closed-loop governance system of "unified management, strict enforcement, and dynamic control". At the same time, its world-class hiking trail network, represented by the MacLehose Trail, closely connects extensive protected areas with citizens' daily lives, integrating multiple values: ecological conservation, recreation services, and nature education. The underlying logic is to exchange highly intensive development for large-scale ecological conservation, transforming ecological protection from a "cost of development" into a "core asset of urban livability" and providing a core reference for high-density cities worldwide.



| Case 2 | Tokyo – Full-scale Habitat Creation Mechanism Embedding Nature Throughout the Urban System

Tokyo challenges the binary of "city versus nature" and embeds biodiversity conservation into all scales and processes of urban development. At the macro level, the Satoyama conservation initiatives sustain peri-urban complex ecosystems, preserving traditional landscapes and diverse habitats where humans and nature coexist. At the meso level, ecological network nodes and green corridors reconnect and improve the connectivity of fragmented ecological patches. At the micro level, potential natural vegetation maps are used to guide urban greening, actively creating complete food chains and ecotones. The underlying logic is that "nature is an organic component of the urban system, not a peripheral landscape". Through fine-scale native habitat creation, the city of concrete and steel becomes a living oasis where wildlife can thrive.



(2) Green Progress

The Green Progress dimension focuses on the pressure feedback and governance responses between urban human activities and the natural environment. It is a key yardstick for assessing whether urban development is moving toward a green, low-carbon, and environmentally friendly pathway. Through three indicators—urban low-carbon level, annual average air quality, and water-environment governance—this dimension reveals differences in cities' environmental governance capacities across stages of industrialization and post-industrialization. It reflects the comprehensive governance capacity of cities in energy consumption, pollution control, and environmental infrastructure. Across the sample cities, overall score gaps in this dimension are relatively small, but the structural differences behind them are more complex: some high scores stem from long-term industrial transition and institutional governance, while others may come from lighter industrial structures or insufficient industrialization, and therefore do not necessarily mean that active green transformation has been completed.

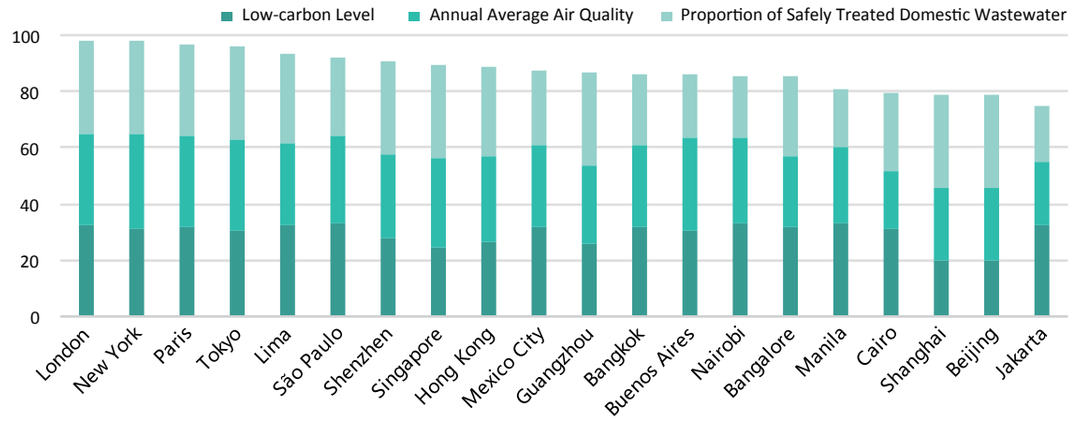


Figure 5 Green Progress Scores by City

From a global perspective, this dimension shows a clear "developmental generation" pattern. Mature global cities such as London, New York, and Tokyo have passed the peak of the Environmental Kuznets Curve and entered a stage of deep decarbonization and high-quality environmental governance. Their leadership in Green Progress is the combined result of decades of industrial restructuring, clean-energy substitution, and strict environmental regulation. Taking annual per capita carbon emissions as an example, these cities have highly service- and finance-oriented economic structures, with energy-intensive industries largely relocated. Through building energy-efficiency retrofits, public transport priority, and energy-structure optimization, they have achieved a significant decoupling of economic growth from carbon emissions. London continues to reduce its urban carbon footprint through refined policy tools such as ultra-low emission zones and energy-efficiency improvements for existing buildings. New York, through decades of air-quality legislation, has become a global benchmark in PM2.5 governance, showing that even megacities can make blue skies the norm through strict vehicle emission standards, fuel upgrades, and industrial boiler retrofits.

For cities in post-industrial transition or rapid industrialization, however, Green Progress presents a more complex picture. Taking Beijing, Shanghai, and Shenzhen in China as examples, all three have matched or even surpassed leading global levels in environmental infrastructure indicators such as domestic wastewater treatment,

demonstrating strong infrastructure investment and delivery capacity. Yet in carbon-emissions indicators, all three face more severe challenges than mature global cities. This does not signal governance failure; rather, it reflects their special role in the global division of labor. As important manufacturing centers and trade hubs, they still have high overall energy consumption and industrial-process emissions, and the inertia of heavier industrial structures means that decarbonization will require more time and deeper structural reform. Even at this stage, however, cities still have room to act. Since 2004, Shenzhen has systematically advanced air-pollution control and taken the lead in achieving 100% electrification of buses and taxis, reducing mobile-source emissions at source through transport electrification. In 2019, it became the first to eliminate black and odorous water bodies citywide. These systematic breakthroughs have made "Shenzhen Blue" and "Shenzhen Clear" iconic ecological calling cards, providing a replicable green-transition model for cities at a similar stage of development.

Some cities may appear to have advantages in per-capita carbon emissions or air quality, but these advantages may not be the result of active governance. Instead, they may reflect a stage-specific situation created by insufficient industrialization, lower consumption levels, or industrial structures that have not yet become heavy. At the same time, pressures on air quality and wastewater governance in cities such as Jakarta, Cairo, and Manila reveal the tension among lagging environmental infrastructure, insufficient fiscal investment, and overly rapid urban expansion. In other words, Green Progress cannot be judged only by current emission levels; it is also necessary to determine whether the underlying driver is active low-carbon transition or environmental pressure that has not yet been fully released at the current development stage.

Green Progress is not only a technical issue, but also a projection of the development stage. For mature cities, the key is sustained deep decarbonization; for transition cities, it is moving from end-of-pipe treatment to source reduction; and for developing cities, it is avoiding the old path of "pollute first, treat later". For most cities, the real challenge is not any single environmental engineering project, but whether energy, industry, transport, buildings, and water-environment governance can be integrated into one long-term transition framework, so that Green Progress shifts from a set of pollution-control indicators to a systematic adjustment of the urban development model.

| Case 3 | London – Market-based Closed-loop Emission Reduction Mechanism Across Key Sectors

London uses market mechanisms to internalize the external costs of pollution, rather than simple administrative restrictions. Its Ultra Low Emission Zone (ULEZ), the largest in the world, charges high fees to high-polluting vehicles, using economic leverage to drive fleet clean-up. The collected revenue is legally reinvested in public transport and active travel infrastructure, forming a closed-loop governance of "polluter pays - revenue reinvested in green infrastructure - continuous emission reduction". Since implementation, roadside nitrogen dioxide levels have nearly halved, and the proportion of vehicles meeting emission standards has jumped from 39% to over 97%, providing a fundamental solution for urban transport emission reduction worldwide.



| Case 4 | New York – Legislation-driven Breakthrough Mechanism in Key Sectors

New York targeted the core source of urban carbon emissions - the building sector (accounting for two-thirds of the city's total emissions). Through Local Law 97, one of the world's strictest building emission regulations, it sets mandatory carbon emission caps and phased reduction targets for nearly 50,000 large buildings, imposing high annual fines of $268 per ton on non-compliant buildings. This rigid legislation directly activated the long-dormant building energy efficiency retrofit market, forcing building owners to accelerate the phase-out of fossil fuel boilers and introduce clean energy systems, ensuring the irreversibility of the city's low-carbon transformation. In the first year, the compliance rate reached 93%. At the same time, New York coordinates clean electricity transformation and congestion charging, forming a governance path of "key sector breakthrough - full-system synergy".



(3) Spatial Resonance

The Spatial Resonance dimension represents the highest-order pursuit of beautiful city development. It goes beyond the "green" and "clean" qualities of the physical environment and touches the humanistic core of whether urban space can be perceived, identified with, and communicated. Through three indicators—City Image Favorability, Destination Appeal Intensity, and Streetscape Visual Quality—it reflects the comprehensive level of public space, historical culture, tourism appeal, streetscape aesthetics, and everyday life experience. Across the sample cities, differences in Spatial Resonance are the most pronounced, showing that urban beauty is not only a matter of governance capacity, but also a combined expression of cultural communication capacity, spatial operation capacity, and the inclusiveness of public space.

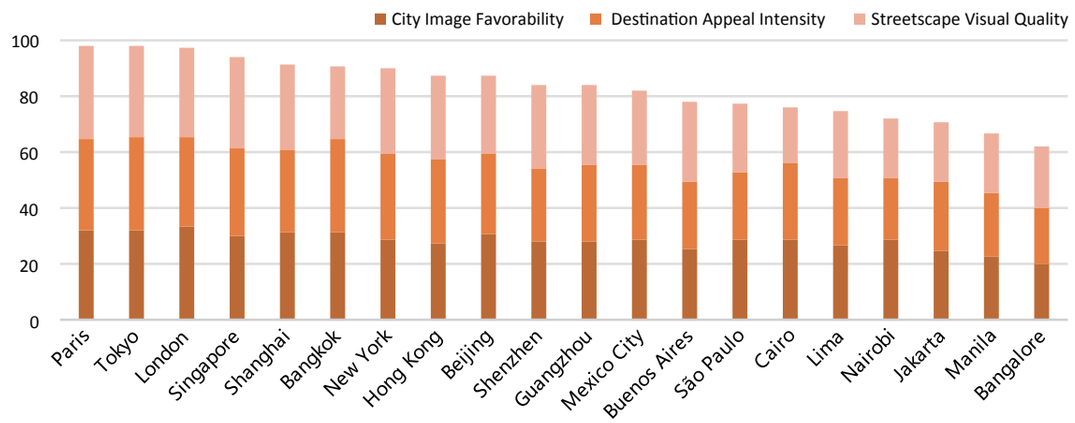


Figure 6 Spatial Resonance Scores by City

The formation pathways of high-scoring cities are not identical. Historic cultural cities such as Paris and London rely on deep heritage, mature urban renewal, and international communication capacity to translate cultural capital into a stable city image. Paris has fully implemented the "15-minute city" concept as systematic spatial governance, transforming commuting routes that people "must pass through" into emotional places where people "want to stay". London, through the revival of Thames waterfront spaces and the adaptive reuse of industrial heritage, has seamlessly woven history and culture into global media narratives, turning the city itself into a super IP that continuously produces cultural imagery. Tokyo and Singapore rely on fine-grained urban design, orderly and clean streets, public transport, and walking experiences to form highly perceptible spatial quality. Shanghai and Bangkok perform strongly in Spatial Resonance, driven more by urban landscapes, tourism consumption scenes, and international destination appeal. Shenzhen's Spatial Resonance comes mainly from the composite shaping of reform-and-opening culture, its mountain–sea urban landscape, and high-density public life. Through citywide urban design control and a quality-control system of "three guidelines plus three general rules", Shenzhen has brought its mountain–sea pattern, architectural interfaces, block scale, and public-space quality under institutionalized management. At the same time, it embeds the concept of "all-age friendliness" throughout spatial development. By using the 200-kilometer Kunpeng Trail that connects mountains and sea to reshape urban experience, and by systematically extending child-friendly parks, age-friendly street retrofits, and barrier-free facilities, Shenzhen helps ensure equal spatial rights for different groups.

Middle- and low-scoring cities also show different types of shortfalls. The first type is strong in tourism appeal but weak in everyday experience, represented by Buenos Aires, Lima, and Nairobi. These cities have high international visitor intensity and iconic attractions, but there is an evident gap in streetscape quality, continuity of public space, and residents' daily experience, creating a disconnect between visitor perception and citizen experience. The second type is economically fast-growing but spatial-quality lagging, with Bangalore as a typical example. The city has strong industrial vitality, yet public-space aesthetics, cultural branding, and street-scale governance have not improved in step, creating a structural contradiction of "fast industrial growth but slow spatial-quality improvement". The third type is constrained by weak infrastructure, including Jakarta, Cairo, Manila, São Paulo, and Mexico City. These cities are held back by insufficient environmental infrastructure, traffic congestion, uneven public-space provision, and weaker street-environment quality, making it difficult for city image to translate into stable international appeal and resident identification. Spatial Resonance is therefore not simply a matter of the number of attractions or the height of landmarks, but whether a city can organize culture, landscape, streets, public services, and everyday life into a continuous experience.

Urban aesthetics should not remain at the level of landmark building or tourism packaging; it should return to people's everyday perception. Historic cities need to shift cultural heritage from static preservation to dynamic operation. Cities with refined governance need to use design guidelines and street quality to create a stable sense of beauty. Younger cities need to shape new urban identities through local culture, public services, and mountain–water spatial patterns. Fine-grained spatial control secures the bottom line of quality, while the discovery and activation of local culture evoke emotional resonance. Ultimately, Spatial Resonance rests on inclusive governance: only when every resident can feel respected and a sense of belonging in everyday spaces can urban beauty become a daily experience within reach for all residents.

| Case 5 | Paris – A 15-Minute City Centered on Spatial ResonanceKey Sectors



The Paris municipal government permanently transformed the right-bank expressway along the Seine into a riverbank plaza. Roaring traffic gave way to conversation, reading, and impromptu performances, turning a once-alienating transport facility into a warm urban living room. More than 200 "school streets" are closed to motor vehicles during drop-off and pick-up times, with playful patterns painted on the ground. Cold road space becomes a soft boundary protecting childhood, and neighbors rebuild mutual trust there. Each year, tens of thousands of on-street parking spaces are removed, and the released corners are planted with micro-gardens, shared book kiosks, and "citizen pavilions", creating dramatic nodes for everyday strolling, chance encounters, and contemplation. These spatial interventions transform "must-pass" commuting routes into "worth-staying" emotional places, elevating time once consumed by traffic into scene-based experiences that nourish community identity.

| Case 6 | Singapore – Pixel-level Urban Design Control MechanismKey Sectors



Singapore uses highly detailed urban design guidelines to extend spatial quality control down to the micro scale of building components. All new construction, redevelopment, and retrofitting projects must comply with the guidelines of their respective urban design districts. The guidelines impose mandatory requirements on building setbacks, facade materials, pedestrian linkways, outdoor signage, and even lighting systems, with zero tolerance for "visual noise". At the same time, systematic policies such as the "Landscaping for Urban Spaces and High-rises" (LUSH) program use tools including green replacement requirements and incentives for vertical greenery to embed the "Garden City" concept throughout the urban construction process. Green coverage increased from 35.7% in 1986 to nearly 50% in 2010. The underlying logic is that "urban aesthetics stems from detailed control across the full process and all scales". Through standardized design guidelines, the consistency and stability of urban spatial quality are ensured, forming a globally recognizable city brand.

3.4.4 Insights and Recommendations

First, the pathway to a beautiful city is not a single template; it lies in "each city finding its own aesthetic language". Urban aesthetics is the unique product of a deep dialogue between governance wisdom and local endowments. It requires adaptive planning as the overarching guide and a multi-dimensional governance toolkit. Cities rich in mountains and water can legally secure ecological boundaries, allowing the city to grow among forests and river networks. High-density cities should use "acupuncture-style" interventions—such as rooftop gardens and micro-habitats—to maximize everyday access to nature. Historic cities should cultivate their cultural fabric, turning accumulated time into perceptible spatial narratives. The key is not to imitate others' pathways, but to understand one's own ecological pattern, development stage, and cultural genes: securing the foundation through bottom-line control, bringing people and nature closer through spatial integration, and activating distinctive resources through light-touch interventions, so that nature is woven into everyday urban life. Only when each city finds its own aesthetic language can diverse pathways converge into a shared vision of urban aesthetics in diversity.

Second, the key to a beautiful city is not a single breakthrough, but "three-dimensional synergy". Natural Harmony secures the safety bottom line, Green Progress regulates development pressure, and Spatial Resonance reinforces governance recognition. The three dimensions support one another and none can be missing. A shortfall in any dimension becomes a bottleneck. Urban governance must guard against favoring one dimension while weakening the other two: excessive ecological expansion without industrial green transition undermines the sustainability of aesthetics; a one-sided focus on environmental indicators while ignoring spatial aesthetics leaves a city clean but emotionally unmoving; and pursuing cultural landmarks while neglecting the ecological base produces a rootless image. No city can reach global excellence through a single-dimensional leap. The overall optimum of three-dimensional synergy is the necessary path. Beautiful city development must not become a departmental silo; it should become the top-level logic guiding planning, transport, industry, and culture, so that progress in each dimension lifts the other two and forms a virtuous cycle of mutual reinforcement.

Third, the future of beautiful cities is not constrained by high density; it depends on inclusive governance. Tokyo, Singapore, Hong Kong, and Shenzhen are all among the world's most densely populated cities, yet they rank highly in the urban aesthetics assessment, demonstrating that high density and urban aesthetics are not inherently contradictory. What truly determines success is whether governance enables every resident to enjoy beautiful spaces equitably. Their core experience lies in integrating refined governance with spatial equity: securing the ecological bottom line through "concentrated development and sufficient wilderness"; creating room to breathe through vertical greening, micro-habitats, and slow-mobility networks; and ensuring that parks, greenways, and safe streets are fairly distributed across every community through all-age friendliness, age-friendly retrofits, and systematic barrier-free facilities, so that older people, children, and people with reduced mobility enjoy equal spatial rights. Only when beautiful city development becomes a process of strengthening the social community can late-developing cities, within a shorter window of opportunity, pursue a "compressed" pathway in which ecological security, environmental quality, and humanistic appeal leap forward together.

A beautiful city is not merely the result of development; it is the mode of development itself. Urban aesthetics must be elevated from an accessory to the underlying logic that guides the whole: institutional rigidity to protect the bottom line of survival, integrated hard and soft measures to open leapfrog pathways, three-dimensional synergy to break down departmental silos, and inclusive governance to realize spatial justice. Only then can the city become a living community in which humans and nature coexist in harmony.

3.5 Resilience

3.5.1 Understanding Resilience

The evolution of urban resilience reflects the interaction between changing safety governance concepts and the development of urban systems. Overall, it marks a paradigm shift from rigid engineering-based resistance to dynamic, system-based adaptation. In the early stage, urban safety efforts focused primarily on disaster resistance. Risks were often viewed as external threats to urban development, and the main approach was to strengthen the engineering performance of buildings and infrastructure through standardized fortification, targeted reinforcement, and hard protective measures. Natural ecosystems, social response mechanisms, and governance learning were largely treated as supplementary elements. At this stage, resilience was understood in relatively narrow terms. It emphasized physical robustness, while paying limited attention to internal coordination, systemic flexibility, and self-adaptive capacity.

As global climate change intensifies, compound disasters become more frequent, and urban operations grow increasingly complex, urban safety governance has gradually shifted toward a more adaptive approach. Urban planning and safety management have begun to incorporate redundancy, emergency spaces, ecological buffers, and other flexible measures to enhance cities' capacity to withstand, absorb, and adjust to shocks. However, this stage remained largely centered on engineering facilities. Resilience efforts were still mainly aimed at reducing disaster losses and enabling rapid recovery, while insufficient attention was given to the buffering value of ecosystems, the self-organizing capacity of social systems, and the iterative improvement of governance systems. As a result, a fully coordinated, system-wide resilience pattern had yet to take shape.

Under the UIS theoretical framework, urban resilience has moved toward a more mature, people-centered and evolution-oriented paradigm. The concept of resilience has evolved from engineering resilience, through ecological resilience, to evolutionary resilience: engineering resilience focuses on recovery efficiency under a single steady state; ecological resilience emphasizes the system's capacity to absorb and buffer disturbances; and evolutionary resilience focuses on dynamic adaptation, learning, reorganization, and transformation, which can better cope with the diverse, compound, and cascading risks faced by modern cities. Under this paradigm, the city is no longer seen as an isolated safety fortress, but as an organic system co-evolving with the risk environment; resilience building is no longer limited to hardware reinforcement, but aims to build a shared safety community in which people, cities, society, and nature adapt to one another in a coordinated way. This paradigm shift guides urban resilience evaluation toward scientific integration and system coordination.

Modern theories of urban safety and systems science provide strong theoretical support for resilience building. As a complex adaptive system shaped by the interaction of human activities,



Figure 1 Resilience in the UIS Framework

infrastructure, the natural environment, and governance mechanisms, a city maintains orderly operation through the continuous exchange of matter, energy, and information. Its safety and stability are not derived from static equilibrium, but from dynamic adjustment enabled by robustness, redundancy, adaptability, and learning capacity. This shows that urban resilience cannot be measured by engineering strength alone. A sound evaluation framework should integrate engineering, ecology, systems theory, and governance science to form a multidimensional assessment logic. A city with a high level of resilience should first be understood as a complex system that operates safely and healthily, performs stably, and has adaptive buffering capacity.

Within global urban safety governance, resilience has become a core dimension for measuring cities' capacity for sustainable development. UN-Habitat, international emergency management organizations, and other institutions widely recognize that urban resilience goes beyond the traditional scope of disaster prevention and mitigation. It is an integrated capability covering baseline defense, emergency recovery, ecological adaptation, and governance transformation. Urban resilience is not only a guarantee for infrastructure safety, but also a concentrated reflection of system service capacity, social stability, and governance modernization. It also serves as a direct indicator of the quality of long-term interaction between human systems and risk environments. Therefore, a scientific resilience evaluation system needs to consider a city's baseline defense capacity in the face of risks, its emergency response and recovery efficiency, and the governance system's capacity for continuous adaptation and improvement.

Scientific theories provide the technical framework for urban resilience, while humanistic and governance values give it practical relevance. Urban safety ultimately serves residents' everyday lives and livelihoods. A high level of resilience is reflected not only in the system's capacity to withstand shocks and risks, but also in a sense of security and belonging that citizens can perceive, trust, and rely on, enabling a transition from "passive risk avoidance" to "safe and secure living". Therefore, resilience evaluation should not only focus on hardware facilities and technical indicators, but also consider response efficiency, social coordination, governance effectiveness, and citizens' experiences, so as to realize the unity of technical rationality and humanistic value.

Based on systems science theory and the UIS resilience framework, a four-dimensional evaluation system comprising "Defense, Recovery, Adaptability, and Transition" is constructed. These four dimensions follow a progressive logic of "baseline defense, rapid recovery, ecological buffering, and governance evolution", and together form a comprehensive urban resilience evaluation system.

Defense: **Supported by engineering fortification and infrastructure systems, Defense safeguards the baseline for safe urban operation and serves as a fundamental prerequisite for resilience.**
It focuses on building fortification standards and municipal lifeline security, ensuring that key functions are not interrupted and basic operations remain stable in the face of extreme disasters, thereby providing a fundamental safeguard for urban safety.

Recovery: **Supported by emergency response and rescue capacity, Recovery improves the efficiency of functional restoration after disasters and connects disaster response with normal urban operations.**
It focuses on transport support, rescue coverage, rapid repair, and social order restoration, so as to minimize disruption time, reduce secondary risks, and ensure the city's rapid return to normal operation.

Adaptability: **Supported by ecological buffering and spatial flexibility, Adaptability enhances the city's long-term risk-adaptation capacity.**
It relies on natural shoreline protection, sponge city development, and ecological space preservation to improve stormwater retention, flood regulation, climate adaptation, and ecological buffering, supporting the shift from passive disaster resistance to active adaptation.

Transition: **With top-level design and governance innovation as its core driver, Transition supports the long-term improvement of resilience capacity.**
Through integrated coordination mechanisms, planning guidance, disaster risk surveys, data application, and platform integration, it supports the city's shift from passive response to active governance, transforms disaster experience into institutional capacity, and enables continuous improvement in urban resilience.

Table 1 Indicator System of Resilient Cities

Objectives	Indicators	Definition
Defense	Building Fortification Level	Overall evaluate the ability of buildings to resist disasters. Consider its seismic design standards, fire protection facilities, and its actual performance in disasters in the past.
	Municipal Infrastructure Guarantee Level	Reflects the guarantee capability of urban municipal infrastructure for the city. Evaluates the continuous supply capacity and redundancy of urban water supply, power supply, and gas supply infrastructure during disasters by considering the average duration of water and power outages per household, the diversity of municipal supply facilities, the backup and excess capacity of municipal facilities.
Recovery	Emergency Traffic Support Level	To assess the density of the urban road traffic network and determine the capacity of the urban transportation network to ensure disaster response. The calculation method is to divide the total length of urban roads by the urban area, which gives the density of the urban road network.
	Emergency Response Service Level	Reflects the initial emergency response coverage capability of the city for sudden incidents. The calculation method is to determine the proportion of the area covered by the 5-minute driving range of fire stations within the city compared to the total area of the city, and then make adjustments based on the city's population density, urban road network and traffic conditions, and urban spatial structure.
Adaptability	Natural Shoreline Retention Rate	Reflect the integrity of the waterbank ecosystem. The calculation method is the percentage of the natural bankline (including the restored ecological bankline) to the total length of the bankline.
	The Proportion of Permeable Urban Area	Reflects the city's ability to absorb, store and infiltrate rainwater. The calculation method is the ratio of the area of permeable surfaces (such as natural soil, green spaces, and permeable pavement) to the total surface area of the urban built-up area.
Transition	Top-Level Design of Resilient City	Reflect the top-level institutional design and coordination capabilities of the city. Evaluate the leadership mechanism of the government in building a resilient city, the situation of planning formulation, and the establishment of the emergency comprehensive platform.
	Disaster Risk Management Level	Reflect the city's systematic governance capability for disaster risks. Comprehensive assessment of the implementation of disaster risk census work, the density of monitoring stations (for earthquakes, meteorology, floods, etc.) and the update and application of disaster data.

3.5.2 Overall Assessment

Based on the assessment results, the comprehensive scores of the 20 sample cities show clear tiered differentiation. According to their overall performance, they are divided into four tiers, presenting the hierarchical pattern of global urban resilience building.

(1) Ranking Tiers

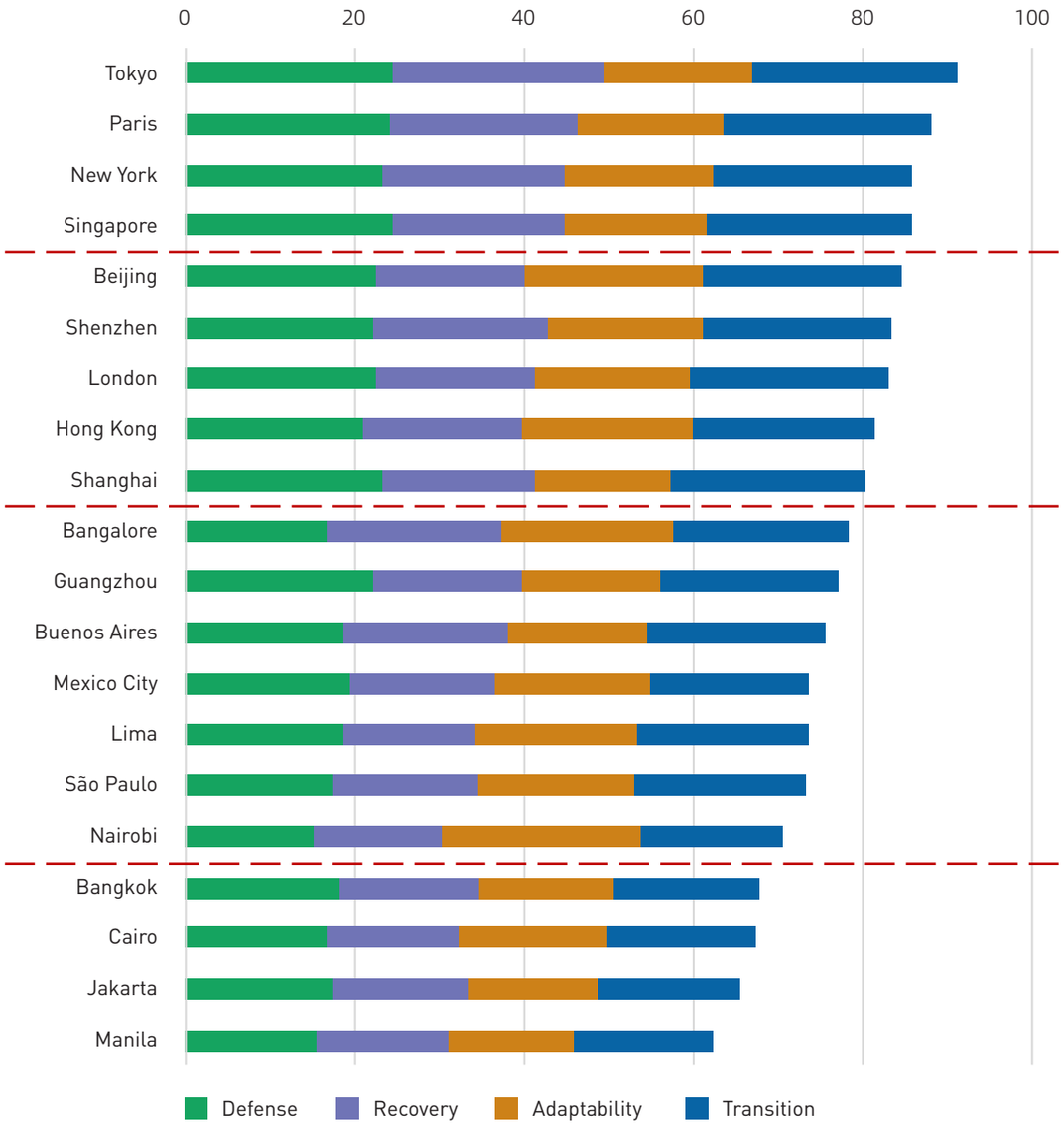


Figure 2 Tier Performance

Tier 1

score > 85: Tokyo, Paris, New York, and Singapore

Its core features are leading performance across all four resilience capacities and a highly balanced structure. These cities have formed a closed-loop safety system covering the entire urban area and the full risk-management process, and demonstrate strong capabilities in multi-hazard resistance, rapid recovery, and dynamic adaptation. After long-term governance evolution, they have developed mature regulatory standards, intelligent monitoring systems, and efficient emergency mechanisms, achieving deep integration of urban safety and urban operations in high-density spaces and complex urban systems. They serve as top global benchmarks for resilient city development.

Tier 2

80 < score ⩽ 85: Beijing, Shenzhen, London, Hong Kong, and Shanghai

Its core features are significant advantages in key resilience dimensions and overall resilience performance that remains among the leading global cities, with room for optimization in certain areas and specific fields. Among them, Shenzhen, as an emerging megacity, performs strongly in Recovery and Adaptability, supported by its young urban fabric, high-standard building fortification, and efficient emergency rescue system, making it a pioneering example of resilient city development on the Chinese mainland. These cities rely on strong infrastructure capacity and governance systems, and perform well in core areas such as building fortification, disaster governance, and top-level design. They have built a solid urban safety framework and are upgrading from targeted protection toward citywide balance, and from basic compliance toward refined quality improvement, serving as the backbone of global megacity resilience building.

Tier 3

70 < score ⩽ 80: Bangalore, Guangzhou, Buenos Aires, Mexico City, Lima, São Paulo, and Nairobi

They are mainly major cities in developing countries undergoing rapid development. Their core features are distinctive breakthroughs in individual dimensions or local scenarios, showing clear pathways for resilience improvement. However, constrained by their development stage, existing infrastructure stock, population pressure, and governance coordination, their overall resilience systems are still being improved, and a stable pattern of citywide coordination has not yet been formed. These cities are actively balancing development and safety, gradually improving overall capacity through targeted improvements in key scenarios. Their exploratory practices provide valuable reference for other cities.

Tier 4

score ⩽ 70: Bangkok, Cairo, Jakarta, and Manila

Its core features are a weak overall safety foundation, widespread shortcomings in key areas such as building fortification, municipal infrastructure support, emergency response, and ecological buffering, and high vulnerability to disasters and extreme events. These cities are at a critical stage of rapid urbanization and development model transformation. Although they face practical challenges such as fragmented governance and insufficient infrastructure, they also have clear latecomer advantages. If top-level design and systematic investment are accelerated, they can quickly address existing gaps and achieve leapfrog improvements in urban resilience.

(2) Performance Profile

Judging from the performance of the 20 cities across four dimensions and multiple indicators, five typical patterns can be identified, namely the full-dimensional coordination type, high-density strong-defense type, strong-foundation leading type, localized refinement type, and weak-foundation type, corresponding to different evolutionary paths of urban resilience.

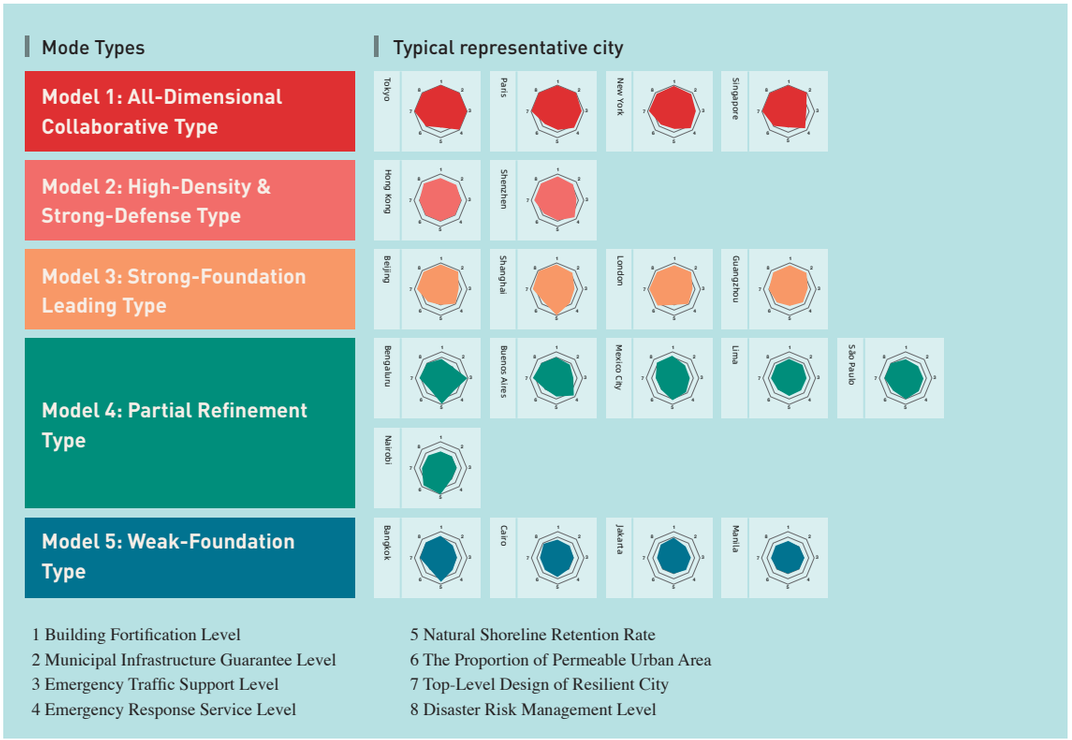


Figure 3 Typology of Resilience Patterns

Table 2 Pattern Classification and Characteristics

Type	Cities	characteristic
Full-Dimensional Collaborative Type	Tokyo, Paris, New York, Singapore	The overall features of this pattern are "proactive management of risks across the full cycle" and "deep integration and co-evolution among multiple systems". These cities have largely moved beyond a single engineering-defense approach. Instead, they use sophisticated legal systems and digital technologies to make uncertain risks more identifiable, manageable, and governable. They have successfully managed the challenge posed by the coexistence of high-density development and complex disaster risks, and have built full-cycle risk governance systems within mega-scale urban systems. The core logic of this pattern is a balance between rigidity and flexibility. On the one hand, these cities establish a physical safety baseline through strict building codes and underground space development. On the other hand, they form flexible social response mechanisms through cross-departmental data sharing and community-based self-governance networks. For example, Tokyo's resilience-related legal and planning frameworks promote regional infrastructure upgrades through legally binding requirements, enabling a shift from "disaster resistance" to "disaster adaptation". Singapore has built a closed-loop safety system with a high degree of self-sufficiency under extremely limited resource conditions through the "Four National Taps" water strategy and strict ecological red lines. This pattern provides a benchmark paradigm for global resilient city development.
High-Density Strong-Defense Type	Hong Kong, Shenzhen	representing typical examples of high-density megacity resilience. The core features of this pattern are "rigid fortification under spatial constraints" and "three-dimensional resilience built under intensive spatial conditions". Extremely high population density and land scarcity do not necessarily lead to weak resilience. If strict standards are used to safeguard building safety, a distinctive safety defense pattern for high-density urban areas can be formed within limited urban space through high-standard fortification, precise rescue, efficient allocation of limited resources, and strict control of ecological spaces. Within a compact urban setting shaped by mountains and the sea, Hong Kong demonstrates a high level of safety redundancy through strict building safety standards, fire safety regulations, slope management, three-dimensional evacuation systems, and community emergency response networks. Relying on strong engineering capacity and institutional innovation, Shenzhen has advanced building fortification and emergency response systems to a high level while developing rapidly, bringing its performance closer to that of leading global cities. This pattern shows that, through meticulous spatial governance and high-standard construction, physical environmental constraints can be transformed into distinctive advantages for improving resilience.
Strong-Foundation Leading Type	Beijing, Shanghai, London, Guangzhou	serving as the backbone of resilience building among global megacities. This pattern reveals "renewal of existing urban assets supported by strong infrastructure" and "overall coordination across large-scale urban areas". With strong fiscal and engineering capacity, these cities have made up for core shortcomings, and their Defense and Transition capacities have reached a high global level. Constrained by large city scale, extensive built-up areas, and a large stock of old buildings and facilities, they still face limitations in emergency transport efficiency, balanced rescue coverage, and ecological buffering space. The bottleneck of resilience building has therefore shifted to renewal of existing urban assets, system coordination, and citywide balance. Beijing and Shanghai have promoted dedicated resilience plans at the megacity scale, laying the cornerstone of citywide safety through the reinforcement and upgrading of major infrastructure. London and Guangzhou vigorously improve the risk resistance of key lifeline systems while preserving the character of historic urban areas. This pattern is characterized by the gradual upgrading of large existing urban systems: while maintaining normal urban operations and functions, it promotes resilience upgrading through continuous investment and systematic planning, realizing the shift from basic availability to quality enhancement.
Partial Refinement Type	Bangalore, Buenos Aires, Mexico City, Lima, São Paulo, Nairobi	serving as pioneers in resilience building among developing cities. The overall features of this pattern are "precise allocation of limited resources" and "overall improvement driven by targeted breakthroughs". Lacking the conditions for comprehensive citywide transformation, they adopt a targeted intervention strategy, focusing on fields such as emergency transport, natural shorelines, and emergency rescue to build areas of advantage and drive overall resilience improvement through local strengths. This is a pragmatic and incremental path under limited development capacity and funding. Bangalore shows strong "physical redundancy" in terms of road network density, while Buenos Aires focuses on strengthening the flood-control and leisure functions of ecological waterfront spaces. These cities do not pursue all-round perfection, but under fiscal and technical constraints, they identify their most vulnerable or most promising areas, concentrate resources to tackle key problems, and gradually strengthen the urban safety network step by step, demonstrating the pragmatic wisdom of developing cities.
Weak-Foundation Type	Bangkok, Cairo, Jakarta, Manila	constituting a group with significant potential for improvement in global urban resilience building. The core features of this pattern are "insufficient provision of basic resilience capacity" and "risk exposure under fragmented governance". Population growth often exceeds urban carrying capacity, and the core dilemmas include substandard building safety, unstable municipal service provision, insufficient emergency accessibility, and incomplete risk early-warning systems, with informal housing further weakening overall resilience. It is necessary to prioritize baseline safety issues, consolidate the basic safety support system, and then advance systematic citywide resilience upgrading. These cities often face problems such as disorderly expansion brought by rapid urbanization, the concentration of informal settlements, and significant lag in infrastructure provision. Jakarta has long faced the dual threats of land subsidence and flooding, while informal settlements in Cairo lack basic safety safeguards. This pattern warns us that, in the early stage of resilience building, cities must first address the most basic safety needs through mandatory building codes, the expansion of basic municipal facilities, and effective risk early-warning systems, enabling cities to first "remain functional and stable" before seeking higher-level safety development.

3.5.3 Assessment by Objective

(1) Defense

The Defense dimension provides foundational support for urban resilience. It measures a city's physical capacity to withstand sudden shocks such as earthquakes, floods, typhoons, and fires, and serves as the first line of defense for safe urban operation. Through two core indicators — building fortification level and municipal service stability — this dimension evaluates a city's robustness in physical fortification, standard implementation, and system redundancy. From the perspective of the global sample cities, performance in this dimension shows distinct differences in governance pathways, rather than being determined simply by economic level or geographical conditions.

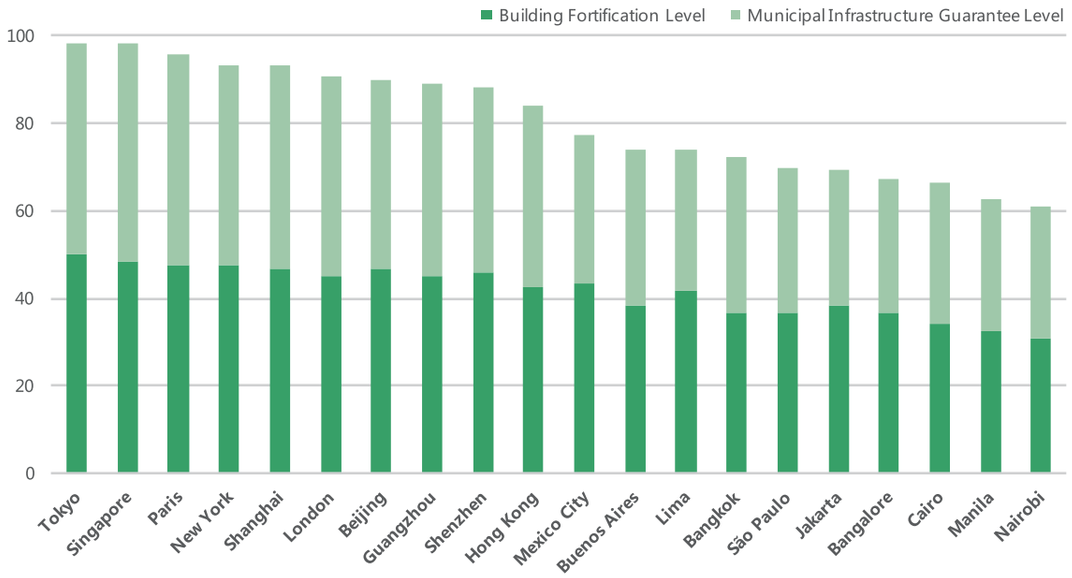


Figure 4 Defense Scores by City

The high scores of mature global cities confirm the key role of binding regulations and citywide control in consolidating the urban defense baseline. As a city exposed to high seismic risk, Tokyo performs strongly in the Defense dimension. Its core experience lies in establishing a comprehensive building safety and fortification system, clarifying mandatory requirements for seismic resistance, fire prevention, and disaster resistance through statutory standards, and combining regular risk assessment with full-process supervision to turn buildings and facilities into nodes of the urban safety system. Singapore is characterized by highly redundant system design. Through diversified water sources, multi-loop power supply, and high-standard building codes, it has built a defense system with a high degree of supply security within a compact urban space, achieving a high level of safety in high-density urban areas.

Several megacities in East Asia and Europe have taken an intermediate path of strengthening infrastructure to address shortcomings and upgrading existing urban assets to improve quality. Cities such as Beijing, Shanghai, London, Shenzhen, and Hong Kong rely on strong engineering capacity to quickly address core shortcomings in

areas such as building fortification and municipal service support. Newly built buildings and key facilities generally meet advanced international standards. Among them, Shenzhen, with its relatively new urban fabric, applies high-grade safety standards to new projects and performs well in building quality and facility reliability. However, these cities generally face problems such as a large number of old buildings and inconsistent facility standards in some areas. The renewal of existing urban assets has therefore become a key direction for further improving Defense capacity.

Many rapidly developing cities face common difficulties, including a weak defense baseline and insufficient system support. In cities such as Bangkok, Cairo, Jakarta, and Manila, urban expansion has far outpaced the provision of safety facilities. Many buildings fail to meet basic fortification standards, while municipal water supply, power supply, and drainage systems remain fragile, making them prone to cascading failures in the face of disasters. Even when some cities have certain natural endowments or construction conditions, lax implementation of standards, insufficient regulatory oversight, and disorderly construction have kept their Defense capacity at a relatively low level for a long time, leaving them exposed to high risks.

Therefore, the key insight from the Defense dimension is that superior development conditions are not, in themselves, a sufficient condition for high resilience. Tokyo and Singapore rely on the combined support of institutions, standards, and engineering capacity to achieve citywide compliance in Defense capacity. Conversely, cities that lack rigid control and systematic design may still struggle to form a stable and reliable defense baseline, even with considerable resource investment. Leading cities in this dimension have upgraded urban defense from passive disaster resistance to active fortification through the coordinated support of institutions, standards, and engineering capacity.

| Case 1 | Tokyo: Full-Chain Statutory Fortification System, Building Ultimate Safety Defense Foundation



Tokyo embeds safety defense into the full process of urban construction, operation, and maintenance with highly rigorous full-chain fortification standards. At the macro level, it relies on the Building Standard Act and national resilience-related legal frameworks to establish statutory safety baselines, clarify mandatory requirements for building seismic resistance, fire prevention, and wind resistance, and conduct rolling citywide risk assessments every five years. At the meso level, it builds redundancy systems for lifeline infrastructure, such as underground utility tunnels, multi-loop power supply, and diversified water sources, to ensure that core functions are not interrupted during extreme events. At the micro level, it promotes the wider application of seismic isolation and damping technologies and reinforcement requirements for older buildings, forming a citywide closed-loop defense system from individual buildings to municipal systems. Its underlying logic is to secure safety through the rule of law and consolidate baselines through standards, reducing disaster risks at the source and providing a replicable paradigm for high-risk cities worldwide.

| Case 2 | Singapore: Extreme Redundancy in Minimal Space, Creating a Self-Sufficient Safety Defense ParadigmFoundation



Under the condition of extremely limited land space, Singapore has built a highly secure and diversified defense system through "system redundancy + strict standards". In terms of water sources, it implements the "Four National Taps" strategy to realize diversified water security through local catchment water, imported water, reclaimed water, and desalinated water. For power supply, it adopts multi-loop networking and distributed backup power supplies to ensure a high level of power supply reliability. Buildings are managed through strict structural safety and fire safety standards, supported by full-process regulatory oversight. Through "limited space, high redundancy, and strict standards", Singapore achieves broad coverage of defense capacity in high-density built-up areas. This shows that spatial constraints are not necessarily safety disadvantages, and that scientific planning and strict implementation can enable high-density cities to build strong defense resilience, providing a benchmark path for resource-constrained cities.

(2) Recovery

The Recovery dimension is a key expression of urban resilience, measuring the city's capacity for emergency accessibility, rapid rescue, and functional restoration after sudden shocks, and serving as the core safeguard for the city to return from disruption to stability. Through two indicators — emergency transport support and emergency rescue services — this dimension evaluates the full-process efficiency of transport support, rescue resource deployment, and efficient response in disaster scenarios. The gap among global cities in this dimension is essentially the gap in the maturity of emergency systems, the rationality of spatial organization, and the sophistication of response mechanisms.

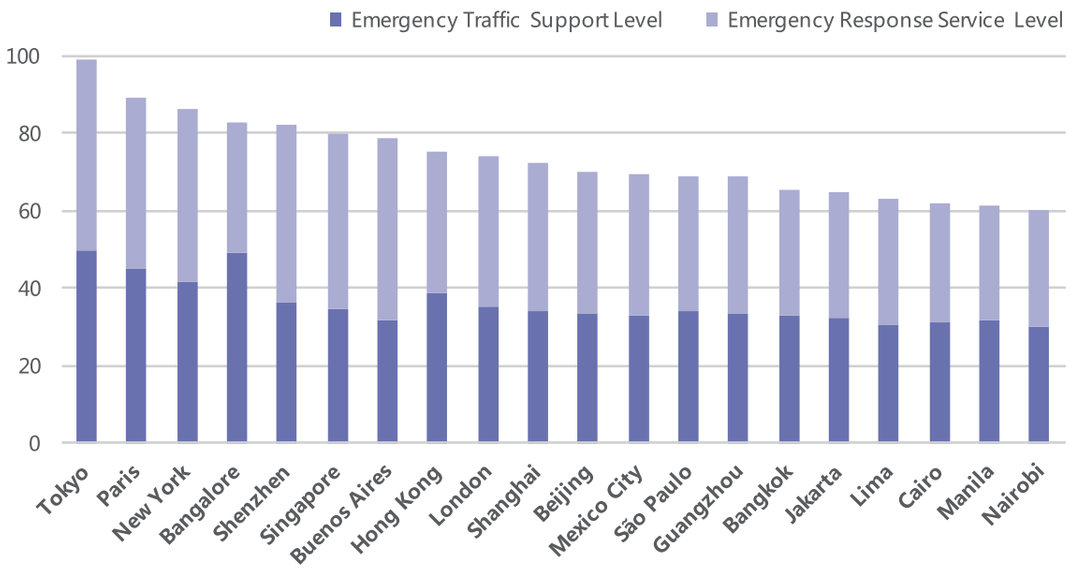


Figure 5 Recovery Scores by City

The leading performance of Tokyo, Paris, and New York comes from the long-term accumulation of citywide networked emergency layouts and rapid response mechanisms. Tokyo maintains emergency access and timely rescue during disasters through a high-density road network, dedicated emergency routes, and evenly distributed rescue stations. Combined with a highly mature citizen coordination mechanism, this forms a closed loop of "rapid access, precise deployment, and efficient response". New York relies on a regular road network and dedicated emergency routes to offset congestion pressure in high-density urban areas, while large-scale and professional rescue forces support broad coverage of key areas. This shows that spatial structure and mechanism design can significantly offset the pressures brought by urban scale.

Another type of city achieves efficient recovery through compact spatial organization and precise station distribution, with Shenzhen, Singapore, and Hong Kong as typical representatives. Shenzhen has a contiguous built-up area, a regular road network, and a balanced distribution of rescue stations, and stands out in emergency accessibility and rescue efficiency. Hong Kong builds hierarchical emergency routes based on its mountainous terrain, maintaining stable rescue capacity under mountainous, high-density conditions. These cities do not pursue super-large spatial coverage. Instead, through compact urban space, precise station distribution, and intelligent scheduling, they achieve efficient and broad-coverage emergency recovery capacity.

A large number of cities suffer from spatial imbalance, uneven coverage, and weak mechanisms, resulting in generally weak recovery capacity. Cities such as Bangalore, São Paulo, and Mexico City have good conditions at local nodes or along single corridors, but rescue resources are highly concentrated in core areas, with insufficient coverage in peripheral and vulnerable areas. Emergency routes are often interrupted by congestion, illegal construction, and terrain barriers, leading to a situation of "fast response in core areas, slow response in peripheral areas, and functional failure in vulnerable areas" after disasters. For cities such as Manila, Cairo, and Jakarta, emergency systems are still in their infancy, with insufficient stations, poor accessibility, and inadequate coordination, resulting in slow functional recovery after shocks and further amplification of risks.

Therefore, the key insight from the Recovery dimension is that city size and spatial density are not decisive factors for recovery capacity. Tokyo and New York achieve broad coverage across large urban areas, while Shenzhen and Singapore achieve high efficiency in compact urban spaces. Their common features are balanced emergency networks, evenly distributed rescue nodes, and standardized response mechanisms. Single-point investment without systematic organization can hardly truly improve a city's capacity to recover rapidly from shocks.

| Case 3 | New York: Full-Domain Emergency Network Closed Loop, Realizing Rapid Restoration of MegacitiesDefense ParadigmFoundation

New York builds a rapid recovery closed loop for megacities through "dedicated emergency routes + balanced station distribution + intelligent scheduling". Based on a gridded road network, it designates emergency priority routes to ensure rapid passage of rescue vehicles during disasters. It takes evenly distributed fire rescue stations and medical emergency stations as nodes to improve short-time emergency response coverage, and establishes a unified emergency command platform to dispatch rescue resources in real time and break down information silos. A full-chain rapid response mechanism is formed, from building safety and traffic management to rescue operations and functional restoration. Even in high-density and highly complex urban areas, rapid restoration after disaster impacts can be achieved, providing a systematic solution for recovery capacity development in megacities.



| Case 4 | Shenzhen: Precise Station Distribution and Efficient Response, Shaping a Benchmark for Recovery Capacity of Emerging CitiesDefense ParadigmFoundation

Leveraging its relatively young urban fabric and planning advantages, Shenzhen has developed a model of recovery capacity based on "balanced station distribution, efficient emergency transport access, and professional rescue". Its urban road network is relatively regular and well-connected, supporting emergency access, while emergency routes are designed to improve movement efficiency and reduce congestion. Fire stations and emergency shelters are arranged in a balanced manner according to population distribution and spatial structure, achieving relatively balanced coverage across the city. Emergency rescue teams are professionalized and equipped with modern facilities, with response speed and rescue efficiency remaining at a high level. At the same time, Shenzhen incorporates emergency spaces into urban renewal for coordinated construction, promoting the extension of emergency resources from core areas toward citywide coverage. This enables "rapid access, arrival, rescue, and repair during disasters" and demonstrates a high-efficiency recovery-capacity pathway for emerging megacities.



(3) Adaptability

The Adaptability dimension provides the long-term basis for urban resilience. It measures a city's capacity to use natural spaces and ecological patterns to cope with long-term risks and buffer extreme shocks, serving as a key pathway for cities to reduce risks in coordination with nature. Through two indicators — natural shoreline retention rate and level of sponge city development — this dimension assesses the effectiveness of urban ecological buffering, stormwater retention and flood regulation, and spatial adaptation. Global differentiation in this dimension shows that the strength of adaptability stems more from governance choices than from natural endowments.

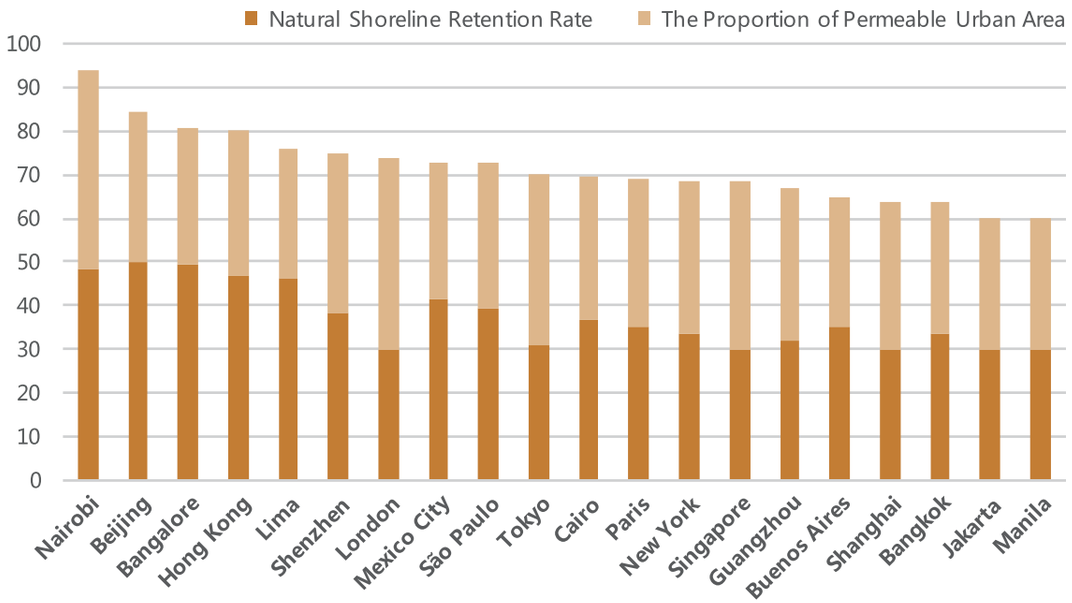


Figure 6 Adaptability Scores by City

The high scores of Nairobi, Beijing, Hong Kong, Bangalore, Lima, and other cities reveal the critical importance of strict protection and ecological restoration for improving long-term adaptation capacity. Nairobi relies on extensive ecological spaces and natural water-system buffers to form natural urban buffer zones, significantly improving stormwater retention, flood regulation, and climate adaptation capacity in a low-cost and sustainable way. Beijing greatly improves its capacity to respond to extreme weather through basin-wide water-system governance, ecological shoreline restoration, and sponge city development. Hong Kong safeguards ecological shorelines and the blue-green foundation through statutory control, maintaining strong ecological buffering capacity even under high development intensity.

Cities such as Tokyo, Singapore, London, and New York have taken a path of fine-grained ecological retrofitting in built-up areas and making the most of limited spaces. These cities have high development intensity and limited natural space, but embed ecological adaptation capacity into street corners, rooftops, green spaces, and waterfront areas through river ecological restoration, multifunctional shoreline use, permeable space networks, and three-dimensional stormwater retention systems. Singapore is moving from a Garden City to a City in Nature, while London enhances stormwater retention and flood regulation through a citywide blue-green network. Both serve as examples of improving Adaptability in high-density built-up areas.

In contrast, many rapidly expanding cities have seen ecological spaces encroached upon and buffering functions continuously weakened. Cities such as Mexico City, São Paulo, Bangkok, and Jakarta have experienced disorderly urban sprawl that fragments rivers, encroaches on shorelines, and hardens ecological spaces, resulting in a sharp decline in stormwater retention, flood regulation, and natural buffering functions. Under extreme weather, they are therefore more prone to compounded risks of waterlogging, geological hazards, and ecological degradation. Even if these cities have favorable natural conditions, due to the lack of strict control and systematic restoration, their ecological adaptability continues to decline and long-term urban risks continue to accumulate.

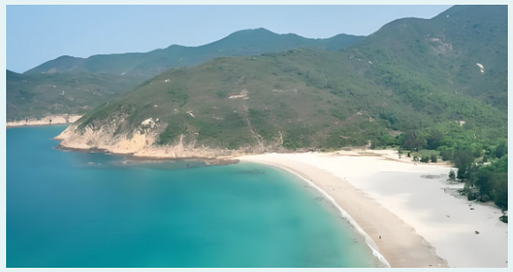
Therefore, the key insight from the Adaptability dimension is that favorable natural endowments cannot offset governance gaps, while compact spaces can still improve adaptation capacity through fine-grained design. Leading cities invariably safeguard ecological baselines through strict control, restore buffering functions through systematic projects, upgrade ecological spaces from "peripheral decoration" to a "safety foundation", and allow nature to continuously support urban resilience.

| Case 5 | Nairobi: Rigid Protection of Ecological Background, Building a Low-Cost Climate Adaptation Paradigm



Nairobi treats natural ecology as its greatest resilience asset, creating a strong example of ecological adaptability through strict protection of natural water systems and basin-wide ecological restoration. It preserves natural river forms and riparian ecological buffers, maintains a high proportion of natural permeable space, and uses native green spaces, wetlands, and water systems as a natural stormwater retention and flood regulation system. This helps slow runoff and reduce flood peaks during the rainy season, while supporting water replenishment during the dry season, without relying primarily on large-scale engineering projects. Nairobi considers ecological buffer spaces as a non-negotiable baseline for urban development, allowing natural systems to perform the core function of disaster buffering. Its underlying logic is "using nature to protect nature, and using ecology to adapt to risks". This enables a high level of long-term adaptation at relatively low cost and provides a replicable ecological resilience pathway for developing cities.

| Case 6 | Hong Kong: Statutory Ecological Shoreline Control, Shaping an Adaptation Model for High-Density Cities



Under a high-density development pattern, Hong Kong balances urban development and ecological safety by safeguarding ecological shorelines and blue-green buffer spaces through statutory planning. It protects coastal and riparian ecological spaces through legislation, strictly controls the hardening of natural shorelines and ecological spaces, and retains a high proportion of natural and ecologically restored shorelines. Mountains, green spaces, and water systems together form continuous ecological buffer zones, improving stormwater retention, flood regulation, geological stability, and climate adaptation capacity. Hong Kong also treats ecological buffering as a baseline requirement in spatial planning, retaining micro-ecological nodes even within built-up areas. This shows that high-density cities do not have to sacrifice ecology, and that strict ecological control can allow nature to continuously provide risk-buffering functions, setting a benchmark for coastal and riverside high-density cities.

(4) Transition

The Transition dimension provides strategic guidance for urban resilience. It measures a city's capacity for strategic planning, institutional development, risk surveys and assessments, and comprehensive safety governance, serving as a fundamental driver for the shift from passive response to proactive, forward-looking governance. Through two indicators — top-level design for resilient cities and comprehensive disaster risk governance — this dimension assesses the extent to which urban safety governance is systematic, institutionalized, and modernized. The gap among global cities in this dimension directly shapes the long-term direction of their resilience building.

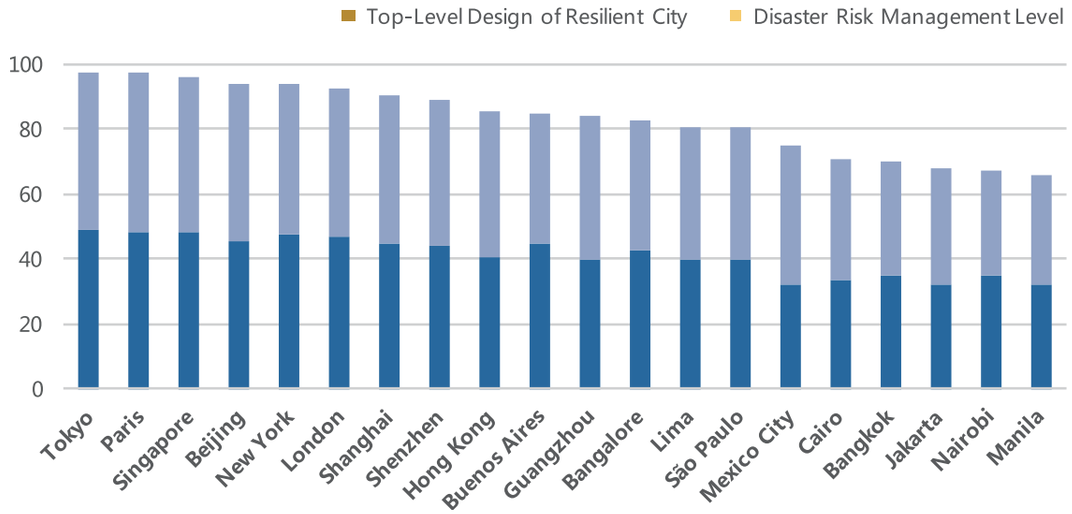


Figure 7 Transition Scores by City

Tokyo, Singapore, Paris, and New York remain at the forefront, thanks to their mature systems of strategic guidance and full-cycle risk governance. Tokyo enables risks to be identified, controlled, and managed through statutory disaster prevention planning, regular risk assessment, and citywide early-warning platforms. Singapore integrates resilience into national long-term strategies and builds a forward-looking safety governance model through multi-department coordination, digital technology-enabled governance, and full-process contingency planning. New York and Paris promote the transformation of risk governance from post-disaster response to pre-disaster prevention and full-process control through dedicated agencies, special plans, and thematic databases.

Cities such as Beijing, London, Shanghai, Shenzhen, and Hong Kong have formed a planning-led transition path characterized by targeted breakthroughs and systematic improvement. Beijing promotes the institutionalization and systematization of resilience building through city-level coordination mechanisms, citywide risk surveys, and a map-based emergency command system. Shenzhen, with the governance flexibility of a relatively young city, has quickly developed emergency space planning and unified command platforms, catching up rapidly in institutional development and technology application. Hong Kong continuously addresses governance gaps through cross-departmental emergency coordination, real-time monitoring and early warning, and waterfront flood-control upgrades. These cities have established high-level frameworks and are shifting from targeted construction toward citywide balance, and from hardware construction toward greater institutional and operational efficiency.

Most developing cities are still at a stage where systems remain immature, governance is fragmented, and risk profiles are unclear. Cities such as Bangalore, Mexico City, Lima, and São Paulo have carried out exploratory practices in local fields, but lack unified top-level design, have insufficient inter-departmental coordination, and face incomplete chains of risk monitoring, surveys, assessment, and application. Their governance measures are mostly fragmented responses. Cities such as Bangkok, Cairo, Jakarta, and Manila face even greater challenges, with absent strategies, missing mechanisms, and insufficient platforms. Their risk governance still remains at the level of passive response, unable to support the continuous improvement of urban resilience.

Therefore, the key insight from the Transition dimension is that urban resilience is not a pile-up of individual projects, but the result of the collaborative evolution of top-level design, institutional rules, governance capacity, and technology platforms. The common path of leading cities is to determine direction with strategy, define rules with institutions, clarify risk profiles with data, and ensure efficiency with coordination, promoting the transformation of urban safety governance from "responding to incidents" to "managing risks", and from "reactive remediation" to "proactive resilience building".

| Case 7 | London: Institutional Iteration and Full-Domain Governance, Creating a Paradigm of Continuously Evolving Resilience Transition



London promotes long-term resilience transition through continuous institutional improvement and citywide risk governance. Following major safety incidents, it has quickly improved its regulatory system, established dedicated resilience governance bodies, and developed long-term coordination mechanisms. It develops dedicated resilience strategies and integrates risk prevention and control into the entire process of urban planning, construction, and management. It also carries out citywide risk surveys and assessments, establishes dynamically updated risk maps, and supports evidence-based governance decision-making. Through an iterative cycle of "incident reflection – closing institutional gaps – system re-optimization", London enables the continuous evolution of resilience capacity. This shows that mature cities can continuously improve their Transition capacity and move toward long-term safety through institutional improvement and governance upgrading.

| Case 8 | Beijing: Special Planning Leading Full-Domain Coordination, Building a Benchmark for Transition Capacity of Megacities



Guided by China's first provincial-level special spatial plan for resilient cities, Beijing has built an integrated governance system of "top-level design – spatial coordination – risk surveys – digital enablement", becoming a model for Transition capacity development in megacities. At the municipal level, Beijing has established a high-level coordination mechanism, issued the Guiding Opinions on Accelerating the Construction of Resilient Cities, and formulated and implemented the Beijing Special Spatial Plan for Resilient Cities (2022–2035), fully integrating resilience and safety requirements into territorial spatial governance. Beijing has also carried out citywide surveys of natural disaster risks, built a dynamically updated disaster risk database and a unified "one-map" urban safety platform, enabling risks to be identified, measured, controlled, and managed. Relying on its smart city foundation, it has integrated monitoring data from multiple departments and built an integrated emergency platform covering early warning, command, dispatch, and response. This promotes the transformation of the governance model from post-event response to pre-event prevention and precise control. Its underlying logic is to define the urban framework through planning, strengthen coordination through institutions, and improve efficiency through data. In this way, Beijing elevates resilience building from a special task to an underlying logic of urban development, providing a replicable and scalable paradigm for Transition capacity development in mega-capital cities.

3.5.4 Insights and Recommendations

Based on Shenzhen's development trajectory and the resilience assessment of 20 global cities, this report distills key insights for resilient city development. Urban resilience is not simply the accumulation of funding and technology, but the result of long-term alignment among institutional depth, system redundancy, and governance flexibility.

First, the foundation of resilient cities lies in "legislation first". Global samples show that urban safety does not depend entirely on natural resource endowments. The leading positions of Tokyo and Singapore, as well as the rapid improvement of Shenzhen's Defense capacity, are fundamentally attributable to turning safety baselines into legally binding requirements. Legislation and mandatory standards are essential for consolidating institutional red lines in areas such as building fortification and urban lifeline redundancy and are key to maintaining stable urban operation during disasters. Many cities in the Global South suffer from fragmented governance, while development-first models often weaken safety defenses, leading to high post-disaster recovery costs and limited results. Therefore, latecomer cities should define safety baselines through legislation, build cross-departmental coordination mechanisms, and strengthen governance capacity through institutionalization.

Second, the breakthrough of resilient cities lies in "balancing rigidity and flexibility". Physical defense and engineering fortification form the hard foundation of urban safety, while digital tools and social mobilization form the soft core of emergency support. Latecomer cities with limited funding often find it difficult to replicate the heavy-asset infrastructure models of first-tier cities. Cities such as Bangalore and Nairobi have activated urban system resilience in low-cost ways through small-scale, targeted interventions and the introduction of social capital. Through data-enabled risk assessment, community emergency systems, and community-based self-help networks, cities can quickly contain the spread of disaster losses. Cities should therefore avoid infrastructure perfectionism, use precise engineering investment to safeguard lifeline baselines, and rely on social co-governance to upgrade both hard infrastructure and soft governance capacity.

Third, the advancement of resilient cities depends on "four-dimensional coupling". Advantages in a single dimension cannot support high-level urban resilience. London has strong Defense capacity, but constraints in Adaptability prevent it from achieving the all-dimensional coordination seen in Tokyo and New York. Defense, Recovery, Adaptability, and Transition should be interconnected and mutually reinforcing, forming a complete resilience system. Urban development should move beyond the one-sided emphasis on engineering defense while neglecting ecological buffering and social governance. It should address hidden weaknesses, integrate resilience building into citywide governance, and promote coordinated development across the four dimensions.

Fourth, the goal of resilient cities lies in "inclusive sharing". Shenzhen, Tokyo, Singapore, and other ultra-high-density cities have performed well in resilience, challenging the assumption that higher population density inevitably means higher risk. High-density cities can unlock safety dividends through intensive development, flexible spatial reserves, three-dimensional transport systems, and small-scale disaster-prevention spaces. At the same time, resilience building should uphold spatial justice, implement inclusive governance, and avoid the overlap of social exclusion and vulnerability in high-risk areas. Latecomer cities can rely on clear safety frameworks and refined public services to avoid the passive cycle of "disaster–reconstruction", and achieve multiple benefits in urban safety, livelihood security, and governance efficiency under compressed development timelines and spatial constraints.

3.6 Humanism

3.6.1 Understanding Humanism

Over the past century, our understanding of urban humanism has undergone profound transformations. Each new realization is not a simple negation of previous stages, but a continuous expansion of our previous knowledge in the face of new urbanization conflicts and challenges.

The earliest discussions of urban humanism emerged from the acute crises of mass urbanization triggered by the late nineteenth-century Industrial Revolution. As populations surged into cities, severe threats to public health and social order made the establishment of basic public norms the primary task of urban governance. In this period, the core meaning of a humanistic city centered on visible behavioral order: clean public spaces, regulated civic conduct, and functional infrastructure. This responded to the most pressing governance demands of early urbanization process. Yet the understanding of urban humanism at this stage remained largely functional. It equates maintaining good social order with realization of a humanistic society, while paying insufficient attention to the emotional and spiritual dimensions of the city as a collective cultural community.

From the mid-twentieth century onward, as modern cities grew in scale and social structures became more complex, the purely order-centered conception of a humanistic city came under scrutiny. Scholars gradually recognized that the city is not merely a managed space, but a carrier of social relations and public life. In 1961, Jane Jacobs argued in The Death and Life of Great American Cities that urban vitality does not spring from uniformly ordered design, but grows from street-level diversity, human interaction, and the complexity of everyday life. The successive emergence of the European Capital of Culture program (launched 1985) and the World Cities Culture Forum (WCCF, established 2012) further affirmed, at the policy level, the central role of cultural construction in urban civilizations. The rise of heritage conservation and cultural policy reinforced the city's role as a community of collective memory. The measure of urban humanism thus deepened — from outward behavioral compliance to inward cultural identity, from the question of "whether the city is orderly" to the deeper question of "whether the city has a soul."

In the twenty-first century, global cities have broadly entered a phase of high mobility and pluralization. Now urban civilizations faces a new structural challenge: how to achieve social integration and sustained cooperation amid diversity. Unlike traditional urban humanistic patterns that evolved spontaneously and became evident with time, rapid population changes have continuously reinforced the need for institutional construction and interference for contemporary urban civilizations. A broad international consensus has therefore emerged that urban governance should take participation, inclusion, and collaborative co-governance as core principles. This means enabling all residents, regardless of origin or background, to participate equally in urban public life and to develop a genuine sense of belonging to their city. In China, this evolution is reflected in a profound transition from building "civilized cities" to building "humanistic cities" The fundamental question of urban humanism has thus advanced from "Does the city have public order and a sense of belonging?" to "Does the city achieve co-governance amid diversity?"

Based on this evolutionary trajectory, this report's assessment rests on three essential questions: How is the city lived? How is the city remembered? How is the city governed?

The humanistic city is not merely a spatial container of humanism; it is the social medium through which a humanistic ideologies are actively formed, accumulated, and passed on. A true humanistic city is not defined simply by clean public environments or rich historical heritage. It is reflected in whether a city can, amid high mobility and diversity, continuously cultivate public norms, forge shared cultural identity, and enable residents of different backgrounds to genuinely participate in common life and collaborative governance.



Figure 1 Humanistic City in the UIS Framework

As elaborated in this report, a humanistic city is one that encourages unique civic qualities, builds cultural consensus, strengthens cultural identity and confidence, and fosters a shared sense of belonging.

On this basis, the report divides urban humanism into three interrelated sub-dimensions: Civic Behavior, Cultural Understanding, and Inclusion & Engagement.

Behavior & Literacy is the most immediately visible expression of a humanistic city and a foundational condition for the normal functioning of urban public life. It measures the extent to which residents follow shared rules and assume public responsibilities in everyday public life, as well as the degree to which such behavior has moved from external constraint to internalized civic awareness.

Cultural Understanding is the spiritual mechanism through which a city brings diverse individuals into a shared community. It asks three key questions: Does the city have rich historical and cultural resources for residents to inherit collectively? Does it provide equitable and accessible public cultural spaces for all residents to engage with? Do residents form emotional connection and a sense of spiritual belonging through everyday cultural practices?

Inclusion & Engagement is the fundamental institutional guarantee of a humanisti city. It focuses on three key questions: Does the city genuinely open public resources, civic rights, and participation opportunities to all residents? Are immigrant and mobile populations included into institutional pathways of belonging? Is residents' willingness to engage in public service effectively motivated and supported by institutional mechanisms? Inclusion & Engagement is not an add-on to a humanistic city. Instead, Only when diverse actors participate in co-building, co-governance, and shared development can a humanistic city be strong and resilient.

The three sub-dimensions do not form a linear progression; rather, they interact dynamically throughout urban development. Behavior & Literacy represents the foundational expression of civic life; Cultural Understanding builds shared identity and emotional connections across diverse groups; and Inclusion & Engagement, through open institutional arrangements, ensures sustained awareness and participation in public life and urban governance. Together, they determine whether a city forms a stable and resilient collective civic community amid high mobility and rich diversity.

The listed eight indicators primarily measure a city's institutionalized humanistic performance within modern public governance systems. It includes quantifiable indicators of behavioral norms, public cultural services, and institutionalized social participation. Practices embedded in community traditions, religious networks, neighborhood mutual aid, and informal social relations are harder to be fully covered by current indicator framework. Therefore, this report focuses on cities' capacity for institutional integration, rather than offering an absolute judgment on the full spectrum of urban humanism.

Table 1: 8 Indicator System of Urban Humanism

Dimension	Indicator	Definition
Behavior & Literacy	Public Behavioural Order	Measures citizens' overall level of compliance with shared norms in public spaces; a weighted composite of road traffic safety and urban public safety perception, reflecting both objective outcomes and citizens ' daily experience
	Civic Environmental Behaviour Participation	Measures the prevalence of citizens translating environmental awareness into daily action; calculated as the proportion of permanent citizens participating in household waste sorting — the higher the rate, the greater citizens' self-discipline regarding public environmental responsibility
Cultural Understanding	Cultural Heritage Richness	Measures the material heritage base of a city's historical and cultural resources; refers to the number of officially recognized tangible cultural heritage sites, which may be weighted by protection level or counted directly
	Cultural Space & Facility Sharing	Measures the accessibility and spatial equity of public cultural services; calculated as the total number of public cultural facilities (museums, libraries, cultural centers, art galleries, community cultural centers, etc.) per 10,000 permanent citizens
	Cultural Participation & Consumption	Measures the depth of participation in cultural activities and citizens' willingness to consume cultural products; calculated as annual resident expenditure on cultural, recreational, and artistic activities divided by permanent population
Inclusion & Engagement	Demographic Diversity & Inclusiveness	Measures the openness and mobility of a city's population structure; expressed by the proportion of non-native citizens among permanent citizens
	Public Cultural Accessibility & Usage	Measures the accessibility and actual utilization of public cultural resources; calculated as public library borrowings per resident
	Civic Volunteering Rate	Measured by the proportion of registered volunteers among citizens aged 16–70, and average annual hours of public service participation per resident; higher rates indicate greater civic engagement in public services

3.6.2 Overall Assessment

The composite scores of the 20 sample cities range from 70.86 to 88.16 — a range of approximately 18 points, narrower than the score distributions in other dimensions. In the domain of humanistic development, the gaps between cities are not as drastic as those in economic development or ecological quality. Every city is responding, in its own way, to the same fundamental question: how to foster a genuine sense of commonality among its citizens. Differences exist, but they more often reflect divergent mechanisms of humanistic formation and governance pathways, rather than simple differences in development stages.

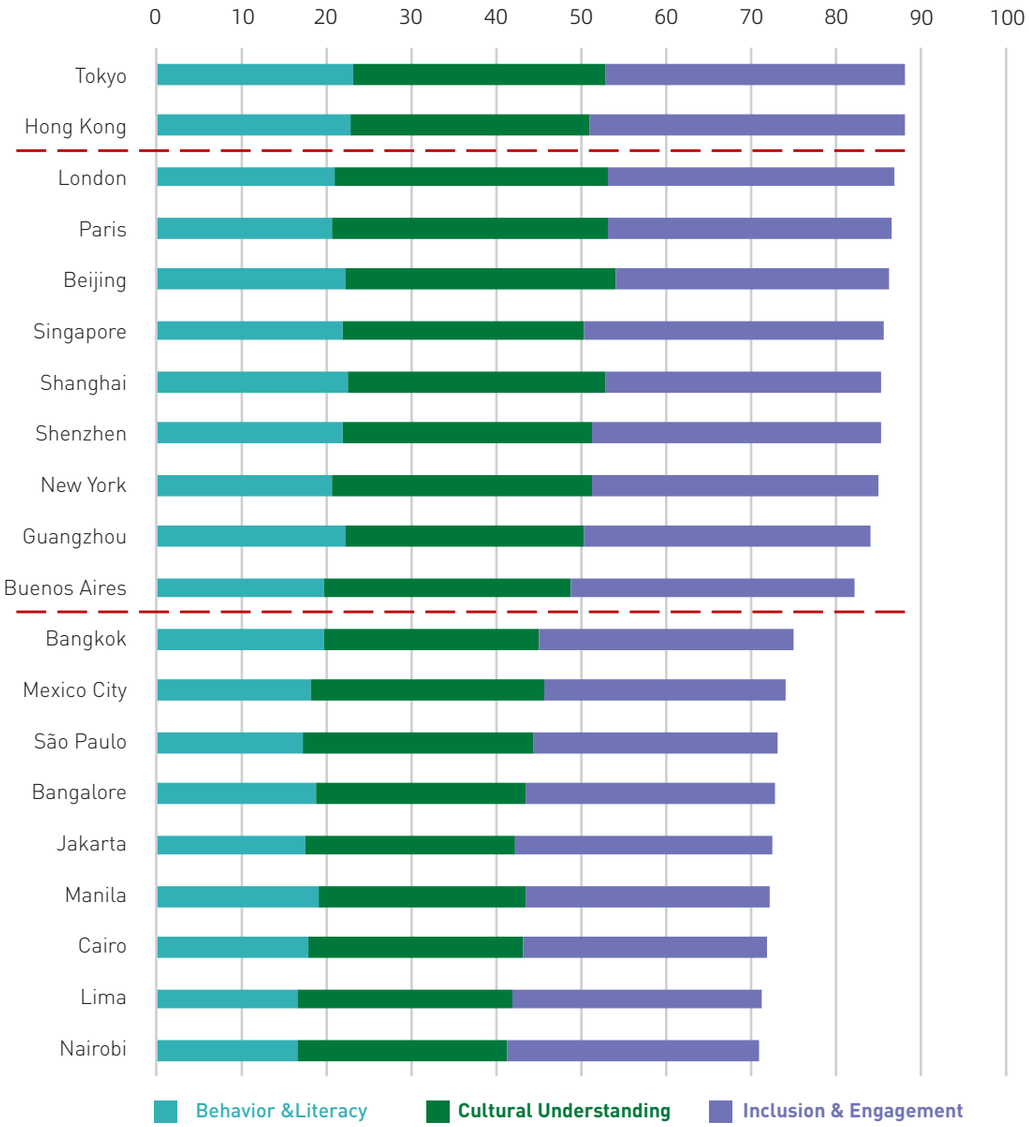


Figure 2 Composite Scores of Different Cities

(1) Ranking Tiers

Tier 1

Composite Score ≥ 88: Tokyo and Hong Kong

Tokyo and Hong Kong have achieved a high level of coordinated development across all three sub-dimensions, with humanistic development progressed from institutionally-driven to socially internalized. Tokyo leads the entire sample in Behavior & Literacy: everyday public norms such as waste sorting have been deeply woven into citizens' daily lives, reflecting self-discipline that accumulates through decades of sustained institutional requirements. Hong Kong distinguishes itself in Inclusion & Engagement: a mature network of community organizations, a deeply rooted tradition of voluntary service, and highly active public cultural participation together sustain remarkable civic vitality within one of the world's most densely populated and diverse societies. Both cities demonstrate that mature humanistic development initiates from institutional frameworks, but later depends on the long-term internalization of public behavior and social participation.

Tier 2

80 ≤ Composite Score < 88: London, Paris, Beijing, Singapore, Shanghai, Shenzhen, New York, Guangzhou, and Buenos Aires

This tier encompasses nine globally representative cities from Europe, East Asia, North and South America, making it the most diverse tier in the sample in terms of developmental pathways and humanistic structures. Each city excels in one or two sub-dimensions, giving rise to distinctly recognizable humanistic profiles. London, Paris, and Beijing stand out in Cultural Understanding because of their deep historical and cultural heritage. New York excels in the same dimension through its highly developed public cultural institutions system and its extensive experience in governing a pluralistic society. Singapore and Shenzhen demonstrate a notably balanced performance across all three dimensions, representing a pathway in which humanism is advanced through intentional institutional construction; Shenzhen's exceptionally high level of humanistic integration against a backdrop of high population mobility offers a valuable reference for cities of a similar type. Shanghai and Guangzhou reflect the synergy between historical cultural heritage and contemporary institutional governance. Buenos Aires sustains a high level of participation through its civil society traditions and community resilience. The defining characteristic shared across this tier is that each city has, within its own historical conditions and developmental trajectory, forged an effective mechanism for integrating humanistic values.

Tier 3

Composite Score < 80: Bangkok, Mexico City, São Paulo, Bengaluru, Jakarta, Manila, Cairo, Lima, and Nairobi

This tier includes nine cities that are representative cities of the Global South in the middle of rapid urbanization process. Cities in this tier broadly face multiple concurrent pressures — continuous population growth, lack of infrastructure provision, and insufficient public governance capacity. Several cities have nonetheless demonstrated active attempts and localized strengths in specific dimensions. Bangkok, for instance, performs relatively well in Behavior & Literacy, reflecting a degree of established foundation in public norms; several Latin American cities have accumulated considerable civic energy at the level of public participation, drawing on community traditions and social resilience. Overall, however, this tier still has substantial room for improvement in terms of public cultural facility provision, institutionalized participation mechanisms, and cultivation of civic behaviors — and therefore holds the most significant potential for further development.

(2) Performance Profile

Examining the performance of all 20 cities across the three sub-dimensions and eight indicators, their different driving logic can be categorized into three performance profile types. The types not only explain the score gaps between the cities but also foreshadow different challenges each will face in future humanistic developments.

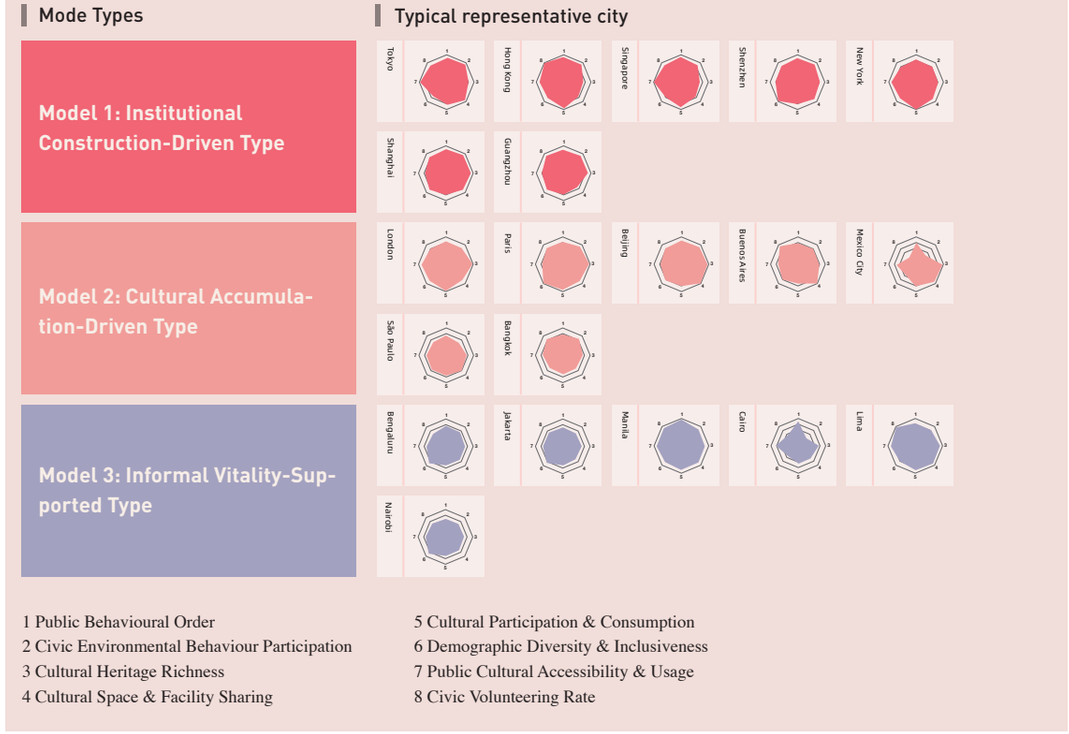


Figure 3 Humanistic Development Typologies

Table 2 Typologies of Humanistic City

Type	Cities	characteristic
Institution-Driven	Tokyo, Hong Kong, Singapore, Shenzhen, New York, Shanghai, and Guangzhou	The shared characteristic of this type of city is that humanistic development relies heavily on sustained and precisely calibrated institutional regulations — legislation establishes norms, public facilities expand cultural accessibility, and institutionalized inclusion mechanisms activate civic participation. Institution is both the starting point and the source of continuing momentum. The strength of this pathway lies in its operability, measurability, and replicability. Its inherent challenge is that there is no clear answer of whether institutionally driven humanism can ultimately transition into internalized social habit and cultural self-awareness.
Cultural Heritage-Driven	London, Paris, Beijing, Buenos Aires, Mexico City, São Paulo, and Bangkok	The shared characteristic of this type of city is that historical and cultural traditions, long-term social memory, and a rich public cultural atmosphere constitute the most powerful cohesive force in urban humanism. The abundace of historical heritage, combined with active public cultural consumption, forms the core bond through which citizens identify with their city. Cities of this type tend to possess strong cultural cohesion, yet they face a common challenge: finding a path to transform traditional cultural capital into a more open and inclusive modern urban community in an era of rapid population mobility and increasingly plural social structures.
Informal Vitality-Driven	Bengaluru, Jakarta, Manila, Cairo, Lima, and Nairobi	The shared characteristic of this type of city is that indicators of humanism within formal institutional frameworks are generally low — yet a substantial reservoir of social vitality exists within thier informal social networks. The core challenge facing cities of this type is not "building humanism from scratch," but rather how to gradually establish a more equitable, stable, and open formal institutional framework while preserving existing social vitality, thereby achieving an effective bridge between informal humanist energy and modern public governance.

The three pathways are not mutually exclusive; in practice, they coexist within every city in varying proportions. More importantly, all three pathways converge on four structural questions that recur across every city in the sample: the quality of institution system design; the relationship between cultural heritage and contemporary integration; the development of a sense of belonging among mobile populations; and the sources of motivation for public participation. These four questions form the core of the structural findings that follow.

(3) Key Findings

Finding 1: The Success of Immigrant Integration Depends on Institutional Mechanisms, Not Time

Does a higher proportion of immigrant citizens inevitably make humanist integration more difficult? Nairobi, Bengaluru, and Jakarta all have immigrant populations exceeding 40% of their total population — yet their volunteer participation rates and public cultural facility densities are significantly lower than those of Shenzhen, London, and Hong Kong, cities with comparable levels of population mobility. The root of this divergence lies not in economic development levels, but in the quality of institutional inclusion mechanisms.

London and Hong Kong possess relatively well-developed immigrant integration systems and equitable public service frameworks. Shenzhen offers a points-based household registration scheme, equal residential permit entitlements, and barrier-free access to public cultural resources. By contrast, mobile populations in Nairobi, Bengaluru, and Jakarta are, in most cases, situated at the institutional margins — lacking formal pathways to recognized status and facing unequal access to public services. Thus they form relationships with their cities defined by economic exchange rather than civic belonging. Without institutional inclusion mechanisms, it is impossible for immigrants to develop a true sense of belonging regardless of how much time they spend residing in the cities.

Finding 2: Coercion Can Initiate Civilized Behavior, but Habit is the Destination

The waste-sorting participation rate indicator reveals a geographic concentration across the 20 sample cities that is rare in global urban research — East Asian cities occupy virtually all the top scorers. This is no coincidence; it is the structural outcome of three overlapping factors: relatively strong administrative and mobilization capacity, relatively high resident disposition toward rule compliance, and a cultural value orientation that links collective responsibility to individual behavior.

Tokyo's waste-sorting practices evolved from post-war urban waste governance and the rise of environmental awareness in the 1960s and 1970. It continues to evolve in the following decades through institutional policy imporvement, community collaboration and family education. It has eventually became an instinctive habit in Japanese households requiring no reminder — sorting calendars are posted in kitchens, neighbors remind one another, and incorrect disposal generates social pressure. This is not the product of just institutional enforcement but the gradual internalization of cultural habit. Institutional policy is the starting point of humanism, but not its destination. A city that maintains order through surveillance and a city that spontaneously maintains a cultural habit may register similar scores on paper, yet they display drastically different maturity in humanistic developments.

Finding 3: The Relationship Between History and Humanism — Heritage is the Result of Humanistic Activities, Not Its Cause

A widespread bias holds that the longer a city's history and the richer its cultural heritage, the deeper its sense of humanistic identity.

Shenzhen has been given the label "cultural desert" for many years. Rather than trying to imitate, Shenzhe's response is to create cultural coordinates unique to this city in a contemporary context through high-density public cultural investment. Singapore's National Heritage Board encompasses within its heritage recognition framework colonial-era British civic architecture, Chinese shophouse districts, Tamil temples, Malay kampong sites, and post-war buildings — unifying the historical imprints of four ethnic communities within a single preservation system. Its success does not rely on cultural nostalgia, but instead on the reinforcement of pluralistic coexistence within a city-state where four official languages and three major ethnic groups share a common life. Both Shenzhen and Singapore exemplify a same principle: forward-looking, proactive investment in providing a shared historical foundation for diverse societies.

Finding 4: Wealth and Humanism Are Decoupled — Public Participation is Not a By-product of Affluence

Does greater urban wealth give its citizens more capacity to engage in public affairs, and therefore produce higher volunteer participation rates? New York and London record the highest per-capita cultural consumption in the sample, yet their volunteer participation rates are not among the highest. Buenos Aires has a per-capita cultural consumption less than one-tenth that of New York — yet its volunteer participation rate ranks second highest in the entire sample.

Buenos Aires's high volunteerism is rooted in nearly a century of immigrant community self-organization traditions in Argentina. From the late nineteenth century onward, Italian, Spanish, Jewish, and Arab immigrant communities built dense mutual-aid networks to survive on unfamiliar soil. During the 2001 economic crisis — when Argentina's GDP contracted by approximately 11% in a single year and the formal social welfare system came close to collapse — these mutual-aid networks rapidly transformed into city-wide community kitchens and neighborhood assistance organizations, assuming basic social functions, and have since persisted in the form of an institutionalized public society. The Buenos Aires experience offers a critical empirical lesson for research: public participation is the product of historically accumulated cultural tradition and the intentional construction of an institutional civil society — not the result of high income. For resource-constrained city in the world, this is a liberating discovery: cultivating a community self-organization ecosystem can begin at any time, without waiting for the economy to reach any threshold.

3.6.3 Assessment by Objective

(1) Behavior & Literacy

The Behavior & Literacy dimension measures the level of rule-consciousness and self-discipline in public life. "Humanistic self-awareness" originates with the individual and extends outward into the collectively maintained "humanistic order." This dimension is assessed through two indicators — public behavioural order (a weighted composite of road traffic safety and urban public safety perception), and civic environmental behaviour participation (municipal waste sorting participation rate) — measuring, from surface to depth, how humanistic literacy is reflected in sensory judgement and everyday behavior. Waste sorting serves as a telling example: it cannot be achieved through administrative mandate alone, nor can it emerge purely from spontaneous community initiative. The genuinely establishment of the habit of waste sorting simultaneously reflects sound institutional implementation and a deep internalization within civic consciousness.

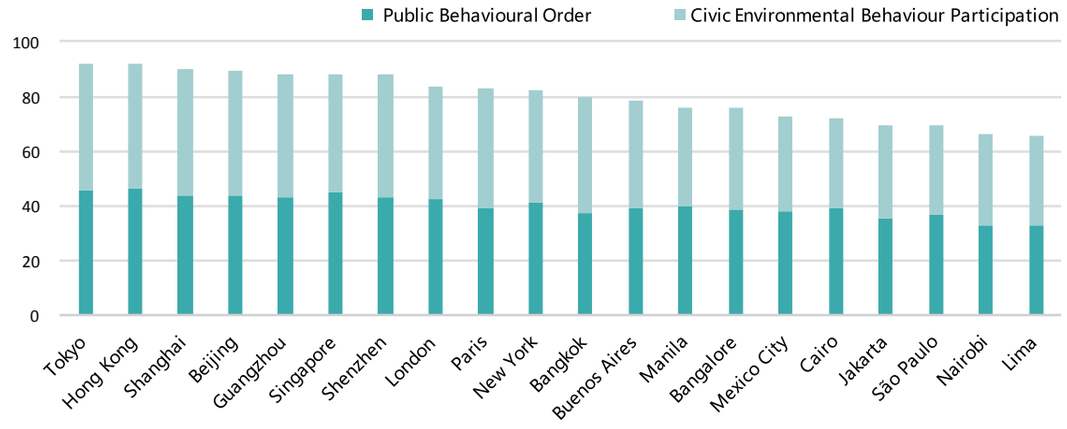


Figure 4: Behavior & Literacy Dimension Scores by City

Across the global sample, East Asian cities lead this dimension by more effective institutional enforcement, more comprehensive public facility provision, and more deeply embedded civic education. These cities perform well across all three indicators, pointing to a shared underlying governance logic: first construct an institutionalized regulatory framework covering everyday life scenarios, then internalize that framework into citizen behavior.

Take the highest scorer, Tokyo, as an example. Its road traffic fatality rate of approximately one death per 100,000 residents reflects high-standard traffic engineering design and a deeply rooted culture of respecting road rights. At the level of public safety, the community-based koban police box system extends the reach of law enforcement to the street level, generating effective deterrence. Most notably, Tokyo's waste sorting system has undergone continuous evolution over more than half a century: from the Waste Disposal Act of 1970 to the Basic Act for Establishing a Sound Material-Cycle Society of 2000, waste sorting has been progressively embedded as a key structural component of urban humanistic governance. Today, Tokyo operates a timed collection system spanning five major categories and more than fifteen sub-categories. Singapore and Hong Kong have translated norms from soft advocacy into hard institutional constraint through mandatory legal frameworks — encompassing strict traffic enforcement,

prohibitions on littering, and explicitly codified penalties for public misconduct — forging a governance pathway in which "rules are civilized behaviors." Chinese mainland cities perform equally strongly in this dimension: Beijing, Guangzhou, Shenzhen, and Shanghai have built public safety networks through the Skynet surveillance system, substantially improving social order and citizens' sense of security. Shenzhen's Shenzhen Municipal Household Waste Classification Management Regulations, enacted in 2020, combine scheduled and fixed-point supervision with points-based incentives, effectively promoting the daily internalization of sorting habits.

By contrast, public safety constitutes a shared challenge for the mid-tier European and North American cities. Despite strong performance in other respects — London's road traffic safety indicator is excellent, at approximately 1.2 deaths per 100,000 citizens, and a functioning waste sorting system has been established through schemes such as England's Simpler Recycling program — urban safety perception scores are comparatively weak. This reflects deeper structural social divisions: income inequality, community fragmentation, and the uneven distribution of law enforcement resources have produced a fracture in civil literacy within these cities, generating a polarized pattern of "ordered affluent districts" and "imbalanced deprived districts."

Several cities in the Global South remain constrained by their socioeconomic foundations and face far more complex social compositions, making it difficult to establish effective institutional guarantees for safety, order, and norms. The mixed flow of non-motorized and motorized vehicles, combined with underdeveloped public transport systems, erodes road-rights consciousness through congestion and disorder, compounding traffic hazards. Under conditions of limited fiscal capacity and inadequate infrastructure, large numbers of low-income residents in informal settlements and urban peripheries find it difficult to priorities practices such as waste sorting.

Whether meaningful improvement in humanistic dimensions can be achieved ultimately depends on whether sufficient political will can be mustered to translate institutional design into genuine implementation — thereby enabling citizens to receive a series of positive externalities, whether in the form of safer community environments or more efficient road traffic. The formation of this virtuous cycle is precisely the critical leap by which humanistic literacy moves from institutional requirements to social self-awareness, and it holds relevance for cities undergoing rapid urbanization with high proportions of mobile populations.

| Case 1 | Tokyo: A Full-Chain Environmental Education System from School to Community

Tokyo's high waste-sorting participation rate is supported by both legal requirements and long-term environmental education. From an early age, students learn how waste sorting affects incineration and resource recovery through school education and visits to local waste processing facilities. At the community level, environmental education centers and neighborhood recycling activities provide practical guidance and encourage collective participation. Tokyo's success shows that lasting waste-sorting habits are formed through the joint efforts of families, schools, and communities, turning institutional rules into everyday civic habits.



(2) Cultural Understanding

The Cultural Understanding dimension examines how a city enables its citizens to share common cultural experiences and forge a collective identity. It is assessed through three indicators: cultural heritage richness (the volume of tangible cultural heritage), cultural spaces and facility sharing (the number of public cultural facilities per 10,000 citizens), and cultural participation & consumption (per-capita cultural expenditure). In general terms, these three indicators reflect a progressive developmental pathway — heritage provides the point of departure, expanded facility accessibility draws in greater voluntary participation, and participation in turn generates cultural consumption.

Yet the sample cities offer far more diverse narratives, demonstrating that this pathway does not unfold in a strictly linear fashion. Cultural resource richness is not determined by the length of a city's history; it is a composite reflection of a city's capacity to excavate, conserve, activate, and disseminate its cultural heritage. More critically, the depth of historical heritage cannot by itself determine the depth of cultural consensus. Even cities with limited historical accumulation can chart an autonomous contemporary cultural development pathway by filling gaps in cultural facilities, cultivating contemporary cultural markets, and staging culturally influential events. The flourishing of cultural life depends not only on historical heritage, but on finding the communities and consumers it serves in the present.

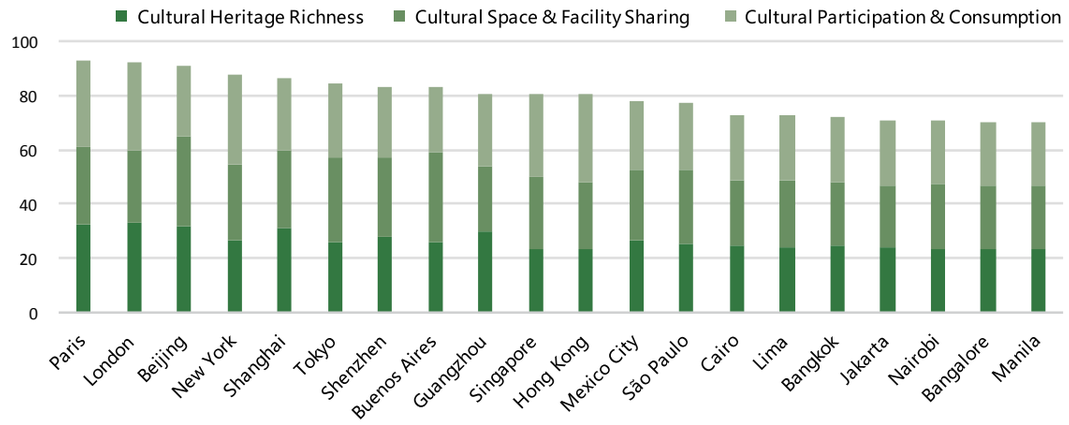


Figure 5: Cultural Understanding Scores by City

Paris, London, and Beijing hold a commanding lead in the first tier. The former two possess deep historical and cultural heritage that has been effectively converted into active cultural consumption markets. Beijing is distinguished by the density of its public cultural facilities: a vast network of national-level museums and cultural institutions constitutes an unparalleled cultural supply infrastructure, further energized in recent years by the Beijing Museum City Development Plan, which leverages digital technology to activate cultural participation. Cultural heritage confers first-mover advantage: where the foundation is sufficiently rich and investment is well-directed, cultural consensus follows naturally.

The second-tier cities present several distinctly different developmental models. One is the market-driven cultural consumption model, exemplified by Hong Kong and New York. Hong Kong has positioned itself as the central node of Asia's art market through Art Basel Hong Kong; New York has made cultural consumption one of the

city's most penetrating identity symbols through the Broadway performing arts ecosystem — demonstrating that a mature cultural consumption market can drive the formation of urban cultural consensus. A second model is one of systematic, proactive construction: Singapore has incorporated the cultural heritage of its multiple ethnic communities into a unified policy framework, sustained investment in landmark cultural facilities and arts venues, and deepened multiculturalism from a surface characteristic into a distinctive national humanistic narrative — illustrating how an emerging pluralistic society can actively construct cultural consensus within a relatively short historical timeframe. A third model involves more locally grounded cultural identity curation: Shenzhen has actively projected the spiritual heritage of Reform and Opening Up to material expressions, revitalizing its industrial and reform-era built environment and stepping onto the international cultural stage through the Shenzhen Biennale; Buenos Aires seized upon the transformation of a historic bookshop to allow a community of readers to collectively elevate the city to the distinction of "World Book Capital." The shared logic underlying these cities is the cultivation of a foundation of an ambient capable of continuously generating cultural vitality — affirming that contemporary action is the true driver of cultural identity construction.

The third tier, composed predominantly of cities from the Global South, includes no shortage of historically significant cities — Cairo, São Paulo, and Manila among them. Yet systemic constraints including population pressure, resource limitations, and uneven facility provision have left these cities with notable gaps in overall cultural consensus, and they have yet to develop cultural markets with broad radiating influence. These cities are nonetheless full of potential, awaiting a catalyst for a qualitative breakthrough — a major popular cultural festival, the transformation of a cluster of spaces and venues — that could set off a chain reaction.

Cultural policy has no standard format and no endpoint. At its core, it is an ongoing interpretation of a city's identity and values — and it is precisely this quality that determines whether it can stir a genuine sense of belonging and resonance in its citizens. Regardless of developmental stages, every city should approach its own unique historical narrative with openness and creativity, translating it into cultural symbols that consolidate civic identity.

| Case 2 | Beijing: Activating the Educational and Communicative Functions of Museums Through School-Museum Partnerships

Beijing's "Museum City" initiative is not only about increasing the number of venues, but also about turning cultural resources into shared identity. Through school-museum partnerships and programs such as the "First Museum Lesson", museums are integrated into cultural education, especially for young people. The Palace Museum, for example, has worked with more than one hundred schools and educational institutions to present traditional architecture, artefacts, and historical narratives through exhibitions and immersive courses. The Beijing Museum City Development Plan 2023–2035 further supports community museums, digital heritage resources, and diverse cultural application scenarios. This approach extends museums beyond fixed venues and makes them a vehicle for intergenerational cultural transmission.



| Case 3 | Shanghai: Breaking the "Venues Without Visitors" Deadlock Through Extended Hours and Innovative Scenario-based Programming

Shanghai's public cultural development focuses on making cultural venues part of citizens' everyday lives. By extending the opening hours of community cultural activity centers and piloting night-time museum and gallery programs such as "Museum Magical Nights", the city makes cultural services more accessible to working residents. Through programs such as "Youth Night Schools" and the Citizens' Cultural Festival, Shanghai also brings cultural activities into streets, squares, and community spaces. This strategy of extended hours, community outreach, and scenario-based programming help transform public cultural facilities into active civic participation, rather than leaving them as impressive figures on paper.



| Case 4 | Buenos Aires: Transforming Urban Space into Spaces for Reading

Buenos Aires' reading culture is strongly shaped by its creative reuse of urban space. In 2000, the city converted a former theater into El Ateneo Grand Splendid, preserving its Baroque dome and gilded balconies while transforming the space into a landmark bookstore that now attracts over one million visitors each year. Beyond this iconic project, Buenos Aires has built a dense network of bookstores, libraries, book fairs, and public reading programs. These turns reading into an accessible part of everyday life and shows how existing urban spaces can become cultural infrastructure.



(3) Inclusion & Engagement

The Inclusion & Engagement dimension examines the friendly and interactive atmosphere co-created by cities and their citizens— reflecting both the centripetal force that draws diverse populations and the degree to which citizens actively pursue public and civic causes. Three indicators are used: demographic diversity & inclusiveness (proportion of non-native residents), measuring whether a city has already absorbed a significantly diverse population; public cultural accessibility & usage (public library borrowing volume per resident), ensuring that supply-side provision matches with demand and that the "venues without visitors" phenomenon is not overlooked by focusing solely on facility coverage; and civic voluntary rate (volunteers as a share of the resident population), reflecting the degree of voluntary investment in public affairs.

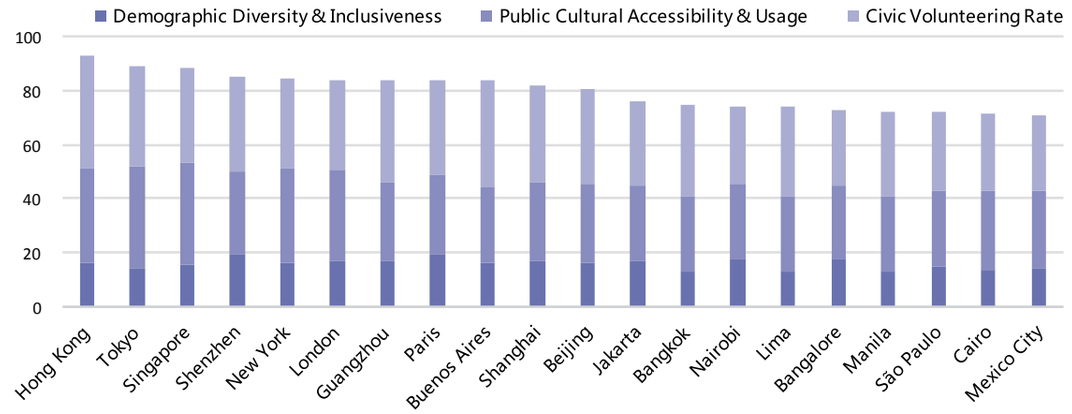


Figure 6: Inclusion & Engagement Scores by City

Hong Kong holds a clear advantage in this dimension, ranking first. As Asia's global metropolis and a meeting point of Eastern and Western cultures, Hong Kong has long attracted experts of different professions and citizens of diverse backgrounds from across the globe, establishing a solid foundation in population diversity. It has also built a notable ecosystem of civic engagement and public participation. According to the Social Welfare Department, the city is home to 151 government-funded social welfare organizations; citizens contribute an average of approximately 1.5 hours of voluntary service per week; and signature charitable events such as the Walk for Millions and Flag Day have long been woven into the fabric of everyday life. Meanwhile, Hong Kong's public library system — comprising fixed libraries, mobile libraries, and self-service library kiosks — records an exceptionally high annual borrowing volume of over 16 million volumes, with borrowing rankings that renews annually, reflecting a deeply embedded culture of library engagement.

A cluster of cities closely follows on the ranking — Tokyo, Singapore, Shenzhen, New York, London, Guangzhou, Paris, Buenos Aires, Shanghai, and Beijing — whose scores are not far apart. Whether through long histories of immigration or rapid urbanization, these cities all possess a degree of demographic diversity. The more pressing question is how to mobilize that diverse population to actively participate in social and cultural life. A wide range of cases demonstrates that public institutions are accelerating their efforts to cultivate a culture of participation — whether through physical venues, accessible services, or digital platforms — all aimed at making public cultural services easier to access, thereby stimulating grassroots enthusiasm. Taking library services as an example, Singapore's National Library Board (NLB) has introduced a Borrow-n-Deliver service alongside

barrier-free membership and adaptive facilities for persons with disabilities. In the field of voluntary service, Guangzhou launched the "Volunteer Time" mini program in 2023, an online platform that aggregates voluntary service information across all city districts in real time, posting volunteering opportunities and registering volunteer hours. Shenzhen seized upon the 2011 Universiade as a catalyst, transforming the event's volunteer service stations — the U-Stations — into permanent, professionalized civic volunteer service platforms, converting voluntary service from individual dedication into a meaningful force for urban co-governance. From the service pledge "Once you arrive, you are a Shenzhener" to the more recent civic call "Volunteer whenever you have time," the governing philosophy of inclusion has progressively expanded from a government safety-net guarantee into a shared civilizational identity enjoyed and co-created by the public at large.

Cities serving as regional hubs — Jakarta and Nairobi among them — alongside Bangalore, whose rapid industrial clustering has drawn specific population groups, and several South American cities, all in fact possess a degree of demographic diversity foundation. Yet population diversity does not equate integration. The latter requires proactive public service intervention: building supply-side coverage, stimulating demand-side response, and gradually cultivating a social atmosphere in which people from all walks of life can naturally gather in public spaces around shared interests or civic issues — coalescing, over time, into a genuine participatory force. These cities also host various international voluntary organizations: MEDLIFE in Lima and Habitat for Humanity in São Paulo, for instance, are engaged in medical outreach and habitat improvement. The activity infrastructure and civic resources these organizations bring can serve as a point of departure — establishing communication networks and co-governance platforms around themes such as culture of reading, youth development, social integration, and the mitigation of wealth inequality, thus releasing broad cultural participation and cultivating mutual trust, and ultimately triggering the endogenous accumulation of social capital.

Genuine inclusion and public engagement require urban communities to shift from passive beneficiaries to active participants. Identifying the existing endogenous civic motivations and needs within a city, and finding the forms of inclusion and participation suited to its own soil, may well be the most viable entry point for activating meaningful improvement in this dimension across many cities of the Global South.

| Case 5 | Shenzhen: Embedding Voluntary Service into Community Daily Life Through the "U-Station" Platform

Shenzhen's U-Stations have turned volunteer service from occasional activity into everyday community infrastructure. Located in community service centers, they operate year-round, providing volunteer program information, matching services, and material support. Residents can easily join nearby volunteer activities, which greatly lowers the threshold for participation. The city has also strengthened professional volunteer service, with more than 1,200 specialized teams in fields such as health care, legal aid, mental health, and emergency rescue. Through the Volunteer Academy, Shenzhen provides systematic training and supports a full loop of recruitment, training, matching, and recognition, making volunteer service an institutionally supported part of urban life.



3.6.4 Insights & Recommendations

Urban Humanism is not a natural outcome that appears only after urban development becomes stable; quite the reverse, it is a precondition for a city's long-term stable development. A systematic comparison of the 20 sample cities reveals that time, historical accumulation, and economic wealth themselves do not naturally lead to the successful establishment of a humanistic city. The key factors that determine whether humanism can truly take root in a diverse and mobile modern city are institutional support, equitable access to cultural resources, and the sustained participation of formal and informal civic vitality.

1. The Foundation of a Humanistic City Begins with Institutional Support

The data from the 20 sample cities shows that cities do not need to wait until its population becomes stabilized to start establishing institutionalized behavior norm policies, nor do they need to wait for a certain level of economic development before investing in public culture. Creation of universally accessible public services, open cultural spaces & facilities, and an active civic atmosphere can all be initialized at any stage of development.

2. The Pathway to a Humanistic City Lies in the Collaborated Effort of Behavior, Culture, and Governance

No city can reach a leading level of humanism through a single dimension alone. Behavior & Literacy forms the visible civic foundation of everyday life; Cultural Understanding provides the shared identity and emotional bond that bridge diveristy; and Inclusion & Engagement offers the institutional guarantee for sustained participation of diverse stakeholders. The absence of any one dimension will constrain the overall development of urban humanism.

For cities with limited resources, this suggests a pragmatic pathway: start by addressing facility gaps, followed with strengthening of civic cohesion, and eventually motivating improvements to the broader system toward a higher level of balance.

3. The Key to Success of a Humanistic City Lies in the "Institutional Conversion of Informal Social vitality"

Existing indicators primarily measure the expression of civic behavior within formal institutional frameworks. Yet the vast reserves of social vitality embedded in community traditions, neighborhood mutual aid, and informal organizations remain largely invisible in conventional statistics. The waste recycling ecosystem of Cairo's Zabbaleen community, the collaborative networks of Bangalore's technology communities, and the century-old immigrant mutual aid traditions of Buenos Aires all represent powerful sources of social cohesion that exist beyond formal institutions.

The development of urban humanism should not seek to replace this informal vitality, but rather to recognize, support, and channel it into more stable and widely accessible forms of public participation.

There is no single standard for urban humanism, nor is there a single pathway for its advancement. Cities with long histories can draw on cultural heritage to strengthen cultural identity and sense belonging; emerging cities can build social cohesion through institutional innovation and mutual aid. A truly humanistic city does not erase differences. Instead, it seeks common ground while embracing diversity, creating a humanistic atmosphere in which people genuinely choose to live their lives together.

3.7 Global Pilot Cities Assessment: Intelligence

3.7.1 Understanding Intelligence

Human understanding of how cities operate is, in essence, a spatial manifestation urban governance capacity in spatial systems. The evolution of urban governance has progressed from "mechanical management" to "networked coordination," and further toward "dynamic intelligence." During the era of industrial civilization, urban governance largely followed linear and bureaucratic logics, viewing the city as a "machine system" that could be segmented, controlled, and managed through standardized approaches. Roads, utility networks, energy systems, administrative structures, and public service systems operated within relatively isolated sectoral frameworks. Urban governance during this period relied heavily on experiential judgment, hierarchical transmission, and reactive responses. The "efficiency" of this era was built upon economies of scale and centralized management; however, effective inter-system coordination remained limited, information transmission was slow, and urban operations depended extensively on manual coordination.

With the acceleration of global urbanization, megacities began to exhibit increasingly complex characteristics. High-frequency coupling relationships emerged among population mobility, industrial organization, transportation systems, ecological environments, and public services, while traditional governance systems gradually exposed shortcomings such as delayed responsiveness, insufficient coordination, and resource mismatches. Entering the information age, e-government systems, communication networks, and information platforms became widely integrated into urban management, enabling urban governance to transition from "mechanized management" to a stage of "digital connectivity." For the first time, digital technologies broke through spatial and organizational boundaries, allowing cities to develop basic capacities for data collection, information transmission, and platform integration. Nevertheless, smart city development at this stage largely remained at the level of "business process digitalization," with limited substantive coordination among different systems.

Entering the 21st century, with the rapid development of the Internet of Things (IoT), big data, artificial intelligence (AI), cloud computing, and digital twin technologies, the logic of urban operations has undergone profound transformation. Cities are no longer merely physical spaces composed of roads, buildings, and infrastructure, but have gradually evolved into complex living systems formed by the coupling of "people flows—logistics flows—energy flows—information flows." The goal of smart cities has shifted from simply improving management efficiency to system coordination, public value creation, and dynamic resilience building. Smart cities have thus entered the "intelligent coordination" stage, where the core is no longer single-point technology application, but the reconstruction of urban operational systems through digital technology, enabling cities to gradually acquire capabilities in real-time sensing, dynamic analysis, coordinated decision-making, and continuous evolution.

This paradigm shift is reflected in the East through governance traditions emphasizing "holistic

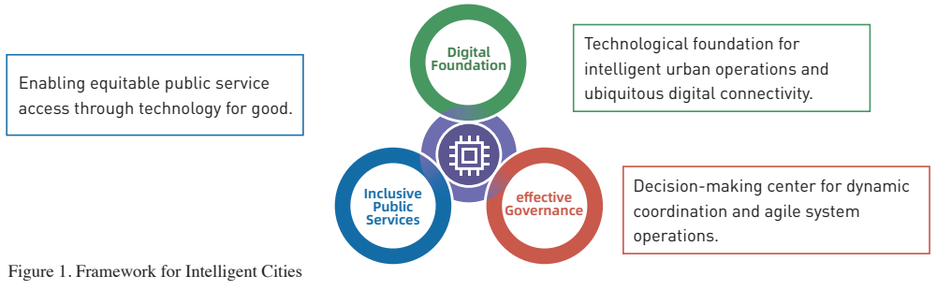


Figure 1. Framework for Intelligent Cities

governance" and "system coordination," which stress the organic interconnections among different urban functions. In the West, it is reflected through the theoretical traditions of Complex Systems Theory, Cybernetics, and Digital Governance, which emphasize information feedback, dynamic optimization, and networked coordination. Within this context, smart cities are no longer understood as simple aggregations of technologies, but rather as a restructuring of urban organizational models in the era of digital civilization. Cities are no longer merely objects to be "managed"; instead, they are gradually becoming complex adaptive systems capable of self-perception, self-regulation, and self-optimization.

Modern urban science further provides the theoretical foundation for smart cities. Complex Adaptive Systems Theory posits that cities are not formed by the simple superposition of independent modules, but are dynamic network systems composed of population, industry, transportation, ecology, infrastructure, and governance systems. Within the system, information flows, resource flows, and decision-making flows interact continuously, constantly adjusting in response to external environmental changes. Cybernetics reveals that the stable operation of complex systems depends on a closed-loop mechanism of "sensing—analysis—decision-making—feedback," and digital technology precisely makes it possible for cities to establish real-time closed loops. Meanwhile, platform economy and network society theories further demonstrate that digitization is reshaping the way urban resources are organized, gradually shifting urban operations from traditional hierarchical structures to network-coordinated structures.

Smart city standardization research promoted by international organizations such as the United Nations, the International Telecommunication Union (ITU), and the International Organization for Standardization (ISO) has further translated this theoretical understanding into a global governance framework. In relevant standard systems, the core objectives of smart cities are no longer limited to information infrastructure construction, but increasingly focus on overall urban operational efficiency, equity in public services, and governance resilience. Smart city construction is no longer merely a "technology project," but encompasses a systematic transformation of infrastructure, public services, social governance, and sustainable development. Therefore, a city with genuine smart capabilities requires not only advanced technology, but also an efficient, coordinated, dynamically feedback-driven, and continuously evolving urban operational system.

Based on global smart city development experience and Shenzhen's digital transformation practice, this report constructs a three-dimensional analytical framework of "Digital Foundation—Inclusive Public Services—Effective Governance."

Digital Foundation: Centered on digital infrastructure and data capabilities, it builds the sensing and connectivity foundation for urban operations, determining whether a city possesses the capabilities to "see, connect, and compute." This includes communication networks, sensing systems, data platforms, computing facilities, and digital spaces. The digital foundation is not merely a technical system, but a prerequisite for the city to develop holistic coordination capabilities.

Inclusive Public Services: Emphasizing the extension of digital technology into livelihood services and social operations, making public services such as education, healthcare, transportation, elderly care, and culture more equitable, convenient, and accessible. It reflects not only the city's digitalization level, but also whether the city can translate technological capabilities into social wellbeing.

Effective Governance: Emphasizing the improvement of urban risk early warning, resource allocation, and public governance capabilities through data sharing, platform coordination, intelligent decision-making, and dynamic dispatch, enabling the city to form an operational closed loop of "sensing—analysis—decision-making—feedback." Its essence is to drive the transition of cities from static management systems to dynamic operational systems.

Within this three-dimensional framework, "holism, coordination, closed-loop, and dynamism" constitute the core logic of intelligent city evaluation. Holism emphasizes the need for unified architecture and system integration capabilities in urban digital construction; coordination emphasizes data connectivity and collaborative operations across departments, systems, and spaces; closed-loop emphasizes the need for continuous feedback and optimization mechanisms in urban governance; and dynamism emphasizes the city's capacity for continuous learning, iteration, and evolution.

Table 1. Indicator System of Intelligent Cities

Objectives	Indicators	Definition
Digital Foundation	Urban Data Platform Integration	Whether the city possesses an integrated multi-source data digital foundation serving as a unified platform for smart city system operations
	Network Connectivity Level	The breadth of fiber broadband coverage and the quality of ultra-high-speed connectivity, reflecting the foundational guarantee level of networks as "digital utilities"
Inclusive Public Services	Public Network Coverage Rate	Measuring the city's capability to provide inclusive wireless network services in public spaces
	Digital Payment Convenience	The digitalization level of the city's commercial consumption environment and the convenience of cashless living
Effective Governance	Digital Civic Engagement Level	Measuring the government's collaborative capability to utilize digital platforms to solicit public opinion and form governance closed loops
	Convenience of Online Government Service	Measuring the digital delivery capacity and operational efficiency of government services

3.7.2 Overall Assessment

Based on the three-dimensional evaluation framework of "Digital Foundation—Inclusive Public Services—Effective Governance," combined with comprehensive calculations using six core indicators—urban data platform integration, network connectivity level, public network coverage rate, digital payment convenience, digital civic engagement level, and convenience of online government service—the global intelligent city development landscape exhibits pronounced gradient differentiation. From the overall rankings, Singapore, Shenzhen, and London constitute the first tier of global intelligence; Hong Kong, New York, Shanghai, Guangzhou, Beijing, Tokyo, and Paris form the second tier; São Paulo, Bangkok, Buenos Aires, Lima, Jakarta, Bangalore, Manila, and Mexico City are in an intermediate transition stage; while Nairobi and Cairo demonstrate a development state characterized by the coexistence of foundational capacity building and localized breakthroughs.

(1) Ranking Tiers

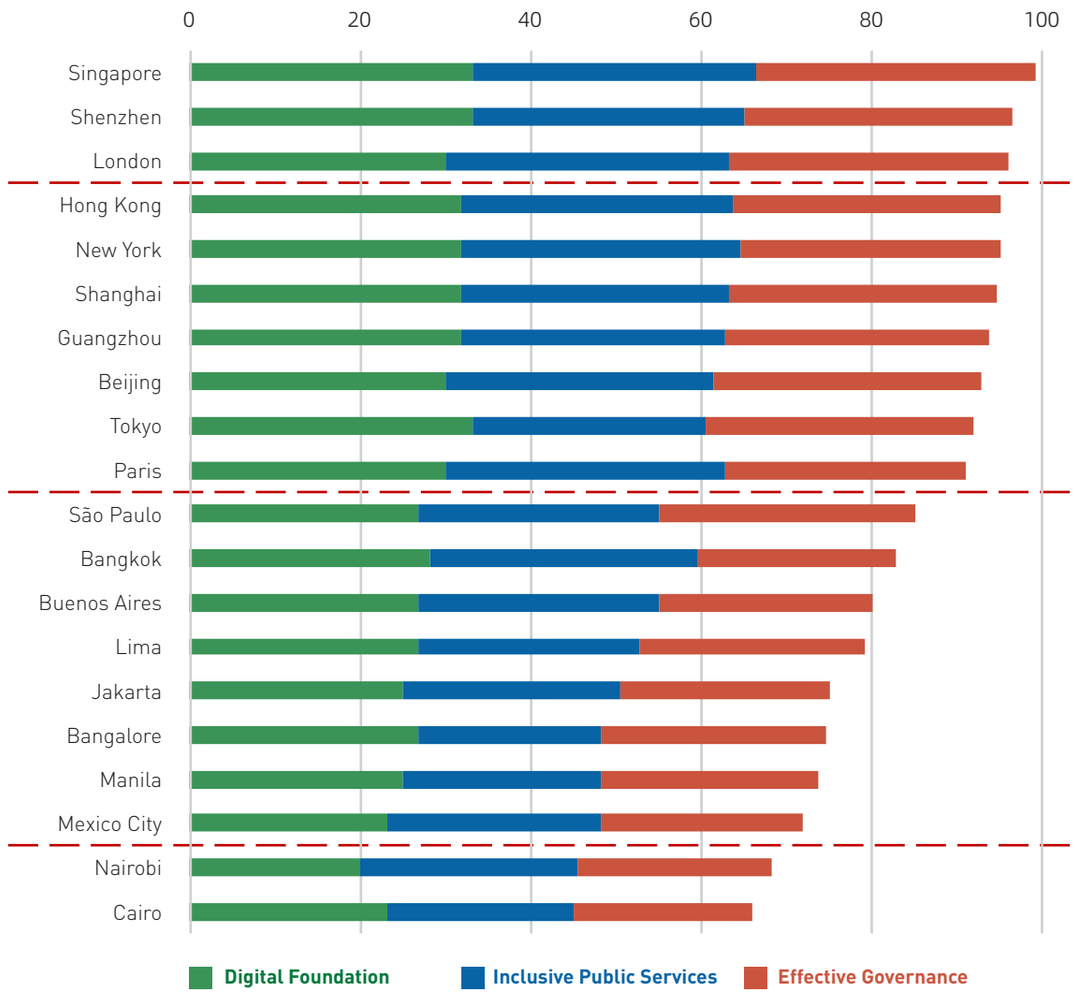


Figure 2 Tier Performance

This gradient differentiation reflects not merely differences in technological advancement, but more fundamentally divergent development stages in digital infrastructure, public service systems, and governance structures across cities. Global intelligent city competition has gradually shifted from "whether digitalization exists" to "whether systematic coordination capabilities have been formed."

Tier 1

Score > 95: Singapore, Shenzhen, London

First-tier cities have basically formed a highly coordinated intelligent city operational framework of "digital foundation—inclusive public services—effective governance system," with intelligent construction no longer remaining at the level of single-point applications, but gradually entering the stage of whole-domain coordination and dynamic operation.

The most salient characteristic of first-tier cities is that digital technology has been deeply embedded into urban operational systems. Singapore relies on its "Smart Nation" strategy to construct a national-level digital governance system, demonstrating high holism in online government services, digital identity systems, and urban digital twins; Shenzhen leverages its robust digital industry ecosystem and high-frequency application scenarios to form a global leading advantage in digital foundation construction, mobile payment, and real-time governance; while Tokyo, though relatively conservative in the digital consumption domain, has formed a highly mature operational capability in refined infrastructure management, transportation coordination, and disaster prevention systems. These cities are no longer merely "digital cities," but are beginning to evolve toward "dynamically intelligent cities." Their core competitiveness lies not only in network and platform capabilities, but more importantly in cross-departmental coordination, real-time feedback, and system closed-loop capabilities.

Tier 2

85 < Score ≤ 95: Hong Kong, New York, Shanghai, Guangzhou, Beijing, Tokyo, Paris

Tier 2 cities already possess relatively strong digital foundations and have reached globally advanced levels in certain domains, but their overall coordination capabilities and uniformity still exhibit certain differences.

The common characteristic of tier 2 cities is "localized leadership with systemic integration." For example, New York and London possess significant advantages in open data, digital finance, and public participation, but due to relatively decentralized governance systems, their unified coordination is comparatively limited; Shanghai and Guangzhou have rapidly developed urban operation platforms, digital government, and online services, but still have room for improvement in global open innovation ecosystems and internationalized digital governance; Beijing demonstrates strong coordination capabilities in digital governance and government platform construction, but the market-driven vibrancy of digital life scenarios is slightly weaker than Shenzhen. Overall, these cities have transitioned from the "informatization stage" to the "digital integration stage," but there remains room for advancement toward truly dynamic coordination and intelligent governance systems.

Tier 3

70 < Score ≤ 85: São Paulo, Bangkok, Buenos Aires, Lima, Jakarta, Bangalore, Manila, Mexico City

Tier 3 cities are in a stage of rapid intelligence enhancement, characterized by relatively fast digital progress in certain domains but still uneven overall capabilities. For example, although Jakarta and Manila have limited digital foundation capabilities, their mobile internet platforms and digital payment development speeds are relatively fast; São Paulo, Buenos Aires, and Lima are gradually forming certain foundations in digital governance and mobile internet applications.

Tier 3 cities typically exhibit high mobile internet penetration rates and relatively active platform economies, but their urban digital foundations, public governance coordination capabilities, and data platform systems remain relatively weak. For example, Bangalore has formed strong technological innovation capabilities relying on its software industry, but its public digital services and urban governance system construction lag relatively behind; São Paulo has made rapid progress in smart transportation and urban safety monitoring, but urban wealth disparity and spatial fragmentation still constrain digital inclusiveness. These cities generally demonstrate typical characteristics of "localized breakthroughs with overall capacity gaps," and the key to their future development lies in transitioning from platform-based digitalization to systematic smartness.

Tier 4

Score ≤70: Nairobi, Cairo

Tier 4 cities remain at the foundational capacity building stage in overall intelligence, but certain domains exhibit pronounced "latecomer leapfrogging" characteristics. For example, although Nairobi has the lowest overall composite score, its mobile payment and digital finance systems are representative among developing-country cities globally.

Tier 4 cities generally face challenges including insufficient infrastructure, weak governance systems, and inequitable public services; therefore, intelligent city construction focuses more on communication networks, digital payments, and basic government platform development. Compared with cities in preceding tiers, their intelligence development is not built upon complete industrialization and informatization accumulation, but relies more on mobile internet and platform economies to achieve leapfrogging development.

The characteristics of this tier of cities also demonstrate that there is no single path to intelligent cities. For developing-country cities, mobile internet and digital payments can compensate to some extent for traditional infrastructure deficiencies, but they still need to gradually establish unified data platforms and governance coordination systems in the future.

(2) Performance Profile

If different tiers reflect the "horizontal differences" in urban intelligence development, then different patterns reflect the "development logic and path differences" behind urban intelligence evolution. Global smart cities do not follow a uniform development paradigm; due to differences in institutional structures, economic foundations, industrial systems, technological capabilities, and social issues, different cities exhibit different capability combinations across the three dimensions of digital foundation, inclusive services, and efficient governance, thereby forming several distinctive development patterns. These patterns not only determine the priority directions of urban smartness construction, but also profoundly influence their governance structures, public service systems, and technology application approaches.

Based on the performance of the 20 cities across three dimensions and six indicators, five typical patterns are identified: Government-Led Model, Industry-Driven Model, Open Collaboration Model, Inclusive Breakthrough Model, and Governance Improvement Model, corresponding to different development paths in the domain of " intelligence."

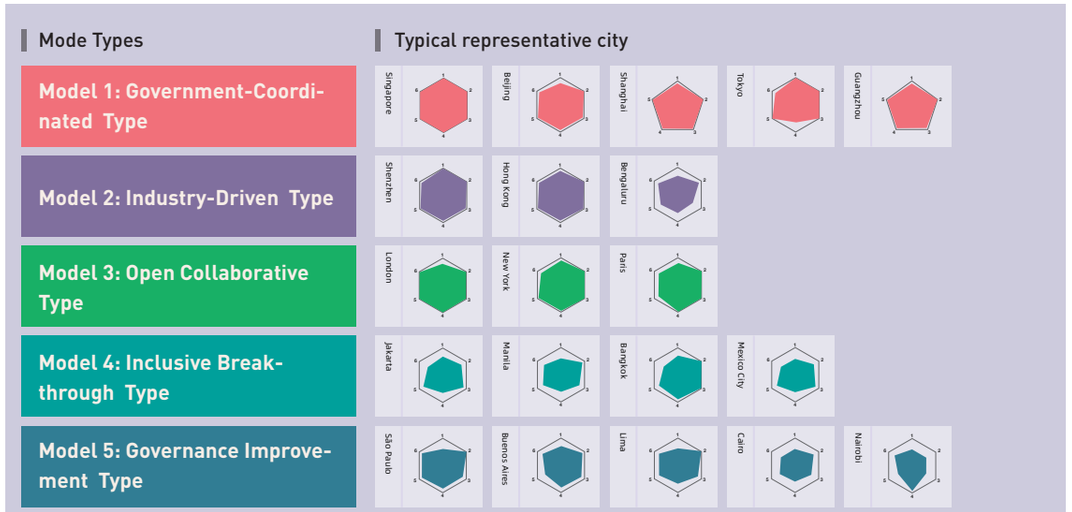


Figure 3 Typology of Intelligence Patterns

Type	Cities	characteristic
Government-Led Model Driving Urban Intelligence Through Holistic Governance Capacity	Singapore, Beijing, Shanghai, Tokyo, Guangzhou	The most salient characteristic of this pattern is the outstanding performance in the "Effective Governance" and "Digital Foundation" dimensions, particularly in indicators such as urban data platform integration, online government service convenience, and digital public participation activity, where these cities rank at globally leading levels. These cities typically advance through government-led top-level design, establishing unified digital foundations and cross-departmental coordination systems, using digital means to enhance the governance efficiency of megacities. Singapore is the most mature representative of this pattern. Its "Smart Nation" strategy has not only constructed a unified national data system and digital identity system, but has also achieved data coordination and real-time linkage across domains including transportation, housing, healthcare, and public safety. Beijing and Shanghai have gradually formed comprehensive digital governance systems covering urban operations, public services, and social governance through platforms such as Yi-Wang-Tong-Ban (Government Services Online) Tokyo places greater emphasis on refined infrastructure management, with its urban digitalization more reflecting highly mature coordination capabilities accumulated over the long term. Guangzhou has formed relatively strong holistic governance capabilities in domains such as urban operation centers, government coordination, and smart transportation. The common characteristic of this type of city is that digitalization first serves the modernization of urban governance. The smart city is not only a technical system, but also a large-scale urban collaborative operational capability. Its advantages lie in unified architecture, high cross-departmental coordination efficiency, and complete governance closed loops, but it also tends to face challenges such as high system complexity and insufficient market innovation elasticity.
Industry-Driven Model Advancing Smartness Iteration Through Digital Industry Ecosystems	Shenzhen, Hong Kong, Bangalore	This pattern demonstrates particularly outstanding performance in the "Digital Foundation" and "Inclusive Public Services" dimensions, especially in indicators such as network connectivity level, digital payment convenience, and platform innovation activity. Its smartness construction relies more on digital industries, technology enterprises, and market innovation ecosystems for advancement. Shenzhen is the world's most typical industry-driven intelligent city. Technology enterprises such as Huawei, Tencent, and DJI not only constitute the core driving force of the city's digital economy, but also deeply participate in urban governance, public services, and digital infrastructure construction, enabling Shenzhen to form a rapid iteration system of "technological innovation—scenario application—industry feedback." Hong Kong leverages its status as an international financial center to form unique advantages in cross-border digital payments, fintech, and international data flows. Bangalore relies on its global software industry and IT service systems to form a powerful digital talent and innovation ecosystem, though its public governance and urban infrastructure still have certain gaps. The core characteristic of this pattern is the highly interactive relationship formed between the digital industry and the smart city. The city is both an important market for digital technology and an important testing ground for new technology applications. Its advantages lie in fast innovation speed, high market activity, and rich digital consumption scenarios, but in terms of unified data systems, public governance coordination, and city-level platform integration, there is often a need for further strengthening.
Open Collaboration Model Building Intelligent Ecosystems Through Open Platforms and Social Coordination	London, New York, Paris	This pattern demonstrates outstanding performance in digital public participation activity, open data sharing, and public service coordination, with its smartness construction emphasizing collaborative innovation among multiple stakeholders including government, market, and society. London has long promoted an open data strategy, making large amounts of transportation, energy, environment, and public service data available to society, forming a mature urban innovation ecosystem. New York has formed global influence in domains such as digital finance, smart transportation, public safety, and social participation, with its urban digitalization highly dependent on market platforms and social innovation forces. Paris has increasingly focused on the coordinated advancement of digital governance and green transformation in recent years, forming distinctive characteristics in public space digitalization, green smart transportation, and civic participation. Compared with government-led cities, open collaboration cities typically do not rely on a single unified platform, but form networked smart ecosystems through open data, market innovation, and public participation. These cities usually possess strong internationalization and innovation activity, but due to multiple governance stakeholders, they also tend to encounter issues such as data fragmentation and insufficient coordination efficiency.
Inclusive Breakthrough Model Achieving Rapid Digital Leapfrogging Through Mobile Internet	Jakarta, Manila, Bangkok, Mexico City	The most salient characteristic of this pattern is that the "Inclusive Public Services" dimension improves significantly faster than "Digital Foundation" and "Effective Governance." These cities typically leverage mobile internet, electronic payments, and platform economies to achieve rapid popularization of digital lifestyles. Jakarta and Manila have greatly enhanced the digitalization levels of transportation, consumption payments, and life services in recent years by relying on super-app platforms; Bangkok has developed rapidly in domains such as digital tourism, electronic payments, and smart mobility; Mexico City has promoted public service digitalization and urban service onlineization through mobile internet platforms. This type of city demonstrates that smart cities do not necessarily need to undergo complete traditional industrialization and informatization stages. Mobile internet and platform economies can help cities achieve leapfrogging digital development to a certain extent. However, at the same time, these cities often still have obvious gaps in urban data platforms, online government coordination, and public governance capabilities, and their long-term challenge lies in how to gradually transition from "consumption-oriented digitalization" to "governance-oriented digitalization."
Governance Improvement Model Responding to Urban Realities Through Digitalization	São Paulo, Buenos Aires, Lima, Cairo, Nairobi	This pattern exhibits generally moderate overall composite levels, but certain indicators demonstrate localized breakthrough characteristics. Its smartness construction is often not centered on technological advancement as the core objective, but rather emphasizes using digital technology to address real social governance issues such as traffic congestion, public safety, financial accessibility, and insufficient public services. São Paulo has focused in recent years on advancing smart transportation and public safety monitoring system construction; Buenos Aires has enhanced public service efficiency and civic participation levels through digital government platforms; Lima has focused on advancing transportation digitalization and basic public service improvement; Cairo has concentrated more on basic government digitalization and urban infrastructure upgrading; Nairobi has formed a globally typical case in the domain of digital financial inclusiveness by relying on the M-Pesa mobile payment system. This pattern demonstrates that for many developing-country cities, intelligent city construction is first and foremost a form of "problem-oriented digitalization." The core value of digital technology lies not in constructing complex technical systems, but in enhancing basic public service capabilities and social governance efficiency. The key to the future development of these cities lies in gradually transitioning from localized digital breakthroughs toward more systematic, platform-based, and coordinated intelligent city construction paths.

3.7.3 Assessment by Objective

(1) Digital Foundation: From “Information Connectivity” to “Urban Digital Nervous System”

The digital foundation is the foundational capability for smart city operations. Its essence is not merely communication networks or data platform construction, but whether the city has formed a unified digital space, real-time data flow capabilities, and cross-system coordination capabilities. From the calculation results of the 20 cities, the digital foundation dimension exhibits pronounced gradient differentiation. Singapore, Shenzhen, and Tokyo have achieved full marks in both “urban data platform integration” and “network connectivity” indicators, constituting the global first tier; New York, Hong Kong, Shanghai, Guangzhou, and other cities follow closely, forming relatively mature digital foundation systems; Bangkok and São Paulo demonstrate “localized digital leadership with insufficient overall coordination”; while Nairobi and Cairo remain primarily at the basic platform construction stage.

Behind this differentiation, the essential reflection is the difference in digital development logic across cities. Some cities emphasize government coordination and unified platforms, some rely on market innovation and industrial ecosystems, and others achieve latecomer leapfrogging through mobile internet. Therefore, the digital foundation is not only a technical capability issue, but also a reflection of urban organizational capacity and governance structure.

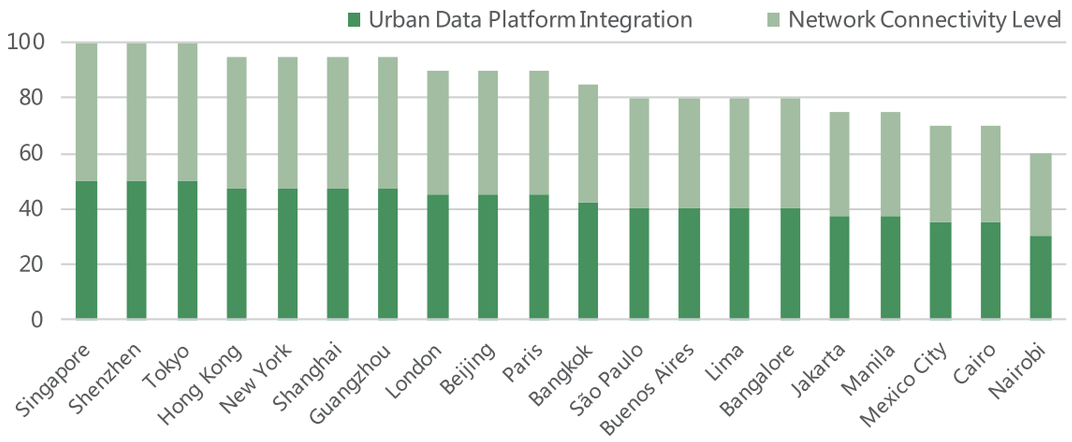


Figure 4. Digital Foundation Scores by City

| Case 1 | Shenzhen: From "Digital City" to "Urban Intelligent Agent"

Shenzhen is one of the world's most representative cities in digital foundation construction. Its characteristic lies not only in advanced network facilities, but in having formed a highly coupled development model of "industry—technology—governance."

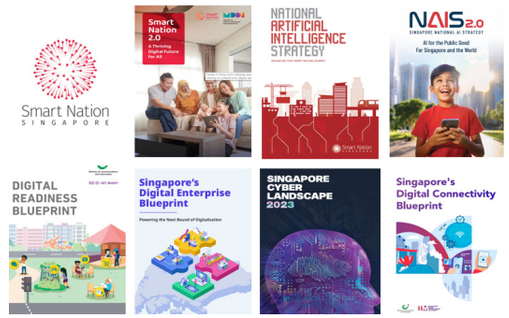
At the network connectivity level, Shenzhen has long ranked among the top cities in China. As of 2025, Shenzhen has cumulatively built more than 80,000 5G base stations, with 5G density at a globally leading level, and gigabit fiber-optic networks have basically achieved full-area coverage. High-speed networks not only support consumer internet, but are deeply embedded in industrial internet, connected vehicles, urban sensing systems, and low-altitude economy scenarios.

More representative than basic networks is Shenzhen's exploration in urban digital platforms. Shenzhen has built a City Information Modeling (CIM) platform and is gradually evolving toward a digital twin city. The platform integrates multi-dimensional data including transportation, planning, construction, underground pipelines, environmental monitoring, and urban safety, gradually forming a unified digital space for urban operations. Particularly in the construction of the Urban Operation Management Center, Shenzhen has begun to combine AI analysis, real-time sensing, and cross-departmental coordination, enabling the digital platform to evolve from a mere "display system" into the urban operation dispatch system.

Shenzhen's particularity lies in the strong coupling relationship between its digital foundation construction and the local digital industry. Enterprises such as Huawei, Tencent, and DJI are not only technology providers, but also directly participate in the construction of urban application scenarios. This has enabled Shenzhen to form a globally rare closed-loop system of "technology iteration—urban application—industry feedback." However, at the same time, Shenzhen also faces issues such as complex platform systems and non-uniform cross-departmental data standards, and the complexity of megacity governance is continuously increasing.



| Case 2 | Singapore: The Holistic Coordination Model of a National-Level Digital Foundation



Singapore also achieved full marks in the digital foundation dimension, representing a typical "government-led" model. Since proposing the "Smart Nation" strategy in 2014, Singapore's smart city construction logic has never been about single-item technological leadership, but about forming a highly unified national-level digital architecture. Singapore has established a unified national digital identity system (Singpass), a unified data platform, and a city-level digital twin system "Virtual Singapore." This system can integrate data on buildings, transportation, energy, underground spaces, and population activities, supporting urban planning simulation, disaster simulation, and transportation optimization.

The most prominent characteristic of Singapore's digital foundation is "holism." Its data platform, public services, and governance system possess a highly unified architecture, with extremely strong cross-departmental data coordination capabilities. For example, during the pandemic, Singapore was able to rapidly achieve linkage among health codes, travel data, and public service systems, demonstrating powerful system coordination capabilities.

However, the Singapore model also has distinct characteristics: it is built upon a relatively small national scale and a highly centralized governance structure, possessing strong institutional particularity. By comparison, megacities attempting to replicate this model often face more complex data governance and organizational coordination challenges.

Core Insights on the Digital Foundation Dimension

Global urban development experience indicates that the digital foundation is evolving from traditional information infrastructure into the "digital nervous system" of urban operations. The gap between cities is gradually shifting from network coverage and platform quantity to differences in data space integration, cross-departmental coordination, and dynamic response capabilities. The common characteristics of leading cities such as Singapore, Shenzhen, and Tokyo lie in having constructed multi-source sensing systems, unified urban data platforms, and real-time analysis and prediction capabilities, enabling digital platforms to gradually transition from "data tools" to "urban operation hubs." Meanwhile, the development paths of different cities are not identical: Singapore emphasizes government coordination, Shenzhen relies on industrial ecosystems for rapid iteration, London, New York, and Paris place greater emphasis on open data and social coordination, while Jakarta and Nairobi achieve localized leapfrogging through mobile internet.

From a future trend perspective, the digital foundation is evolving from "data aggregation" toward "digital twins," and from "information systems" toward "urban operating systems." With the development of artificial intelligence, edge computing, and real-time sensing technologies, urban digital platforms will increasingly possess dynamic learning and prediction capabilities, and urban governance will gradually shift from static management to real-time dispatch and proactive optimization. For Shenzhen, its advantage lies in possessing the world's most active digital industry ecosystem and rich scenarios, but the more important task for the future is no longer to continue increasing the quantity of digital facilities, but to further strengthen cross-departmental coordination, unify data standards, and enhance city-level dynamic governance capabilities, enabling the digital foundation to truly become the foundational capability supporting efficient megacity operations.

(2) Inclusive Public Services: Whether Smart Cities Can Truly Enter Daily Life

If the digital foundation determines whether an intelligent city "can operate," then inclusive public services determine "why it exists." Global smart city development practice demonstrates that digitalization does not inherently mean public value enhancement. A truly vibrant intelligent city is not the most technologically complex city, but one that enables ordinary residents to genuinely feel convenience, efficiency, and equity.

From the calculation results of the 20 cities, the differences in the inclusive public services dimension exhibit more distinctly social characteristics than the digital foundation. Singapore, Hong Kong, Shenzhen, and Tokyo are in the first tier, with the common characteristic that digital services have deeply entered residents' daily lives. Second-tier cities such as Shanghai, Guangzhou, London, and New York are highly advanced in certain domains, but there still exist certain differences in digital usage across different groups. Third-tier cities such as Jakarta, Manila, and Bangkok demonstrate characteristics of "highly active mobile digitalization with insufficient equity in public services." Nairobi and other cities, though limited in infrastructure levels, have mobile payment and mobile finance penetration rates that are globally representative.

This demonstrates that the development logic of inclusive services in urban intelligence levels is not entirely synchronized with traditional economic development levels; developing and least-developed countries can similarly achieve effective enhancement of inclusive public service capabilities through intelligence construction and single-point breakthroughs.

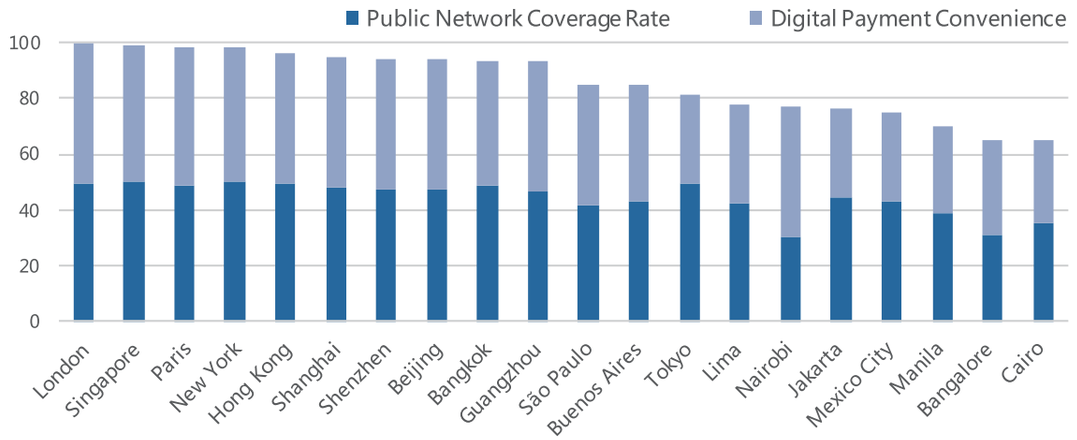


Figure 5. Inclusive Public Services Scores by City

| Case 3 | Hong Kong: Digital Convenience in a High-Density City

Hong Kong is one of the cities with the highest digital life convenience globally. Hong Kong's highly developed electronic payment system has enabled Octopus cards, e-wallets, and mobile payments to be deeply integrated into public transportation, commercial consumption, and daily services. The high-density urban structure further reinforces digital service efficiency, enabling residents to complete high-frequency life needs within extremely short spatial scales.This type of city demonstrates that inclusive services are not merely about "technology coverage," but more importantly about forming a low-threshold, high-accessibility life service system.



| Case 4 | Nairobi: "Latecomer Leapfrogging" in Digital Inclusiveness

In the domain of inclusive public services, what is most noteworthy is not traditional developed cities, but the "leapfrogging digital inclusiveness" demonstrated by certain developing-country cities.Although Nairobi still has gaps in overall digital infrastructure, its mobile internet penetration rate is extremely high, making it a globally typical case of leapfrogging digital finance development. The widespread popularization of the M-Pesa mobile payment system has enabled large populations previously lacking bank accounts to directly enter the digital finance system. Although its city-level data platform and governance system remain relatively weak, digital payments and mobile internet have already become important foundations for urban operations.This type of city demonstrates that intelligent cities do not necessarily follow the traditional path of "infrastructure first, then digitalization." In the mobile internet era, digital inclusiveness does not necessarily depend on complete industrialization foundations; mobile internet and mobile payments are reshaping the public service structures of developing-country cities, and some developing-country cities can achieve rapid leapfrogging through localized digitalization.



Core Insights on the Inclusive Public Services Dimension

Global smart city development experience indicates that digitalization construction can only form sustained and stable public value when it is truly integrated into residents' daily lives. Compared with the digital foundation reflecting technical capabilities, inclusive public services more directly reflect the social warmth and equity orientation of urban intelligence. Leading cities such as Hong Kong, Singapore, and Shenzhen have formed digital life systems covering high-frequency scenarios such as payments, transportation, healthcare, and government affairs, with technology gradually becoming "invisible" and convenience becoming residents' most direct perception. Meanwhile, the paths to digital inclusiveness differ across cities. Developed cities place greater emphasis on unified digital identities and public service coordination, while cities such as Jakarta, Manila, and Nairobi rely more on mobile internet and digital payments for rapid popularization. This demonstrates that digital inclusiveness does not entirely depend on high-level infrastructure; platform economies can similarly drive public service coverage. The focus of future intelligent city construction will also shift further from "service digitalization" to "service equity," paying greater attention to the digital divide, elderly adaptation, and public service inclusiveness.

(3) Effective Governance: From "Digital Government" to "Urban Operation Closed Loop"

Effective governance is the core objective of intelligent city development and also the domain with the greatest divergence among global cities. From the calculation results, cities such as London, Singapore, Tokyo, Shenzhen, Hong Kong, Shanghai, Guangzhou, and Beijing lead overall in digital public participation and online government services. Among them, Singapore ranks at the forefront globally in online government service convenience; Tokyo demonstrates outstanding performance in digital public participation activity; Shenzhen, Shanghai, and Guangzhou have formed relatively strong coordination capabilities in digital governance systems such as "Unified Urban Operations Management Platform" and "Yi-Wang-Tong-Ban (Government Services Online)" Meanwhile, certain cities in Latin America and Southeast Asia, though highly active in mobile internet usage, still have relatively limited digitalization of governance systems, with immature public participation and cross-departmental coordination mechanisms.

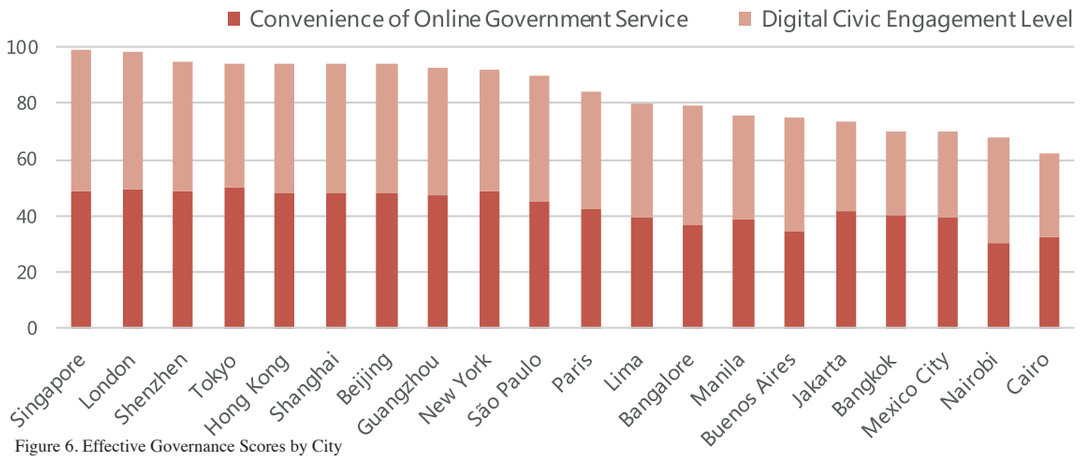


Figure 6. Effective Governance Scores by City

Core Insights on the Effective Governance Dimension

Global intelligent city development practice indicates that effective governance has become the most core and most differentiated domain of urban intelligence capabilities. Many cities have already achieved government digitalization and platformization, but cities that can truly form a closed-loop governance system of "sensing—analysis—decision-making—feedback" remain relatively limited. The key to smart governance lies not merely in moving traditional businesses online, but in reconstructing urban operational methods through data sharing, cross-departmental coordination, and dynamic dispatch, enabling cities to gradually acquire capabilities in real-time response, proactive early warning, and continuous optimization.

From the experience of leading global cities, effective governance has broadly formed two different paths. One is the "government-led" model represented by Shanghai, Beijing, and Singapore, which strengthens cross-departmental coordination capabilities under government leadership through unified urban operation platforms and digital government systems, enabling real-time linkage across systems including transportation, safety, environment, and livelihood. The other is the "open collaboration" model represented by New York and London, which places greater emphasis on open data, public participation, and social collaborative innovation, with markets, enterprises, and social organizations jointly participating in urban governance. Although these two models follow different paths, they are essentially both driving urban governance from traditional hierarchical management toward networked collaborative governance.

At the same time, global experience also demonstrates that governance capacity is often the most difficult breakthrough in intelligent city construction. Compared with technology platform construction, cross-departmental coordination, data sharing, and institutional restructuring involve deeper-level organizational adjustments. Particularly in megacities, system complexity continues to increase, governance objects constantly change dynamically, and relying solely on a single department is already insufficient to address complex urban issues. Therefore, the development direction of intelligent governance is shifting from "business digitalization" to "urban operation systematization," from "post-event disposal" to "real-time prediction," and from "single-point management" to "whole-domain coordination."

| Case 5 | The China Model: The "Unified Urban Operations Management Platform" Model



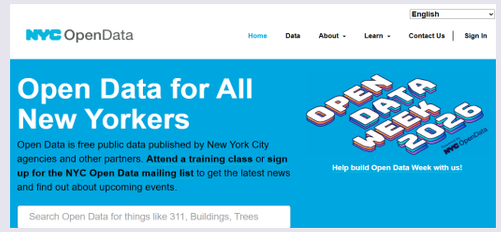
Shanghai's "Unified Urban Operations Management Platform" initiative represents a significant global case of digital governance for megacities. Its core objective is not merely the construction of a governance platform itself, but the integration of multiple urban systems—including transportation, fire services, market regulation, and environmental governance—through a unified urban operations platform, thereby enabling cross-departmental coordination and integrated governance.

Beijing places greater emphasis on real-time dispatch capabilities in megacity governance. Through urban operation centers and digital platforms, Beijing has gradually strengthened dynamic management of transportation, safety, and public events.

Shenzhen promotes the evolution of urban governance from "digital government" to "urban operation intelligent agent" at the city-wide level. Since 2016, the Shenzhen Urban Operation Management Center has been able to integrate large amounts of real-time data and has gradually achieved risk early warning, event coordination, and dynamic dispatch. Compared with traditional governance models, its greatest change is that governance is beginning to shift from "hierarchical transmission" to "real-time linkage."

| Case 6 | The Western Model: Open Governance Model

Compared with Chinese cities, New York and London represent another path. They do not emphasize highly centralized governance platforms, but place greater importance on open data, public participation, and social coordination. Large amounts of urban data are made available to society, and enterprises and social organizations can jointly participate in urban governance innovation. However, this model also tends to encounter governance fragmentation issues.



3.7.4 Insights And Recommendations

Based on Shenzhen's more than four decades of digitalization practice and systematic comparison with 20 typical global cities, this report distills the following core perspectives: the essence of intelligent city construction is not merely technological upgrading, but the holistic reconstruction of urban organizational capacity, governance capacity, and social coordination capacity. What truly determines a city's intelligence level is the long-term coupling of institutional capacity, industrial ecosystem, public value, and system coordination.

1. The Core of Intelligent Cities is "System Coordination," Not Facility Construction

Global experience demonstrates that intelligent cities are transitioning from "single-point digitalization" toward "holistic coordination." Leading cities such as Singapore, Shenzhen, Tokyo, and London no longer rely solely on networks, platforms, and devices, but have constructed complete operational systems covering sensing, analysis, decision-making, and feedback. Through unified data platforms and cross-departmental coordination mechanisms, they achieve real-time linkage across domains including transportation, energy, government affairs, and public services. The key to future urban competition lies not in the quantity of digital facilities, but in whether unified digital foundations, data flow capabilities, and cross-departmental real-time coordination capabilities exist. For developing-country cities, prioritizing the establishment of stable data sharing mechanisms and basic coordination capabilities is more important than blindly pursuing complex technologies.

2. Intelligent Cities Require Joint Driving by Government, Industry, and Society

Different cities have formed diverse development models: Singapore, Beijing, and Shanghai demonstrate "government-led" characteristics, advancing holistic governance modernization through top-level design; Shenzhen and Bangalore rely more on digital industries and technology enterprises to form an "industry-driven" path; London and New York form "open collaboration" ecosystems through open data and social innovation. Among these, Shenzhen's experience is most representative: with its strong information industry foundation, forward-looking policies, innovative culture, market mechanisms, and sustained talent and fiscal investment, it has achieved high-frequency interaction among government, enterprises, and resident needs, enabling technology to rapidly translate into public value. This demonstrates that intelligent city construction requires both governmental organizational capacity and industrial innovation vitality and social participation mechanisms.

3. Development Paths Are Diverse; the Key Lies in Matching One's Own Stage

There is no single template for intelligent cities. Developed cities have already entered the digital twin and dynamic governance stage, while many developing-country cities remain at the foundational digitalization stage. Cities with stronger economic foundations can prioritize the construction of unified digital foundations and coordinated governance systems; rapidly urbanizing cities should start from low-cost entry points such as digital payments, online government affairs, and transportation digitalization to enhance governance efficiency and public service levels. Appropriate development pace and breakthrough points should be selected according to one's own economic capacity, industrial foundation, and social needs.

4. The Future Direction of Intelligent Cities Will Be "Dynamic, Inclusive, and People-Centered"

With the development of artificial intelligence, digital twins, and other technologies, intelligent cities will shift from "informatization management" to "dynamic governance," achieving real-time sensing, predictive analysis, and proactive optimization. At the same time, attention must be paid to issues such as the digital divide, data security, privacy protection, and algorithmic fairness. An ideal intelligent city must not only be intelligent and effective, but also equitable, inclusive, and human-centered.

Therefore, the essence of the intelligent city is to reconstruct urban operational logic through digital means, building a more coordinated, effective, inclusive, and sustainable development system. Its core value lies in whether the city possesses future-oriented system organizational capacity and dynamic evolutionary capability.

CHAPTER 4

CHAPTER 4
FUTURE OUTLOOK

UIS GLOBAL PILOT CITIES OBSERVATION REPORT 2026



Future Outlook

UIS is more than an evaluation framework — it is global public goods for urban governance. Beyond city rankings and comparative analysis, UIS is committed to delivering solutions, case references, data, and actionable pathways, continuously strengthening its six product lines around the core functions of orienting cities, guiding direction, and enabling action.

The UIS Reporting System serves as the foundation of the entire product ecosystem, providing city administrators, research institutions, and international organizations with comparable, trackable reference points through ongoing six-dimensional global city rankings and thematic reports.

The UIS Urban Diagnostic Tool bridges evaluation results and governance action, offering a dual-track model of self-service smart diagnostics and in-depth customized consulting — helping cities move from reading rankings to genuinely addressing weaknesses.

The UIS Global Awards and Benchmark Certification distills best practices and establishes governance benchmarks, progressively building a solution repository for cities worldwide to draw upon.

The UIS Capacity Building and Training Programme integrates academic resources with Shenzhen's local experience, positioning UIS as a hub for global urban governance knowledge exchange.

The UIS City Summit and Dialogue Forum leverages Shenzhen's home-ground advantage to establish a multi-tiered, regular global city dialogue mechanism, gradually cementing Shenzhen's standing as a convening center for global urban governance.

The UIS Open Urban Data Platform builds core databases across six dimensions with standardized open interfaces, forming a self-sustaining open data ecosystem. Together, these six products span the full chain of evaluation — diagnosis — certification — training — dialogue — openness, mapping UIS's complete journey from index results to governance services.

There is no single blueprint for how a city should grow, yet all cities share a common calling of our time. Two thousand years ago, Aristotle wrote in *Politics*: "the state comes into existence, originating in the bare needs of life, and continuing in existence for the sake of a good life." The logic that cities exist for people has never changed. Two thousand years later, Edward Glaeser wrote in *Triumph of the City:* "cities are not only mankind's greatest invention, but also our best hope for the future. " The triumph of cities has never been about scale or density — it lies in their capacity to respond to human needs and enable human flourishing. Within the UIS framework. Innovation is the endogenous driver of sustainable urban development; livability is the fundamental pursuit of people-centered urbanism; aesthetics reflects the harmonious resonance among people, city, and nature; resilience is the core guarantee of urban safety and reliability; humanism forms the value foundation of inclusive and diverse cities; and intelligence governance provides the structural support for precise and efficient urban management. These six dimensions work in concert, together forming a methodology for understanding cities in their entirety. This is the purpose of UIS: to read cities, diagnose cities, and improve cities.

This pilot evaluation marks not an ending, but a point of departure. As the scope of assessment expands, the methodology matures, and the product ecosystem grows, UIS will become a bridge — connecting Shenzhen's experience with global practice, and contributing Shenzhen's answers to the shared pursuit of innovation, livability, aesthetics, resilience, humanism, and intelligence in cities worldwide.

Appendix: Indicator Reference Table

Innovation	Indicators	Definition	Reference	Data Source
Density	High-level Papers per Million Inhabitants	Measures the overall scale and spatial concentration of high-quality knowledge production within the region. The *Nature Index* Share value — reflecting a city's contribution to publications in 145 designated high-impact journals — serves as the core metric.	WIPO GII (Science & Technology Articles)	Nature Index "Share" Indicator
	Patents per Million Inhabitants	Measures the overall volume of technology development and intellectual property creation within the region. The indicator is computed based on granted invention patents and Patent Cooperation Treaty (PCT) patent data, expressed as the number of patents per million inhabitants across cities.	WIPO GII (Patents by origin)	Derwent Patent Search
Abundance	Urban Innovation Vitality	Captures the frequency and spatial distribution of human nighttime activities as a proxy for innovation-related production, consumption, and public service activity — interpreted as the "nighttime density of economic activity" rather than direct innovation output. High-precision nighttime light remote sensing data, combined with built-up area boundaries, are used to quantify the intensity and dynamic changes of innovation-driven economic activity within cities.	UN-Habitat (CPI)	NASA/NOAA Black Marble Nighttime Lights; OECD Metropolitan Database;
	Attractiveness & Inclusiveness for Migrant Population	Measures a city's capacity to attract and integrate external talent. For mainland China, the indicator is primarily calculated as the proportion of non-registered (non-hukou) permanent residents in the total resident population; for other countries and regions, it is derived from a composite of net population growth and the share of immigrant population.	UN-Habitat (CPI) , GPCI , SDG 8	UN-Habitat Population Census, UN Migration Data, World Bank Migration Statistics
	Startup Incubation Level	Derived from a composite of the number of incubation platforms and unicorn enterprises. Calculated by weighting the number of certified technology business incubators and maker spaces against the number of unicorn and potential unicorn enterprises.	Silicon Valley Index, 2thinknow Global Innovation City Index	China Torch Statistical Yearbook; CB Insights Unicorn List
Intensity	Total Labor Productivity	Measures the output efficiency per unit of labor input, calculated as regional GDP divided by the average number of employed persons in the region.	OECD, World Bank, SDG 9	OECD Productivity Database; ILO;
	R&D Intensity	Measures the level of resource allocation to R&D activities and its structural share of total economic output. Calculated as gross domestic expenditure on R&D (GERD) divided by city GDP.	European Innovation Scoreboard (EIS), SDG 9	OECD MSTI Database; UNESCO UIS R&D Statistics; Eurostat;
	Business Environment Maturity	Evaluates the convenience, fairness, and regulatory quality of the regional market environment. Drawing on the methodology of the World Bank's Business Ready (B-READY) report or equivalent frameworks, the indicator aggregates scores across dimensions including starting a business, obtaining construction permits, and access to credit.	World Bank B-READY, SDG 8	World Bank B-READY WEF Global Competitiveness Report
Connectivity	Technology Transaction Activity	Measures the vibrancy of technology commercialization and knowledge flows within the regional economy. Calculated as a composite of the annual value of registered technology contracts divided by GDP and the number of internationally recognized academic events hosted by the city.	UN Trade and Development (UNCTAD)	UNCTADstat, WIPO Statistics Database
	Direct Investment (FDI+OFDI)	Measures the region's two-way participation in global innovation resource allocation. Typically computed as the combined annual value of foreign direct investment (FDI) inflows and outward direct investment (OFDI) outflows.	GPCI, UNCTAD World Investment Report; SDG 17	fDi Markets

Livability	Indicators	Definition	Reference	Data Source
Settlement	Housing support	Measured by a composite housing security index, including the rent burden ratio — the ratio of median urban rent to median household disposable income — and the supply rate of affordable housing, measured by the share of newly added policy-supported housing in total new housing supply.	SDG 11.1.1/GPCI/EIU/MERCER	UN-UMF Database AF2; Numbeo; OECD / national statistical offices
	Basic service access	Measured by the coverage of basic public services. It reflects the share of urban areas where residents can conveniently access community services, healthcare, education, and other essential public facilities within a 15-minute living circle.	UN-Habitat UMF / SDG 11.3 / SDG 11.7 / 15-minute city framework / OECD accessibility	OSM POI; WorldPop / GHSL
	Health and longevity	Measured by life expectancy, indicating the average number of years residents are expected to live under current social conditions. It reflects the overall level of healthcare, living environment, quality of life, and social development.	SDG 3 / UN-Habitat UMF / EIU / Mercer / OECD Well-being Framework	WHO; World Bank; UN DESA; national and city statistical offices
Quality	Mobility efficiency	Measured by the average one-way commuting time. It reflects the convenience of daily travel and the planning, construction, and operational efficiency of urban transport infrastructure.	SDG 11.2.1 / UN-Habitat UMF / OECD transport accessibility indicators / GPCI / EIU	OECD Metropolitan Database; TomTom Traffic Index; Traffic report
	Advanced service access	Measured by the coverage of enhanced public services. It reflects the share of urban areas where residents can conveniently access commercial, cultural, sports, entertainment, and other quality-of-life facilities within a 15-minute living circle.	UN-Habitat UMF / 15-minute city framework / OECD accessibility indicators / GPCI / Mercer	OSM POI; Google Places; local open data portals; GIS network analysis
Quality	Open space quality	Measured by a combination of per capita open space, accessibility to parks, green spaces, squares, and other open spaces, as well as Numbeo's Green and Open Spaces Quality Index. It reflects the comfort and quality of the living environment.	SDG 11.7.1 / UN-Habitat UMF / GPCI Environment / EIU / Mercer	UN-Habitat SDG 11.7.1 database; OSM POI; GHSL / satellite land-cover data; Numbeo Green and Parks Quality Index
	Third-place vitality	Measured by the density of third-place facilities, including cafés, teahouses, bars, bookstores, community activity centers, and other spaces that support social interaction and leisure, per square kilometer.	GPCI Cultural Interaction / Mercer / EIU / 15-minute city framework	OSM POI; Google Places
Opportunity	Demographic structure	Measured by the median age of the resident population. A moderate and stable median age indicates a healthier and more dynamic population structure.	UN-Habitat UMF / OECD metropolitan indicators / World Bank demographic indicators / Shanghai Index	UN DESA World Urbanization Prospects; World Bank WDI; OECD Metropolitan Database; national population censuses; city statistical yearbooks
	Human capital level	Measured by the share of the population with higher education, reflecting the city's human capital and potential for innovation-driven development.	SDG 4 / OECD Education at a Glance / GPCI R&D / Global Innovation Index / Shanghai Index	UNESCO Institute for Statistics; OECD Education Database; World Bank WDI; national population censuses; labour force surveys; city statistical yearbooks
	Income level	Measured by per capita disposable income and price levels, reflecting the income residents can allocate after accounting for the cost of living.	SDG 8 / OECD Better Life Index / Mercer / EIU / Numbeo	OECD income and price statistics; World Bank WDI; Numbeo Cost of Living; household income and expenditure surveys; official income and price statistics

Aesthetics	Indicators	Definition	Reference	Data Source
Natural Harmony	Protected Area to City Territory Ratio	Proportion of protected areas (e.g., nature reserves) in the city's administrative area, measuring the city's ecological conservation efforts and the guarantee level of its ecological security bottom line.	Kunming-Montreal Global Biodiversity Framework, Target 3	United Nations Environment Programme (UNEP) and International Union for Conservation of Nature (IUCN) World Database on Protected Areas (WDPA)
	Share of Built-up Area Covered by Green and Blue Spaces	Proportion of various green spaces and water bodies in the built-up area, reflecting the foundation level of ecological space and the permeability of the natural environment in urban built-up areas.	Global Indicator Framework 15.1.1 of the 2030 Agenda for Sustainable Development	European Union Global Human Settlement Layer (GHSL) Dataset; Google Earth Engine (GEE) Global High-Resolution Remote Sensing Imagery
	Native Biodiversity in Built-up Area	Proportion of native bird species present in the built-up area to the total number of native bird species in the region, reflecting the ecosystem health and biodiversity conservation effectiveness of urban built-up areas.	Singapore Index on Cities' Biodiversity	Global Biodiversity Information Facility (GBIF) Dataset
Green Progress	Low-carbon Level	Annual per capita carbon dioxide emissions of the city, measuring the city's per capita carbon emission intensity and overall low-carbon development level.	IEA's CO_2 Emissions report series	Carbon Monitor Cities; ODIAC Fossil Fuel Emission Dataset
	Annual Average Air Quality	Annual average concentration of PM2.5 particulate matter in ambient air, reflecting the city's ambient air quality and air pollution control effectiveness.	Global Indicator Framework 11.6.2 of the 2030 Agenda for Sustainable Development	World Health Organization (WHO) Global Air Quality Database; Real-time and Historical Air Quality Index (AQI) Data Platform

Aesthetics	Indicators	Definition	Reference	Data Source
	The Proportion of Safely Treated Domestic Wastewater Flows	Proportion of domestic wastewater safely treated by municipal sewage treatment systems, reflecting the city's water environment quality and water pollution control level.	Global Indicator Framework 6.3.1 of the 2030 Agenda for Sustainable Development; State of the World's Cities Report, United Nations Human Settlements Programme (UN-Habitat)	World Health Organization (WHO) National Level Data; Official Websites of Various Cities
Spatial Resonance	City Image Favorability	Public recognition of the city's popular attractions, reflecting comprehensive public evaluation of its overall image and spatial imagery.	New Urban Agenda; City Prosperity Initiative (CPI), United Nations Human Settlements Programme (UN-Habitat)	TripAdvisor City Ratings
	Destination Appeal Intensity	Visit intensity of the city by international and domestic tourists, measuring the city's attraction strength as a major global travel destination.	World Tourism Barometer, United Nations World Tourism Organization (UNWTO)	Official Websites of Various Cities
	Streetscape Visual Quality	Aesthetic quality of landscapes and interfaces at the urban street level, measuring the visual aesthetics and public perception quality of the city's street public spaces.	World Cities Report 2022, United Nations Human Settlements Programme (UN-Habitat)	Google Street View Maps; MIT Place Pulse 2.0 Training Dataset

Resilience	Indicators	Definition	Reference	Data Source
Defense	Building Fortification Level	Overall evaluate the ability of buildings to resist disasters. Consider its seismic design standards, fire protection facilities, and its actual performance in disasters in the past.	GB/T 40947-2021, DB11/T 2280-2024	Standard norms, government departments disclosing information
	Municipal Infrastructure Guarantee Level	Reflects the guarantee capability of urban municipal infrastructure for the city. Evaluates the continuous supply capacity and redundancy of urban water supply, power supply, and gas supply infrastructure during disasters by considering the average duration of water and power outages per household, the diversity of municipal supply facilities, the backup and excess capacity of municipal facilities.	City Resilience Index, Safe Cities Index, DB11/T 2280-2024	China's Urban and Rural Construction Statistical Yearbook, City Statistical Yearbooks, World Bank, Public Information from Government Departments
Recovery	Emergency Traffic Support Level	To assess the density of the urban road traffic network and determine the capacity of the urban transportation network to ensure disaster response. The calculation method is to divide the total length of urban roads by the urban area, which gives the density of the urban road network.	GB/T 40947-2021, DB11/T 2280-2024	Baidu Maps, Gaode Maps, Google Map, government public information and related forums
	Emergency Response Service Level	Reflects the initial emergency response coverage capability of the city for sudden incidents. The calculation method is to determine the proportion of the area covered by the 5-minute driving range of fire stations within the city compared to the total area of the city, and then make adjustments based on the city's population density, urban road network and traffic conditions, and urban spatial structure.	Code of Practice for City Examination & Evaluation in Territorial Spatial Planning (2025 Revision)	City Statistical yearbooks, special plan, Google Map

Resilience	Indicators	Definition	Reference	Data Source
Adaptability	Natural Shoreline Retention Rate	Reflect the integrity of the waterbank ecosystem. The calculation method is the percentage of the natural bankline (including the restored ecological bankline) to the total length of the bankline.	Code of Practice for City Examination & Evaluation in Territorial Spatial Planning (2025 Revision)	City Statistical yearbooks, ronmental Risk Data （Verisk Maplecroft）
	The Proportion of Permeable Urban Area	Reflects the city's ability to absorb, store and infiltrate rainwater. The calculation method is the ratio of the area of permeable surfaces (such as natural soil, green spaces, and permeable pavement) to the total surface area of the urban built-up area.	Cities' Comprehensive Development Index（CNIS）, DB11/T 2280-2024	Sentinel-2/Landsat images
Transition	Top-Level Design of Resilient City	Reflect the top-level institutional design and coordination capabilities of the city. Evaluate the leadership mechanism of the government in building a resilient city, the situation of planning formulation, and the establishment of the emergency comprehensive platform.	Safe Cities Index, DB11/T 2280-2024	Public information from government departments such as those related to natural resources and emergency management, the United Nations "World Urbanization Prospects" report, and the Rockefeller Foundation 100RC
	Disaster Risk Management Level	Reflect the city's systematic governance capability for disaster risks. Comprehensive assessment of the implementation of disaster risk census work, the density of monitoring stations (for earthquakes, meteorology, floods, etc.) and the update and application of disaster data.	Safe Cities Index, City Resilience Index	Public information from government departments such as those related to natural resources, water resources, and emergency management, the United Nations Office for Disaster Risk Reduction (UNDRR), the US Geological Survey (USGS), and the National Oceanic and Atmospheric Administration (NOAA)

Humanism	Indicators	Definition	Reference	Data Source
Behaviour & Literacy	Public Behavioural Order	Measured through a composite index of road traffic safety and perceived public safety, reflecting the extent to which residents adhere to shared rules and behavioral norms in public life.	SDG 3.6.1; WHO Urban Health Indicators; OECD Better Life Index (Safety)	World Health Organization (WHO) Global Health Observatory; Numbeo Safety Index; National Statistical Offices
	Civic Environmental Behaviour Participation	Measured by the participation rate in municipal waste sorting, reflecting the extent to which residents engage in environmentally responsible behaviors and contribute to urban environmental governance.	SDG 12.5; OECD Green Growth Indicators; UNEP Waste Management Indicators	Municipal Environmental Protection Authorities; Household Surveys on Waste Sorting Participation; National Statistical Offices
Cultural Understanding	Cultural Heritage Richness	Measured by the number of tangible cultural heritage assets within the city, reflecting the richness of historical and cultural resources and the accumulation of collective urban memory.	UNESCO World Heritage Framework; UNESCO Culture Indicators; World Cities Culture Report	UNESCO World Heritage List; National Cultural Heritage Authorities; Municipal Cultural Heritage Databases
	Cultural Space & Facility Sharing	Measured by the number of public cultural facilities per 10,000 residents, reflecting the availability of cultural infrastructure and access to public cultural services.	UNESCO Culture 2030 Indicators; World Cities Culture Forum (WCCF); OECD Culture and Local Development	World Cities Culture Forum (WCCF); Municipal Cultural Authorities; National Statistical Offices
	Cultural Participation & Consumption	Measured by per capita cultural expenditure, reflecting residents' engagement in cultural activities and consumption of cultural goods and services.	UNESCO Culture Indicators; OECD Culture Statistics; Eurostat Cultural Participation Indicators	Household Expenditure Surveys; National Statistical Offices; OECD Statistics; World Cities Culture Forum Reports

Humanism	Indicators	Definition	Reference	Data Source
Inclusion & Engagement	Demographic Diversity & Inclusiveness	Measured by the proportion of non-native residents in the total resident population, reflecting the city's openness to population inflows and demographic diversity.	UN-Habitat New Urban Agenda; OECD Migration Outlook; Inclusive Cities Framework	Population Census Data; OECD International Migration Database; National Statistical Offices
	Public Cultural Accessibility & Usage	Measured by the number of public library loans per resident, reflecting both accessibility to public cultural resources and the actual usage by residents.	IFLA Library Development Indicators; UNESCO Public Library Manifesto; WCCF Indicators	International Federation of Library Associations and Institutions (IFLA); Municipal Library Systems; World Cities Culture Forum (WCCF)
	Civic Volunteering Rate	Measured by the share of registered volunteers within the resident population aged 16–70, reflecting the level of civic engagement and residents' participation in public service and social affairs.	UN SDG 11.3; OECD Civic Engagement Indicators; UN Volunteers (UNV) Framework; CAF World Giving Index	United Nations Volunteers (UNV) Charities Aid Foundation (CAF); World Giving Index; National Statistical Offices; Globalization and World Cities (GaWC) Research Network

Intelligence	Indicators	Definition	Reference	Data Source
Digital Foundation	Urban Data Platform Integration	Evaluates the extent to which a city has established a unified spatiotemporal information infrastructure integrating multi-source geospatial data from spaceborne, airborne, terrestrial, marine, and IoT sensing systems, serving as the city's common operational picture for urban governance and management. Scores are assigned based on the maturity of capabilities in geospatial data integration, real-time data synchronization, spatiotemporal monitoring, 3D/4D visualization, scenario simulation and predictive modeling, GeoAI-enabled forecasting and optimization, and cross-sector operational integration. A score of 5 indicates a city-scale Geospatial Digital Twin platform with real-time simulation, AI-assisted optimization, and citywide operational deployment; 4 indicates an advanced integrated platform supporting dynamic updates, multi-source geospatial fusion, and cross-departmental applications; 3 indicates a City Brain, CIM, or equivalent platform supporting data integration, situational awareness, and visualization; 2 indicates a municipal data-sharing and exchange platform with basic spatial data integration and coordination functions; 1 indicates limited inter-agency data sharing capability; and 0 indicates no publicly available evidence of such infrastructure.	ISO 37122:2019; Gartne Hype Cycle for Smart City Technologies and Solutions	Government official technical reports, smart city top-level design white papers, etc
	Network Connectivity Level	Assesses the coverage, accessibility, and performance of fixed broadband networks within a city, using indicators such as fixed broadband subscription penetration, average broadband download speed, and network quality. The indicator reflects the capacity of digital connectivity infrastructure as an essential public utility underpinning the digital economy and smart city development. Based on international rankings, benchmark reports, and overall performance, cities are assigned scores on a five-point scale: 5 = global-leading broadband infrastructure; 4 = high-performing; 3 = moderate-performing; 2 = below-average; 1 = low-performing.	ITU-T Y.4903; IMD Smart City Index; UK Smart Cities Index	ITU/ICT Indicators Database, World Bank, Ookla (Speedtest), M-Lab, and Speedtest Global Reports
Inclusive Public Services	Public Network Coverage Rate	Assesses a city's capacity to provide inclusive wireless internet services in public spaces. The indicator is measured by Public Wi-Fi Hotspot Density (the number of public Wi-Fi hotspots per unit area of the built-up urban area) and reflects the availability, accessibility, and spatial coverage of public wireless connectivity across the city.	ITU-T Y.4903; ISO 37122:2019; EU Rolling Plan for ICT Standardisation	TripAdvisor; Wifimap.io; Open Data Portal
	Digital Payment Convenience	Measures the level of digitalization in the urban consumer environment and the convenience of cashless transactions. The indicator is assessed using metrics such as the share of non-cash transactions and the penetration rate of digital wallets or mobile payment services, reflecting the extent to which digital payment systems are integrated into everyday economic activities.	IMD Smart City	World Bank Global Findex; Statista; GSMA
Efficient Governance	Digital Civic Engagement Level	Assesses the extent to which integrated city service applications or digital government portals provide accessible and functional channels for citizen complaints, inquiries, suggestions, and public consultations, together with transparent feedback mechanisms. The indicator evaluates the capacity of public institutions to leverage digital platforms for citizen engagement, participatory governance, and closed-loop feedback processes.	ISO 37122:2019; IMD Smart City Index; GB/T 33356-2022	UN EGDI; World Bank EGDI
	Convenience of Online Government Service	Assesses the digital service delivery capacity and administrative efficiency of government institutions. Drawing on the Online Service Index (OSI) and related measures, the indicator evaluates the proportion of administrative services that can be completed entirely online, as well as the share of services requiring no in-person visits, reflecting the maturity, accessibility, and effectiveness of digital government services.	GPCI; GB/T 33356-2022	UN EGDI; World Bank EGDI